

UNITED STATES ARMY OPERATIONS UNDER THE OTTAWA CONVENTION:
MINE WARFARE WITHOUT ANTIPERSONNEL LANDMINES

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General Studies

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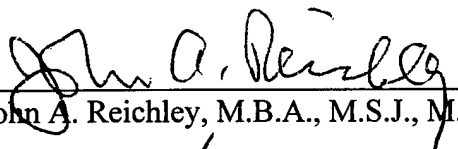
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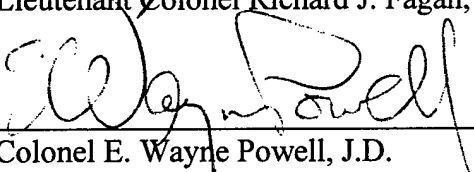
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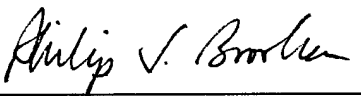
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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

US ARMY OPERATIONS UNDER THE OTTAWA CONVENTION: MINE WARFARE WITHOUT ANTIPERSONNEL LANDMINES by MAJ Jon N. Jones, USA, 110 pages.

This study explores the impacts on US Army operations should the United States decide to abide by the "Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Antipersonnel Mines and on their Destruction." This treaty is commonly known as the Ottawa Convention. These impacts are evaluated to determine if they constitute vulnerabilities to the Army.

The study explores the history of mine warfare and current US doctrine to determine the specific uses of antipersonnel landmines. The study then compares other systems on the battlefield to determine if these other systems can perform the functions of antipersonnel landmines.

Based on the inability of other systems to completely replace antipersonnel landmines, this thesis uses the results of other studies to determine if these shortfalls pose vulnerabilities to the US Army in combat operations.

This study does not focus on the merits and shortcomings of the Ottawa Convention. It does determine that abiding by the treaty would put the US Army at a risk. The study concludes with recommendations for reducing these risks should the United States decide to abide by the Ottawa Convention.

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CHAPTER ONE

INTRODUCTION

The Research Question

Would signing the Ottawa Convention create vulnerabilities for the US Army?

The Trend Toward an Antipersonnel Landmine Ban

Current US Landmine Policy

In May 1996, President Bill Clinton announced a unilateral decision not to use non-self-destructing antipersonnel landmines (APLs) except for the defense of South Korea. Current US Army policy forbids training with or teaching the use of non-self-destructing antipersonnel landmines in obstacle designs except for South Korea.¹ Outside of South Korea, training is limited to personnel engaged in demining and countermining operations.² The US Army may still employ self-destructing APLs and landmines that target vehicles or tanks. This policy is a result of international pressure to eliminate injuries to civilians from minefields left in place as a result of armed conflict.

History of Landmine Use

The noun "mine" is associated with two meanings. The first meaning has to do with the silent weapons of war, which explode under tanks, ships, or people. The second meaning involves tunnels, such as a gold mine or a coal mine. These two meanings of the word have a shared beginning. As early as 850 B.C., the Assyrian Army employed

¹Department of the Army, DAMO-TR, "Training Policy for Non-Self Destructing Anti-Personnel Landmines," unclassified message R 290845Z Jul 97.

²U.S. Department of the Army, FM 20-32, *Mine/Countermine Operations* (Washington, DC: 29 May 1998), xvii.

engineer soldiers to dig tunnels under or through the defenses of their enemies. Eventually, armies filled these tunnels, or mines, with gunpowder and detonated them under fortification walls to create a breach.

The Chinese employed the first self-contained explosive antipersonnel mines against Kublai Khan's Mongol invaders in 1277.³ The first use of landmines by US forces was in the Civil War. Some of these mines (also known as "torpedoes") were artillery shells rigged with trip wires. Other devices were directed at railroads. The Civil War saw both antipersonnel and antivehicular mine use. More than 1,000 antipersonnel mines were incorporated in the Confederate defense of Petersburg.

Improvements to landmines mirrored improvements in rifles and artillery pieces from the late 1800s until World War II. In World War I, the Germans developed an antipersonnel mine that activated when stepped on. This mine was the first device that would be defined as a landmine today. The Germans used these mines to protect their positions in the trenches and to protect antitank mines from dismounted soldiers. The British developed chemical mines for use in World War I. These mines released mustard gas when activated.

Better explosives and increased fragmentation made landmines more and more lethal. In World War II, the Germans introduced the bounding antipersonnel mine. This type of mine, known as a Bouncing Betty, launches itself to a height of around one meter before detonating, causing more significant injuries and increasing the lethal radius of the blast.

All of the major combatant countries used mine warfare in World War II. Some of the most extensive mining was in the North African theater. "[Field Marshal Erwin] Rommel was one of the theaters most astute . . . practitioners in the arts and sciences of

³Major William C. Schneck, "The Origins of Military Mines: Part I," *Engineer*, July 1998, 52.

landmine and countermine operations.”⁴ Rommel employed mines to protect his defensive positions and to influence the maneuver of the British. He was probably the first commander to employ mines to interdict an enemy. On 5 April 1941, Rommel dispatched Major Heymer and his men with two aircraft to place mines on the roads east of Mechili in front of the retreating British army.⁵

The Germans also used minefields consisting of both antitank and antipersonnel mines to hinder the advance of the British. The effectiveness of these nuisance minefields is stated in a report from the British 9th Infantry Division. “The German use of both tellermines and anti-personnel mines is diabolically clever. All roads, paths, stream crossings and breaks in woods are possible mine traps. Consequently, hours of time are lost probing for mines before even a small force can advance.”⁶

The British victory in the Second Battle of El Alamein and the introduction of US forces in November 1942 signaled the beginning of the end for Axis forces in North Africa. Rommel used on the order of 500,000 mines in his defense at El Alamein. “Most of the mines available in Africa were unfortunately of the anti-tank type, which infantry could walk over without danger. They were, therefore, comparatively easy to clear (*The Rommel Papers*, p.299-300).”⁷

Medical records from the New Zealand Division provide some statistics regarding mine casualties. In Tunisia, the division suffered eighty-four killed-in-action. Two of these soldiers, or 2.4 percent, were killed by mines. Of 1,312 wounded, sixty-four were

⁴Engineer Agency for Resource Inventories, *Landmine and Countermining Warfare: North Africa, 1940-1943* (Washington, DC: June 1972), A-1.

⁵Ibid., A-2.

⁶Ibid., B-9.

⁷Ibid., A-10.

wounded due to "mines, etc."⁸ Mines accounted for 5 percent of the wounded. These figures do not account for soldiers killed and wounded when mines presented the Axis forces with targets for artillery or direct fire. The value of mines cannot be measured solely by counting mine casualties.

The casualty figures for the New Zealand Division do not consider psychiatric casualties. The British Military Expeditionary Force psychiatrist reported at the end of the Second Battle of El Alamein that: "The incidence of these severe battle cases fell most heavily on the Royal Engineers, whose task it was to clear passages through enemy minefields so that the infantry and tanks could pass safely through."⁹ Time spent in a minefield lowers a soldier's morale not only because of the fear of tripping a mine, but because minefields are placed to provide targets to those overwatching the minefield.

The fear of mines impacts the ability of a unit to maneuver. "During the Anzio landing . . . the presence of mines in the sand dunes and the woods beyond the beach delayed the British 1st Division's move inland. The troops would not leave the beach until engineers created lanes in the minefields."¹⁰ After the Allied forces broke out of the Anzio beachhead, the Germans increased their use of mine warfare to delay the Allies. The rugged nature of the Italian theater allowed for effective use of mines as delaying obstacles.

As the Allied Army has advanced overland they have met mines in increasing numbers. Enemy methods have changed a great deal since the German defeat in Africa. Most important of these changes is that the patterned mine fields have become less common and that the enemy is scattering mines and mine fields

⁸Ibid., L-1.

⁹Ibid., C-2 - C-3.

¹⁰Daniel P. Mahoney, "Goalie Without a Mask? The Effect of the Anti-Personnel Landmine Ban on U.S. Army Countermobility Operations." (Monograph, School of Advanced Military Studies, Fort Leavenworth, KS: 20 December 1996), 7.

without pattern. This condition is largely due, no doubt, to the fact that the enemy has been forced to retire at times rather rapidly. . . . Antipersonnel mining has increased, and the use of wooden box mines is also increasing. Mines, minefields and booby traps have been placed wherever the enemy expects our army to advance or bivouac. They have been found at beaches and ports, across roads and railways, blocking diversions around demolished bridges, in road verges, repaired potholes, in the spoil of craters, under tire or cart tracks, in ballast under railway lines, and in tunnels. They have been found at streams, river banks and at fords and bridges, in towns and villages. Antipersonnel mines have been found along hedges and walls, and booby traps in haystacks, in ravines and olive groves, and on hillside valleys and hill terraces.¹¹

The author of this passage may well have said that the Germans placed mines everywhere. These nuisance mines slowed the Allied advance, sapped morale, and caused casualties.

The German Army's increased emphasis in mine warfare is reflected in casualty figures. In the battle for Cassino, landmines caused 13 percent of US Army casualties serious enough to result in bone fractures.¹²

Although the Germans were expert in landmine warfare, it was the Soviets who most relied on these weapons. In the decisive Battle of Kursk, the Soviet Central and Voronezh Fronts employed more than 500,000 antitank and more than 400,000 antipersonnel mines in front of the main German advance.¹³ The density of these minefields was about 1,500 antitank and 1,500 antipersonnel mines per kilometer of front. In comparison, the antitank minefield density at El Alamein was five times higher than at Kursk, but due to the lack of antipersonnel mines in Africa, Rommel was able to

¹¹"Types of Enemy Mines Encountered on the Italian Mainland." *Engineer Intelligence Bulletin*, Mine Series No. 2, (31 August 1944), 19, quoted in Engineer Agency for Resource Inventories, *Landmine and Countermining Warfare: Italy, 1943-1944* (Washington, DC: June 1972), 1-2.

¹²Engineer Agency for Resource Inventories, *Landmine and Countermining Warfare: Italy, 1943-1944* (Washington, DC: June 1972), xx.

¹³"Military Consequences of Landmine Restrictions," Research paper prepared by the Dupuy Institute (McLean, VA: 10 April 1996), 3.2.

place only about 10,000 APLs across a sixty-five kilometer front. This density of about 150 APLs per kilometer was ten times less than the APL density in the Soviet defenses at Kursk.

At El Alamein, the British were able to overcome the German defenses. At Kursk, the most successful German penetration was only about thirty-five kilometers. These two battles differed greatly in scope, environment, and the participants. Any conclusions made about the effectiveness of APLs must consider these differences. The Dupuy Study of the effectiveness of landmines in the Battle of Kursk does not attribute the German defeat to the presence of antipersonnel mines, but does estimate that German casualties due to APLs was about 4 percent.

The Korean War saw extensive mine warfare similar to that of the Italian campaign in World War II. The rugged terrain and the rapid advances and retreats that characterized the Korean War created similar conditions for effective nuisance mining. "Mines began to play an increasingly significant role in the war as the retreating North Koreans used them in an attempt to delay the UN forces. The North Koreans also made extensive use of booby traps in abandoned foxholes, on field telephones, dead branches, scraps of lumber, discarded equipment, and on the bodies of the dead. Before evacuating Seoul, they had mined virtually every important intersection and many western style buildings were booby trapped."¹⁴

Statistics from the Surgeon General conclude that mines accounted for 1.65 percent of US killed and 3.32 percent of US wounded. Despite these relatively low numbers, the first sentence from two *Marine Corps Gazette* articles from the period gives a different impression. One article starts, "Probably no single weapon in the Red arsenal

¹⁴Engineer Agency for Resource Inventories, *Landmine and Countermine Warfare: Korea, 1950-1954* (Washington, DC: June 1972), vii.

has been as effective as the mine in producing casualties among UN forces in Korea.”¹⁵ The other article begins with, “One of the more popular means of becoming a Korean battle casualty, if statistics are to be believed, was to tangle with a land mine.”¹⁶ These statements attest to the psychological impacts of mines. Statistics do not seem to back up these statements, but these Korean veterans are under the impression that mines were a leading cause of casualties.

Mine warfare in Vietnam was much different from previous wars. Jungle, delta, and mountain terrain; the nonlinear arrangement of forces; and the limited road network favored the use of nuisance mining by Communist forces. Both sides used mines for perimeter defense. Operating from fixed installations, US forces incorporated antipersonnel mines in the defense of fixed installations, but Communist forces would tamper with these mines by reversing directional mines (such as the Claymore) or remove these mines for their own use. Free World protective minefields were a source of supply for Communist forces. The ambush was a prevalent form of combat operations, and both sides incorporated mines to trigger ambushes and to close escape routes. As in the Italian campaign and in Korea, nuisance mining was a serious threat to US forces.

US casualties from mines were significantly higher in Vietnam than in any other conflict. From January 1967 to May 1969, mines accounted for 8.7 percent of US forces killed and 10.5 percent of those wounded. These figures may be too low since many mine injuries may have been attributed as “fragmentation casualties.” Several US

¹⁵Harry W. Edwards, “Danger! Mines,” *Marine Corps Gazette*, April 1952, quoted in Engineer Agency for Resource Inventories, *Landmine and Countermine Warfare: Korea, 1950-1954* (Washington, DC: June 1972), A-1.

¹⁶Richard W. Smith, “Nobody’s Favorite Weapon,” *Marine Corps Gazette*, October 1954, quoted in Engineer Agency for Resource Inventories, *Landmine and Countermine Warfare: Korea, 1950-1954* (Washington, DC: June 1972), A-3.

divisions reported half of their casualties were due to mines and booby traps.¹⁷ Vehicle casualties were significantly higher. Most estimates are that 70 percent of US military vehicles destroyed in Vietnam were destroyed by mines.

In the 1960s, the United States and the Soviet Union developed crude aircraft-delivered "mine bombs." Both countries developed what are known as "butterfly" antipersonnel mines. These bombs contain submunitions that flutter to the ground and activate when touched. The United States used its version (the BLU-3B) in Vietnam. The Soviet Union used its version in its war in Afghanistan. Another mine warfare development was the flame or napalm mine. Although command-detonated flame munitions have been in use for centuries, the United States developed the first self-contained flame mine for use in Vietnam. These mines were not used in the war.

The Arab-Israeli Wars forced the armies of the world to relearn the lessons of World War II. Syrian and Egyptian forces effectively used minefields to blunt and canalize Israeli attacks. The Israelis relied on hand-breaching or, on some occasions, driving through minefields and accepting losses. The Syrians used flail tanks, a World War II innovation, to mechanically breach Israeli minefields in their assault of the Golan in 1973. Later in the 1973 War, the Egyptian 25th Armored Brigade was conducting a flank attack on an Israeli position. The Israelis counterattacked into the flank of the Egyptians, trapping the 25th Brigade against an Israeli tactical minefield. The Egyptians lost eighty-six of one hundred tanks and all of their armored personnel carriers.¹⁸ The Arab-Israeli Wars reminded military thinkers of the importance of mine warfare on a mobile battlefield. Unlike the prevalence of nuisance mining of Korea and Vietnam, the

¹⁷Engineer Agency for Resource Inventories, *Landmine and Countermine Warfare: Vietnam, 1964-1969* (Washington, DC: June 1972), 28-29.

¹⁸C. E. E. Sloan, *Mine Warfare on Land* (London: Brassey's Defense Publishers, 1986), 7.

Arab-Israeli Wars saw mostly tactical mining reminiscent of the large armored battles of El Alamein and Kursk. Countermine innovations picked up where the armies of World War II left off with a new look at mounted breaching. The Israelis developed the mine plow which the armies of the world adopted.

Significant advances in mine and countermine technology were developed in the late 1970s and 1980s. The most significant improvement was the development of scatterable mines. A scatterable mine is not placed on or in the ground in the conventional fashion. Mine laying with conventional mines requires trained soldiers to place each individual mine on or in the ground, arm the mine, and record its location. This process resembles planting crops by hand and is time consuming. Scatterable mines are "scattered" into the minefield with a machine, explosive devices, or dropped from aircraft. Mine bomblets were improved and antitank versions were developed. These improvements allowed for dramatic increases in mine laying capability because fewer soldiers were required and much less time was needed.

For an example of how much an improvement scatterable mines are over conventional mines, consider the Volcano system. The Volcano is the current premier US mine delivery system and is based on an Italian system developed in the early 1980s. Two soldiers with a Volcano system can emplace a minefield 1,100 meters long and 120 meters deep in about five minutes. Mounted on a helicopter, the same minefield can be installed in about one minute. A conventional minefield of the same size and lethality requires a platoon of trained soldiers five hours to emplace.

Other scatterable systems provide instant point minefields, and artillery can fire mine rounds into an area to create minefields. Although scatterable mines have greatly improved the capability of mine warfare, they have created a new set of problems. Scattered mines are not easily recovered, since no one knows exactly where they end up. Remotely delivered mines, such as those fired by artillery or dropped from bombs, may

land outside the target area. One can never be sure where the mines are, and there is doubt as to the exact location of the minefield.

Mines are a hazard to friend and foe alike. Consequently, all professional armies have recognized the need to control minefield emplacement. The authority to use mines normally originates at the division or corps commander level. Armies have recognized the need to record the location of minefields and booby traps so that friendly forces can be informed of their location and so the munitions can be recovered if the tactical situation permits. Minefields are normally marked as well. International conventions require that minefields have fences around them with signs indicating the danger. The international rules are to prevent civilians from wandering into minefields, but most armies have required minefield marking to prevent friendly forces from accidentally maneuvering into them. Even the Viet Cong marked their nuisance mines and booby traps with subtle indicators, such as a small pile of rocks, to warn civilians and other communists of the danger.

Scatterable mines, particularly remotely delivered ones, cannot be accurately recorded or marked. To overcome this problem, modern scatterable mines are designed to self-destruct or de-activate either on command or with the passage of time. Artillery-delivered mines may be programmed to self-destruct after four hours. If these munitions can reliably "go away" after a known period of time, there is no need to mark their location. Recording their location and informing friendly soldiers is still required, but only for the duration of the minefield. Reliability is very important. The minefield must truly "go away" after the expected period of time. Allied Techsystems, which manufactures scatterable mines for the United States, claims that the self-destruct mechanisms provide a 99.99996 percent reliability rate. This equates to one mine "dud" per 25,000 mines. This dud rate is lower than artillery or bomb dud rates. This reliability rate is even higher than the clearance criteria used by United Nations mine clearing teams.

The Gulf War demonstrated the potential for scatterable mines and showed how far countermining technology had come. The Iraqis used an estimated nine million mines as part of their defense against the Coalition. The Iraqi barriers were complex, consisting of tank ditches, fences, flame trenches, and minefields. The Iraqis covered this obstacle system with integrated direct and indirect fires. When Coalition forces attacked the Iraqi defenses, they did not rely on the dismounted breaching techniques of World War II. Instead, they used mine-clearing line charges launched into the minefields to destroy the mines and mechanical techniques such as tank-mounted rakes, plows, and rollers. Despite estimates that the breaching operation would produce casualties by the thousands, Coalition forces managed to successfully breach Iraqi defenses all along the front with relatively few casualties and much more quickly than anticipated. In the ensuing Coalition exploitation, US forces used scatterable mines in support of offensive operations.

Like Rommel's use of aircraft to place mines before the retreating British, the United States used aircraft to interdict the retreating Iraqis. In the Gulf War, however, the aircraft did not have to land in order to have soldiers install the minefields. US aircraft only had to dispense mine bombs in order to produce minefields. US artillery units used artillery-delivered mines as part of counterbattery fire. These missions directed against Iraqi artillery positions often included at least one round of mines to further hinder the Iraqi artillery.

The Iraqi and Coalition use of mines underscores the evolution of mine warfare since World War II. The Iraqi defenses were the perfection of mine warfare based on the World War II model. Coalition forces employed techniques relearned from the Arab-Israeli Wars to overcome the Iraqi barriers, and employed new, offensive mining technologies to assist in the defeat of Iraqi forces.

Although mine warfare has evolved in modern, mechanized armies from the World War II model into a new form based on scatterable mine technology, less modern armies have increasingly relied on conventional mine warfare as seen in Korea and Vietnam. This has led to a situation where the residual effects of mine warfare have created an international movement to ban mines and in a United Nations treaty effectively banning antipersonnel landmines.

World Landmine Situation

With one exception, every armed conflict since World War II has seen significant use of landmines. The one exception was the Philippine coup attempt. Since mobility was considered an essential element of the Armed Forces of the Philippines counterinsurgency operations, antipersonnel mines were considered to be of little value.¹⁹ Insurgencies, wars of revolution, and civil wars often involve armies of little professional training. These types of conflicts have resulted in extensive and indiscriminate use of landmines. Most mines cost between three and thirty dollars and are relatively safe to use. Because they are so inexpensive, any type of armed group can afford them. Because they are safe and easy to use, little training is required to emplace mines. For these reasons, sixty-five million mines have been laid in the past fifteen years.

Nonprofessional armies rarely mark or record minefield locations. This massive use of mines coupled with a lack of accounting and recording has led to a situation where large portions of many war-torn countries are teeming with mines. Often, no one has a good idea where these mines are or what kinds of mines are in a particular minefield. These leftover minefields are a hazard to local civilians and livestock and greatly complicate restoring normalcy after a conflict. The area of land denied access rather than

¹⁹International Committee of the Red Cross, *Anti-personnel Landmines: Friend or Foe?* (Geneva: March 1996), 32.

the number of mines is more important when describing the socioeconomic impact of the weapon. Market roads may be mined, hindering transportation of goods. Agricultural land is mined, making it dangerous for populations to raise crops and livestock. There are at least 250,000 landmine-disabled persons in the world. Every year landmines claim another 26,000 victims.²⁰

International Movement to Ban Landmines

Because of the number of civilian landmine casualties and the lasting effects of mined areas, there is a growing movement to ban landmines. In May 1996, President Clinton bowed to this pressure and announced a unilateral decision not to use non-self-destructing APLs except for the defense of South Korea. In October 1996, the Ottawa initiative began with a conference of nations hosted by the Canadians. This conference developed a strategy towards implementing a worldwide landmine ban. In February 1997, the first draft of the "Convention on the Prohibition of Landmines" was drafted in Vienna. In the next six months conferences were held by governmental and nongovernmental organizations in Mozambique, Tokyo, Budapest, Zimbabwe, South Africa, Stockholm, Turkmenistan, Brussels, Manila, Australia, Sudan, and New Delhi.

In August 1997, the death of Princess Diana, a leading spokesperson for the landmine ban, spurred this international dialogue and helped focus world opinion on the subject. Canadian Foreign Affairs Minister Lloyd Axworthy, the leader of the Ottawa initiative, said on 31 August 1997, "She had great empathy for the afflicted, and played a

²⁰Home page of the International Campaign to Ban Landmines; available from <http://www.icbl.org>; Internet; accessed 30 Sep 98.

leading role in bringing the issue of land mines into the public consciousness.”²¹ Two days later, United Nations Secretary General Kofi Annan said, “The Princess made a major contribution to alleviating suffering . . . throughout the world. Her unflinching commitment to the cause of banning anti-personnel land-mines not only helped in placing that cause high on every humanitarian agenda, but endeared the Princess to millions around the globe.”²²

Within three weeks of the accident that killed Princess Diana, delegates in Oslo voted in favor of a landmine ban treaty.²³ In December the treaty signing conference took place in Ottawa, where the sixty-one member states of the conference voted on the final Oslo draft of the treaty. Thirty-five nations voted to accept the final draft of the treaty; twenty-five voted against. In a speech to the Washington Conference on Global Humanitarian Demining in May 1998, Secretary of State Madeline Albright stated:

While the United States’ unique responsibilities precluded us from signing the Ottawa Convention last fall, it’s worth remembering that President Clinton was the first world leader to set the goal of eliminating APL worldwide. The new understanding underscores America’s strong commitment to finding alternatives to both anti-personnel landmines and mixed munitions, our obligation to provide for the safety and security of our armed forces, and our clear intention to sign the Ottawa Convention by 2006 if by then we can find and field such suitable alternatives.²⁴

²¹Canadian Dept. of Foreign Affairs and International Trade, “Dedication to Princess Diana,” *Safelane*, available from <http://server2.nonlinear.ca/safelane/site/english/diana>; Internet; accessed 3 October 1998.

²²*Ibid.*

²³“The Princess Ban: Landmines and Legislation,” *Far Eastern Economic Review*, 2 October 1997, 5.

²⁴US Information Agency, “Secretary Albright Says Landmine Crisis Can Be Solved,” *USIS Washington File*, 22 May 1998; available from <http://www.usis-canada.usia.gov/demine15.htm>; Internet; accessed on 12 Oct 98.

This statement indicates America's commitment to an eventual ban of antipersonnel landmines. The speed with which the Ottawa Convention has been ratified may pressure US participation earlier than anticipated.

The Ottawa Convention

The Ottawa Convention is the short name for the United Nations treaty titled "Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Antipersonnel Mines and on their Destruction." On 16 September 1998, Burkina Faso became the fortieth nation to ratify the treaty, which means that after a six-month waiting period the treaty entered into force on 1 March 1999.

The treaty is a result of the United Nations General Assembly Resolution 51/45 S of 10 December 1996, which calls for all states to pursue a legally binding agreement to ban the use and stockpiling of antipersonnel landmines. The treaty recognizes the earlier international efforts embodied in the "Protocol on Prohibitions or Restrictions on the Use of Mines, Booby-Traps, and Other Devices" and the "Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects" as well as welcoming the efforts "undertaken by the International Red Cross and Red Crescent Movement, the International Campaign to Ban Landmines and numerous other non-governmental organizations around the world."²⁵

The treaty calls on each state to never under any circumstance use, develop, produce, acquire, stockpile, retain, or transfer antipersonnel mines. States must also

²⁵ United Nations. Treaty Series. "Conventions on the Prohibitions of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction," 18 September 1998; available from http://www.un.org/Depts/Landmine/UNDocs/ban_trty.htm; Internet; accessed 12 Oct 98: preamble.

destroy stockpiled APLs before 1 March 2003 and destroy all APLs in mined areas by 1 March 2009.

After accepting the final draft of the treaty during the conference held in Ottawa in December 1997, the sixty-one member states were invited to sign it. Thirty-five states signed the treaty. Twenty-five declined to sign. One country did not state a position.

The countries that signed the treaty last December were generally free from security threats. Of the thirty-five countries that signed, twenty-seven were at peace, six were involved in border disputes, and two were suffering from some form of internal unrest. None of these thirty-five nations border China or Russia, and none of these nations were at war.

Countries with serious security threats tended not to sign the treaty. Of the twenty-five nations that did not sign the convention, three (Cuba, Iraq, and the United States) were at peace, four were involved in border disputes, and three were suffering from internal unrest. The other fifteen nations were either at war or near war (North and South Korea, Pakistan and India, Israel and Syria, and Zaire) or border on Russia or China. Including Russia and China, not one country bordering these two nations voted to accept or signed the convention last December.

Since a majority of the member states agreed to the convention, it was posted with the United Nations. Since then, it has been signed by 130 countries and ratified by forty-two. Of the ratifying countries, only Peru is involved in armed conflict. Norway and Turkmenistan, which border Russia, have ratified the convention, but these borders are remote and inaccessible.

Context and Scope

The purpose of this investigation is to explore the effect of banning antipersonnel landmines from the US arsenal in accordance with the Ottawa Convention. Although the Ottawa Convention becomes “binding” international law, the United Nations recognizes

the sovereignty of member states. The United States is not obligated to accept the provisions of the convention. The United States follows the provisions of international treaties with very few exceptions, even when the United States has not ratified those treaties. This examination presupposes US compliance with the Ottawa Convention in order to determine the consequences of compliance. Whether or not the United States *should* sign the treaty or even abide by it is beyond the scope of this thesis.

Except for in Korea, US policy only allows the use of self-destructing antipersonnel landmines. The Ottawa Convention requires a ban on all antipersonnel mines early next year despite the United States' stated intent to ban all antipersonnel landmines by 2006. US policy will have to change if it is to comply with this international law. What would be the effect of such a policy change on military operations? Would compliance with the Ottawa Convention leave US Army units vulnerable to exploitation by hostile forces? By answering these questions, it can be determined if there is a need to revise US doctrine and if there are any current or future technologies that might replace the capabilities antipersonnel landmines provide US forces.

Limitations

Time

This study may not exceed the time guidance for award of a Master of Military Art and Science degree during this academic year.

Clearance

In order to allow for the widest possible dissemination, this study will not consider any classified material.

Delimitations

The Ottawa Convention

This study will use the text of the Ottawa Convention as of 18 September 1997. Any amendments or exceptions subsequent to the Oslo draft of September 1997 will not be considered. This thesis is an examination of the effects of abiding by the Ottawa Convention, so no special exceptions for US interests will be considered, although it is arguable whether or not a special exemption would be made in the case of South Korea in exchange for American support to the treaty.

Time Frame

This study will work under the presumption of a complete antipersonnel landmine ban in accordance with the Ottawa Convention as of 1 March 1999. The purpose of this study is to explore vulnerabilities created by a ban as of now, so that the military can work to eliminate these vulnerabilities at the earliest possible date. This is a timely topic. Material in this study may change, since it will be prepared during the six-month waiting period of the convention. Should the United States sign the treaty or make a statement not to abide by the treaty until some date beyond 1999, the topic of this paper will not change.

Mines Versus Munitions

A current trend is to describe emerging "mine" technologies as "munitions" and not mines. This study avoids a semantic argument and considers any munition meeting the definition of a mine as found in the Ottawa Convention as a mine, regardless of how it is labeled. To provide a conservative approach, definition of antipersonnel mine will be given the widest possible latitude. This study, therefore, may consider some munitions as antipersonnel mines, where others may consider them as something else.

US Army operations

This examination limits itself to US Army operations and the vulnerabilities posed to the US Army. Although this examination should have some significance for other ground forces, this study limits itself to impacts on the US Army.

Significance of the Study

By understanding vulnerabilities the US Army can expect as a result of a complete antipersonnel landmine ban, the Army can determine what changes in doctrine, techniques, and technology are required to overcome these vulnerabilities. Knowing what problems to expect from a complete antipersonnel landmine ban, it can work to eliminate them before such a ban is imposed. Given current international opinion and the entry into force of the Ottawa Convention, it seems inevitable that the United States will eventually participate in a ban of antipersonnel landmines. By studying the impacts of such an act occurring by 1 March 1999, the Army may be able to implement the antipersonnel landmine ban without exposing itself to undue vulnerabilities.

CHAPTER TWO

LITERATURE REVIEW

Summary

There is much literature dealing with landmines and the merits of a landmine ban, but there is not very much available on the specific military impacts of such a ban. This chapter categorizes literature dealing with the landmine ban debate, technical and historical material, and studies of the military impacts of a landmine ban.

The debate surrounding the Ottawa Convention and a landmine ban is extensive and worldwide. As a result, there is much published material calling for a landmine ban. This material is generally backed up with reports and statistics covering the impacts on civilian populations and the difficulties minefields pose to the restoration of peace. There is some material arguing against a landmine ban, although this material is more editorial and less comprehensive. Generally, these articles attack the logic behind the ban, taking the position that irresponsible use of landmines is the problem and that banning mines will not resolve the issue. They are policy statements more than they are factual discussions.

Technical and historical information is found in the text of the Ottawa Convention and other international conventions covering landmine use as well as in US Army field manuals and articles describing the technical aspects of the munitions and how they have been used. There is much material describing the munitions in the United States' inventory and adequate material describing employment techniques and the doctrine of mine warfare. There is surprisingly little information on the history of mine warfare. There is also little scholarly work in this field. The military historian can find much information on the impacts of rifled weapons, aircraft, armored vehicles, and other

modern innovations on warfare. Military historians have not dealt with the impacts of landmines to any great extent, significant as they have been.

Considering the highly emotional aspect of the international movement to ban mines, there is little information providing balance by describing the impacts of a landmine ban on military operations. Information that is available has been produced by or for military organizations. Much of this information is classified, which may explain why those who have spoken out against the Ottawa ban have been vague about the military implications.

Literature on the Debate

Literature surrounding the debate tends to be opinion, rather than based on fact. This material takes a position for or against the ban. Those for the ban cite civilian casualties and the difficulties minefields pose to the restoration of normalcy following a conflict. Those opposed to the ban oppose it because they feel that the ban will not achieve the desired result, or they cite security needs.

Material for the Ban

There is far more material supporting the Ottawa Convention (or some form of landmine ban) than there is opposing it. Much of this material is emotional and openly biased in support of the landmine ban. Despite the position this material takes, there are many supported claims dealing with where the mine problems exist and the impacts these minefields are having on civilians and their communities. Much of this material can be found on the internet. There are several sites devoted to political action supporting the Ottawa process. Two examples of these are *Safelane* and The International Campaign to Ban Landmines home pages.

Safelane

The Canadian Department of Foreign Affairs and International Trade produces this web page. As a Canadian government product, it is openly biased in favor of the Ottawa process. Information available at this site includes a dedication to Princess Diana, praising her efforts in support of the ban. Also available at this site are documents related to the Ottawa Convention dating back to 1996.

International Campaign to Ban Landmines

This web site is rich in information detailing the history of the crusade to eliminate landmines as well as studies on the impacts of landmines on civilians. There are references to Red Cross studies and other international organizations that have studied the impacts on individuals and communities. This site keeps a calendar of events describing events occurring worldwide on the landmine issue. The text of the Ottawa Convention is posted here as well as information from other conventions dealing with the use of landmines. This site is openly biased, but has much useful information.

Clearing the Fields: Solutions to the Global Land Mine Crisis

This book was compiled and edited by Kevin M. Cahill, M.D. Despite the title, the author does not outline any specific steps to resolving the crisis other than calling on the US military to solve the problem. In his conclusion, Cahill states, "Only the military currently possesses the information, expertise, and organization that could reverse the landmine crisis."¹ This book is a collection of chapters by other authors. Included are chapters dealing with the current situation, seeking solutions, and new directions. There

¹Richard M. Cahill, M.D., ed., *Clearing the Fields: Solutions to the Global Land Mine Crisis* (New York: BasicBooks, 1995), 211.

are chapters on the social and political aspect of the debate and material covering the medical dimension.

One chapter in Cahill's book is titled "Why Mines? A Military Perspective." Colonel (retired) Richard H. Johnson wrote this chapter. Most of this chapter is scholarly, describing the military utility of landmines and some technical aspects of the munitions. As an ordnance officer, Johnson's experience was less with employing mines than dealing with them as ammunition or as unexploded ordnance. This point of view is evident in his statement that "the use of nondetectable mines today is at best a terrorist tactic."² These nondetectable mines are of very low metal content to avoid detection by metal detectors. Low metal content does not necessarily mean undetectability with current technology. These types of mines can have military utility in that they are difficult to detect and neutralize by enemy forces. Each of the chapters in this compilation include the opinions of the particular authors. These authors are knowledgeable and provide insight into the landmine dilemma. Johnson's chapter is useful as a baseline of information on the utility and functioning of landmines.

Material Against the Ban

This material is short and editorial. Statements objecting to the ban are found in governmental policy statements from countries opposed to the ban and are often quoted in news sources and in conservative editorials in magazines such as *Far Eastern Economic Review*, *International Defense Review*, and *Beijing Review*. These editorials had little utility for this study other than to balance the material calling for a ban. These articles cite security needs or argue that a ban will not save any civilians from mines already in

²Richard H. Johnson, "Why Mines? A Military Perspective," in *Clearing the Fields: Solutions to the Global Land Mines Crisis*, ed. Kevin M. Cahill, M.D. (New York: BasicBooks, 1995), 35.

the ground as reasons not to accept a ban. Statements by government officials are generally vague, and tend to support the intent of the Ottawa process, but cite security needs as a reason not to sign the convention. China, Finland, Cuba, and the United States have made statements defending their objection to the treaty and each country has cited security needs. These statements do not clearly indicate how the Ottawa Convention would specifically disrupt military operations.

Historical and Technical Information

This category of information is grouped together for the purpose of this thesis because it serves to provide background information. Historical information on landmine use is embedded briefly in military histories but there are few significant sources on the history of mine warfare. There is much material covering the history of the landmine debate, but because most of it is so recent, little of this material can be found in book form. Technical information is also background to this thesis. Included as technical sources are the international conventions covering landmine use and US Army publications covering the technical and tactical functions of landmines.

Historical Sources

The application of landmines in warfare is mentioned in many studies of particular conflicts. Generally, these are passing comments and are not dealt with in any great detail. Two periodicals have dealt with the history of mine warfare specifically.

International Defense Review published an article in November 1989 by J. R. Wyatt titled "Land Minewarfare: Recent Lessons and Future Trends." This article looks at the future of landmine technology. *International Defense Review* has published other articles dealing with landmines, some of which are shown in the bibliography.

Engineer magazine, published by the US Army Corps of Engineers, printed in July 1998 the first of a two-part article titled "The Origins of Military Mines." Anyone conducting a study of the history of mine warfare should start with this article. It is concise and cites numerous sources.

A more in-depth discussion is in C. E. E. Sloan's book *Mine Warfare on Land*. This book is a concise treatment of mine warfare from World War II to the Falkland Islands War. The book provides information on the types of landmines and how they have been used in recent history. A large section of the book is devoted to countermine warfare and recent trends in this field. Sloan outlines multiple uses of antipersonnel mines and attests to their "obvious utility."³ He also stresses the psychological impact mines have on military forces.

The Office of the Army's Chief of Engineers publishes the most comprehensive material on the subject of mine warfare. This fifteen volume series is titled *Landmine and Countermine Warfare*. The series covers landmine use from the North African Campaign of World War II to Vietnam. The series focuses on employment techniques and includes extracts from unit reports. Of particular use to this study are the comments of General Erwin Rommel on the impacts of landmines in North Africa, casualty statistics for allied units, and the unit reports from the Korean War.

The history of the landmine debate has been reported in magazines and newspapers. This issue is very recent, and as far as this author can determine, there are no comprehensive works covering this subject. The *Safelane* web site previously mentioned has a page devoted to the published reports of international meetings leading up to the ratification of the Ottawa Convention. This web page is the best single source for material covering the history of the landmine ban.

³C. E. E. Sloan, *Mine Warfare on Land* (London: Brassey's Defence Publishers, 1986), 35.

Available at the *Safelane* site and at the United Nations home page is the “Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction”, also known as the Ottawa Convention. This treaty provides the basic assumption for this thesis as well as the definitions of key terms. The Ottawa Convention is at appendix A. Also available at these sites is the “Amended Protocol on Prohibitions or Restrictions on the use of Mines, Booby-Traps and Other Devices.” This treaty regulated the use of mines and other devices before the landmine ban was ratified.

After the Guns Fall Silent: The Enduring Legacy of Landmines by Shawn Roberts and Jody Williams is a comprehensive study of the world landmine dilemma. This book devotes sections to each country significantly impacted by residual minefields and details the number of civilian casualties and the impacts on the economies in these countries.

Technical Sources

The US Army Field Manual 20-32, *Mine and Countermining Operations*, is the comprehensive source for current US mine warfare doctrine. This manual outlines operational principles and employment techniques. Every landmine in the US inventory is described in general terms, and the specific application for each mine is described. Other manuals, such as Field Manual 5-102, *Countermobility*, outline general operational methods for obstacle employment including minefields. The US Army has technical manuals describing the specific characteristics of US landmines and how to arm and disarm them.

Studies of the Military Impacts of a Landmine Ban

Articles, papers, studies, and other material that look at the impact of a landmine ban on military operations are surprisingly rare. There is very little material in military

professional journals, and there is almost no information available in the media at large. The more in-depth studies were produced for the military and are classified.

What follows is a brief description of the material available and what conclusions that material makes.

John Arquilla, a professor of defense analysis at the United States Naval Postgraduate School, wrote an article for *World Policy Journal* titled "The 'Velvet' Revolution in Military Affairs." This article is critical of the US military's approach to the current revolution in military affairs. Part of his criticism is that the concepts of Force XXI lend themselves to a nonlinear battlefield and that the US Army's "devotion to landmines" is a sign that the Army cannot see past the linear battlefield of the past. Other than this singular illumination, Arquilla's article offered little to this study.

James Hewish and Rupert Pangelley coauthored the article titled "In Search of a Successor to the Anti-Personnel Landmine" for *Jane's International Defense Review*. This is a rare magazine article on landmine warfare and the effects of the Ottawa ban. This article is very useful at outlining potential landmine replacement technologies and directing the researcher to specific studies and research organizations. The authors look at the uses of antipersonnel mines and what South Africa, Sweden, and the United States might do to replace them. South Africa has studied replacing the protection capability of APLs using sensors to identify intruders and a mortar system called a hedgehog to unleash ordnance on the intruder. The Swedes have experimented with remote sniping to shoot intruders. The article discusses the US direction of research for APL replacement and quotes one government study as saying the only feasible near-term solution is additional force structure.

The International Red Cross came to a similar conclusion in its report for the Review Conference of the 1980 United Nations "Convention on the Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May be Deemed to Be

Excessively Injurious or to Have Indiscriminate Effects.” In 1994, the Red Cross convened a panel of military experts to study the uses of antipersonnel landmines and report on any potential replacements. The panel concluded that “no alternative fulfills the military requirement in the way that antipersonnel . . . mines do.”⁴

In a contradictory report by the Red Cross commissioned in 1996, another military panel concluded that “Although the military value of anti-tank mines is acknowledged, the value of AP mines is questionable.”⁵ Significant to the pursuit of this thesis, the first conclusion of this military panel supports the findings of this chapter.

The military value of landmines, as used in actual conflicts over the past 55 years, has received little attention in published military studies. The specific added value of AP mines, as compared to that of anti-tank mines, has barely received any attention. There is also little evidence that dedicated research on the value of AP mines, based on historical experience, has been carried out within professional military organizations.⁶

The Office of the Secretary of Defense prepared a report to Congress in March 1998 titled “Annual Report to Congress on use by Armed Forces of Anti-Personnel Landmines.” This report is in response to the congressionally mandated landmine moratorium scheduled to begin in February 1999, but repealed in 1998. Although the report discusses the impacts of the moratorium, it applies to this discussion since the moratorium would have produced the same effects as the Ottawa Convention at about the same time. This report and a companion report by the Chairman of the Joint Chiefs of Staff conclude that “at this time, U.S. adherence to [an international APL] ban would put

⁴Richard H. Johnson, “Why Mines? A Military Perspective,” in *Clearing the Fields: Solutions to the Global Land Mines Crisis*, ed. Kevin M. Cahill, M.D. (New York: BasicBooks, 1995), 38.

⁵International Committee of the Red Cross, *Anti-personnel Landmines: Friend or Foe?* (Geneva: 1996), 72

⁶*Ibid.*, 71.

U.S. forces at unacceptable risk”⁷ and “discontinuing APL use imposes unacceptable restrictions on all warfighting CINCs, resulting in adverse effects on the execution of war plans.”⁸ Exactly how this restriction would impact the war plans is classified secret, and is therefore, delimited from this study.

In April 1996, the Dupuy Institute prepared a study on the tactical impact of taking APLs out of the inventory. This study concludes that the United States can expect a 3 percent increase in casualties in the event of a landmine ban according to historical uses of mines. It further concludes that: “FAILURE TO EXPLOIT THE PAYOFF OF DIVISIVE MINEFIELDS COULD EASILY DOUBLE OR TRIPLE US CASUALTIES.”⁹ The use of underline and all capitals is from the original text. These conclusions are discussed further in chapter five.

Major Daniel P. Mahoney III prepared a monograph for the School of Advanced Military Studies, United States Army Command and General Staff College, titled “Goalie without a Mask? The Effect of the Anti-Personnel Landmine Ban on United States Army Countermobility Operations.” Despite the title, this study concludes that the current United States ban on APLs will not have an adverse effect on the US Army since self-destructing APLs can fill the void left by banning conventional APLs. This study uses the Battle of El Alamein as a case study in observing the effectiveness of minefields where few or no antipersonnel mines were available. This study does not look at the

⁷Office of the Secretary of Defense, “Annual Report to Congress on Use by Armed Forces of Anti-Personnel Landmines: In response to FY 1998 Defense Authorization Act, Section 1309” (March 1998), iii.

⁸General Henry H. Shelton, “Report on Effects of Moratorium Concerning Use by Armed Forces of Anti-Personnel Landmines as directed by Section 1402 Defense Authorization Act, FY 1996” (27 April 1998), cover memo.

⁹“Military Consequences of Landmine Restrictions” Research paper prepared by the Dupuy Institute (McLean, VA: 10 April 1996), addendum page 3.

Ottawa ban, but on the current US mine policy. Because Major Mahoney's monograph does not take into account a ban of self-destructing antipersonnel landmines, the conclusions do not necessarily apply to this study. This monograph is useful in locating background sources. Major Mahoney's methodology was useful for this thesis. By examining the maneuver effects of fixing, turning, disrupting, and blocking the enemy with minefields, his study effectively illuminates the need or lack of need for antipersonnel landmines in these systems. Mahoney's study does not consider the use of mines for area denial specifically but does address the difficulty self-destructing mines have filling the protection function.

A US Army War College research project titled "The Landmine Dilemma and the Role of the United States Government" by Lieutenant Colonel Donald R. Yates looks at what the US government should be doing to resolve the international problem. Although not specifically focused on antipersonnel landmines, this study concludes that the United States should support the legitimate use of landmines and work to deter the illegal use of landmines as outlined in conventional weapons protocols.

Perhaps the only open source analytical study of the impact of a landmine ban is found in "The Military Utility of Landmines: Implications for Arms Control." This study prepared for the Office of the Secretary of Defense by Stephen D. Biddle, Julia L. Klare, and Jaeson Rosenfeld of the Institute for Defense Analyses concludes that antipersonnel landmines have no significant value on the battlefield. This study was conducted using the Janus computer model and running multiple force-on-force battles with differing levels of landmine use. The importance of antitank mines was confirmed, and the utility of APLs was illustrated, although the significance of APLs was questioned. This study tried to replace minefield effects with enhanced indirect fire systems and direct fire systems. The study concludes that other means of fire can replace the effects of mines, but at a prohibitive cost. The study called for more research into alternative means of

replacing minefields in what they called an "asymmetrical" approach. In other words, look to replace the effects of minefields not by using a one-for-one approach, but by using a more comprehensive approach.

The weakness of this study with respect to antipersonnel landmines is that the Janus computer model fails to take into account psychological factors. In Janus, dismounted soldiers will attack a position at full speed regardless of the barriers in front of them. Historically, the presence of antipersonnel landmines has been a severe deterrent to dismounted soldiers in the attack.

Conclusions

Although there is not much material available on replacement technology for antipersonnel landmines, there is enough to conduct a thorough investigation. The landmine debate is well documented even if these sources are disconnected and unorganized. The opposition to the Ottawa Convention is underrepresented, but there are many policy statements from those opposed to the ban. The military uses of landmines are well documented both in military and civilian works.

Missing completely from the current body of knowledge is the role of landmines in the US Army of the future. One writer has questioned the need for mines in a force that is nonlinear and completely aware of its situation. Are mines required by Force XXI? This question could be a compelling topic for the future researcher.

CHAPTER THREE

RESEARCH METHODOLOGY

Introduction

This study addresses the question of the military utility of antipersonnel landmines in two stages. The final objective is to determine if adherence to the Ottawa Convention will create any tactical vulnerabilities for the US Army. The first part of this determination is to clearly define what purpose APLs serve. The second part determines what current techniques and procedures may be used to replace APLs. These two stages are relatively straightforward in that they will look at historical landmine warfare and the US Army's current doctrine and equipment.

The First Stage: The Utility of Antipersonnel Landmines

Landmines perform some function on the battlefield. The fact that millions of mines are in the ground today attests to the military utility of landmines. Since World War I, landmines have been used to achieve specific effects on the enemy. This portion of the study classifies these effects.

In order to determine what role landmines play on today's battlefield, this study will look at current US Army doctrine, the current US mine inventory, and the history of mine warfare. Current doctrine will illuminate stated purposes. The design of the landmines themselves should help determine their purpose. History will illuminate actual purposes. Determining the purposes for which combatants have employed antipersonnel landmines will enhance the understanding of the stated doctrinal purpose for these munitions. Only after understanding the perceived need for these weapons can the study determine if other systems can fulfill this need.

In determining the doctrinal use of landmines, the study investigated US Army field manuals covering the employment of landmines and the conduct of countermobility operations. Countermobility operations are those actions which aim to hinder an opponent's ability to maneuver. Landmines are a significant part of countermobility operations.

The history of mine warfare was covered in chapter one. History has provided us many examples of why mines have been used and for what purpose. To look at the historical use of mines, this study drew on C. E. E. Sloan's book *Mine Warfare on Land* and the Red Cross Report *Anti-Personnel Landmines: Friend or Foe?* and on the US Army's *Landmine and Countermine Warfare*. These sources provided descriptions of the uses and effectiveness of landmines in this century. Military members well acquainted with landmine warfare compiled all of these works.

By determining the specific effects APLs are designed to have on the enemy, this study determined if there are other methods or munitions that can also produce these effects.

Stage Two: Replacement Options

Landmines are but one system found on today's battlefield. Modern armies believe in the simultaneous application of many types of systems to achieve a desired effect on the enemy. Perhaps using one of these systems in a different way could replace the need for antipersonnel landmines.

The Battlefield Operating Systems

There are many systems on the modern battlefield. Tanks, infantry (mounted in armored vehicles or dismounted), and artillery are the most notable systems, but there are many others. Information gathering systems abound in the form of airborne sensors,

unmanned aerial vehicles, and ground surveillance radars. Communications systems relay data and voice transmissions to virtually every soldier. Engineers erect obstacles and overcome them. The US Army categorizes these various systems into the battlefield operating systems.

The battlefield operating systems are maneuver, fire support, command and control, air defense, intelligence, combat service support, and mobility and survivability.

Maneuver is the application of movement and direct fire. Tanks, infantry, and attack helicopters are the military arms that are primarily responsible for this function.

Fire support is the application of indirect fire systems. Mortars and field artillery are the primary means of applying indirect fire, although Air Force close air support and air interdiction are considered a part of this operating system.

Command and control is the function employed primarily by maneuver (i.e., tank and infantry) commanders and their staffs. It is the ability to control and synchronize large formations through staff procedures and communications networks.

The intelligence operating system is the ability to gather, analyze, and disseminate information pertaining to the enemy. Given certain key facts about the enemy and his intentions or dispositions, decisions are made that influence employment of lethal systems. The intelligence system also includes counterintelligence which seeks to deny the enemy the ability to use his intelligence gathering methods.

Air defense is the system dedicated to protecting friendly forces from the enemy's air assets. Air defense shoots down enemy aircraft and involves passive protective measures that all forces employ to minimize the effects of air attack.

Combat service support is the function that supports the force by arming, fueling, fixing, and manning the systems on the battlefield. Combat service support, among many other things, provides fuel to run the tanks, ammunition for the artillery, food for the soldiers, and mechanics to repair broken equipment.

Mobility and survivability is the function that enhances the ability of friendly units to move and survive on the battlefield. Engineers are primarily responsible for this battlefield operating system. Engineers build roads and bridges to improve mobility and construct field fortifications to enhance the survivability of soldiers and weapon platforms. Mobility also includes countermobility which attempts to deny the enemy the ability to freely move around on the battlefield.

Countermobility includes mine warfare. Antipersonnel landmines are one set of munitions that contribute to this one element of one of the battlefield operating systems. Can the other operating systems close the gap that removing APLs may produce? Can other countermobility assets do the job of APLs? Answering these questions is the objective of part two.

In determining what other systems or munitions may replace antipersonnel landmines, it is necessary to determine exactly which US munitions are banned by the Ottawa Convention. Perhaps some antitank mines can replace some functions of APLs. Before this can be determined, the mines that are banned must be identified. The Ottawa Convention describes which munitions are banned as well as those that are not. Applying these criteria to US munitions will answer this part of the question.

Conclusions

Part one answers the question of what purpose do antipersonnel mines serve. Part two determines what other systems can meet the purposes of antipersonnel mines should they be banned. The conclusions of chapter four will not answer the question of this thesis, which is would signing the Ottawa Convention create vulnerabilities for the US Army? Chapter five will compare the conclusions of chapter four with other studies on the implications of a landmine ban to determine if any capability gaps constitute vulnerabilities for the US Army.

CHAPTER FOUR

ANALYSIS

Introduction

This study assumed that the United States would abide by the Ottawa Convention as of 1 March 1999, even though the United States has stated that it will not abide until 2006 at the earliest. The reason for this assumption was to determine what impacts the Ottawa Convention would have on current US Army operations. Currently, there is political pressure to ban antipersonnel landmines in the United States. In 1996, the President banned the use of non-self-destructing APLs except in Korea. Also in 1996, Congress enacted an APL moratorium for one year beginning 12 February 1999. Congress repealed this moratorium in 1998, but this legislation demonstrates the political interest in a landmine ban. The political pressure to ban APLs, worldwide and in the United States, has impacted the US Army's ability to use these weapons. By assuming adherence to the Ottawa Convention, this is a worst-case study considering the impacts of a permanent and comprehensive ban of APLs.

This chapter addresses the purpose of antipersonnel landmines and the ability of other systems to replace APLs. To determine the purpose of APLs, this chapter looks at US Army doctrine and the antipersonnel mines in the inventory. Doctrine provides broad principles for mine warfare and specific employment techniques. By examining the landmine inventory, this chapter details specific purposes that each mine is designed for and determines which US mines are banned under the Ottawa Convention. At this point, this thesis should provide an understanding of the doctrinal requirements for APLs and of what each munition is designed to accomplish.

Once the purposes have been determined, other means of meeting these purposes are explored. The next portion of chapter four uses the framework of the battlefield

operating system. Each system is matched to each APL purpose to determine which systems can perform which functions. Many systems can meet particular APL functions but, in many cases, at a lesser degree.

Part 1: The Purpose of Antipersonnel Landmines

US Army Mine Warfare Doctrine

The primary source of mine warfare doctrine comes from Field Manual (FM) 20-32, *Mine/Countermine Operations*. The latest version is dated 29 May 1998 and includes the current restrictions on non-self-destructing antipersonnel landmines except in Korea. FM 5-102, *Countermobility*, provides the governing philosophy and employment considerations for all countermobility operations. *Countermobility* is an older document (1985) and does not include the latest descriptions of obstacle effects found in FM 20-32. FM 5-102 does not provide the detail of FM 20-32 when it comes to munitions or minefield design, but it is useful for understanding the thinking behind the doctrine.

Minefield Types

FM 20-32 describes five types of minefields: protective, tactical, interdiction, nuisance, and phony. These minefields are generally composed of a mix of antitank and antipersonnel mines except for the phony minefield which contains no mines.

Protective Minefields

Protective minefields are designed to protect friendly troops and facilities by deterring the enemy from approaching, slowing him down, and attriting him if he is not deterred. Protective minefields also provide early warning to the defenders. This early warning comes when an enemy soldier detonates a mine. Units emplace hasty protective

minefields outside their positions to provide close-in protection.¹ Another type of protective minefield is the deliberate protective minefield. "Deliberate protective minefields are used to protect static installations such as depots, airfields, and missile sites."²

Tactical Minefields

Tactical minefields influence enemy maneuver. These minefields are a component of an obstacle group which has the purpose of fixing, turning, blocking, or disrupting the enemy. Although other obstacles may be used in these obstacle groups, "Minefields are the most effective means of reinforcing terrain to stop, slow, or canalize the enemy into areas where he can be killed."³ Often, minefields are the only type of obstacle found in an obstacle group.

FM 20-32 provides a basic array of minefields in each type of obstacle group. FM 20-32 also provides a basic design for the individual minefields in the array. These individual minefield designs and arrays are based on achieving the desired effect of fix, turn, disrupt, or block against a Soviet-style threat. The density of the minefields, spacing between minefields, and the antitank/antipersonnel mix were all designed to influence a Soviet-style mechanized enemy conducting a deliberate attack.

Obstacles in the engagement area slow the enemy down and force him to zigzag as he makes his way through the engagement area. By slowing him down, friendly forces have more time to bring weapons to bear. By forcing the enemy to zigzag, friendly forces are given flank shots on enemy vehicles. These obstacles are placed where the enemy

¹U.S. Department of the Army, Field Manual 5-102, *Counter mobility* (Washington, DC: March 1985) 80-81.

²Ibid.

³Ibid., 84.

should decide to bypass the obstacles rather than breach them, and in so doing will encounter other obstacles further in the engagement area. As the enemy bypasses these obstacles, he slows down and zigzags, providing the desired effect for the friendly commander.

The obstacles in the fixing group must not be too daunting or the enemy may decide to avoid the area altogether. Neither should the individual obstacles in the group be too long. If they are too long, the enemy will not readily determine that a bypass is possible and will have to breach, or bypass the area entirely.

Normally, turning obstacle groups are also associated with engagement areas. The purpose of these engagement areas is not so much to destroy the enemy but to force him to use another axis of advance. The turning obstacle group turns the enemy from his desired direction to a direction desired by the defending commander. The enemy is normally turned into a primary engagement area where the friendly units are prepared to destroy him.

Obstacles in the turning group make the enemy experience subtle changes of direction as he bypasses them. The combined effect of these subtle changes in direction and further persuasion in the form of direct fire changes the enemy direction of attack before he realizes it. In the event the enemy commander is not dissuaded from his original axis of advance, the turning obstacle group must be strong enough to provide a blocking effect.

The blocking obstacle group is designed to prevent the enemy from using a certain avenue of approach. Unlike the turning group, the blocking group is not concerned with where the enemy goes, so long as he does not go through the blocking obstacle. Blocking obstacle groups are often associated with an engagement area as well. Such a group may be used at the "exit" of the engagement area. An obstacle group used for this purpose serves as a cork in the bottle to keep the enemy in the engagement area until it is

destroyed. Blocking groups are often used on flank approaches to the defending friendly forces. A small unit, such as a company, may guard a relatively narrow avenue that threatens the flank of a brigade. To support this "economy of force" mission, the company may be provided with a blocking obstacle group.

The blocking obstacle group, and the direct and indirect fires covering it, must be strong enough to prevent the enemy from breaching through. Redundancy, depth, and a significant number of antihandling devices and APLs are common to the minefields of a blocking group.

The purpose of the disrupting minefield group is to upset the enemy timetable and formation. If the enemy is approaching on three parallel avenues with a battalion on each, small obstacles placed in depth on one or two of the avenues will allow one battalion to proceed unimpeded, while its sister battalions are slowed down. This group of disrupting obstacles forces the enemy commander to sacrifice the synchronization of his battalions or to slow his entire formation down.

Unlike the other tactical obstacle groups, disrupting obstacle groups are not normally covered by direct fire systems. Scouts, artillery forward observers, or other soldiers observe these obstacles and reinforce the disrupting effect with indirect fire as required.

Interdiction Minefields

Interdiction minefields kill, disorganize, and disrupt lines of communication and command and control facilities. Interdiction minefields are used to separate enemy forces and delay follow-on echelons.⁴ Interdiction minefields are similar to disrupt minefields in that they both disrupt the enemy's timetable and synchronization; they differ in

⁴U.S. Department of the Army, FM 5-102, *Countermobility* (Washington, DC: March 1985) 81.

application. The interdiction minefield is usually placed after the battle has begun. Scatterable mines are delivered by artillery, aircraft, or even ground units to interdict a particular area based on the enemy situation. These types of obstacles are known as situational obstacles, because even though the commander recognizes the need for the particular minefield, it is only after the situation has developed before he knows when and where to apply the obstacle.

Interdiction minefields are most commonly used to delay follow-on forces, allowing more time for friendly forces to deal with the enemy lead echelons. A well placed, well timed minefield "appearing" between the enemy lead and follow-on echelons can destroy the enemy's synchronization and expose the enemy to destruction in detail. Interdiction minefields are also used to interdict enemy artillery positions. An effective counter-battery round is the Remote Anti-Armor Munition (RAAM) which contains antitank mines. The mines slow the enemy artillery units, giving the counter-battery fire more time to do damage. If the enemy decides not to be slowed, he runs a serious risk of destruction by encountering the mines. Another application of the interdiction minefield is to attack command and control facilities with antipersonnel and antitank mines. By isolating enemy command posts, key decision makers may become separated from fighting units resulting in degraded command and control and possible loss of communications. Interdiction minefields may also target combat service support units to separate fuel, food, and ammunition from the fighting units.

Nuisance Minefields

The most common form of minefield found in the world today is the nuisance minefield. Some current US doctrine refers to nuisance minefields as "point" minefields since they are usually less than 100 meters in diameter and typically affect a specific point on the ground. Physically, these minefields resemble disrupting and interdiction

minefields. The difference is in the target. The nuisance minefield is far less discriminate in its intended target. Any enemy element will suffice. The following quote from FM 20-32 illustrates the purpose of nuisance minefields by comparing them with booby traps. "Booby traps are psychological weapons. They make the enemy cautious and slow down. These actions in turn cause enemy casualties... The principles governing the use of booby traps and nuisance mines are identical."⁵

Armies in retreat are more likely to employ nuisance mining. Mined and booby trapped are fords, bridges, buildings, roads, abandoned supplies and equipment, and likely bivouac areas. The minefields are generally small, sometimes consisting of only one landmine. They are placed to induce caution in the enemy and slow down his pursuit. They do this by inflicting unexpected casualties in what is perceived by the enemy as random. In all situations where nuisance mining is employed, the intended target is the enemy's morale.

Phony Minefields

Phony minefields are areas that appear mined, when in fact they are not. They may be incorporated into tactical obstacle groups, used as protective obstacles, or used as a nuisance to the enemy. Phony minefields used without some "real" minefields present are not likely to fool the enemy. Therefore, phony minefields are seen only after mine warfare has been used in a particular conflict. Phony minefields are easier to emplace and use less resources than real minefields, but their effect is limited to the inclination of the enemy to bypass. A determined enemy who is as likely to go through a minefield as bypass it will not be impacted much by a phony minefield.

⁵U.S. Department of the Army, FM 20-32, *Mine/Countermine Operations* (Washington, DC: 29 May 1998), 13-2.

The Battle of Potter

To illustrate the role of mine warfare in current US Army operations, this paper will now look at the Battle of Potter. This battle was a training simulation fought on a Janus computer model with a staff group of sixteen students, 7B, of the Command and General Staff Officer Course fighting the US Army side, and the staff of the Janus simulator fighting the enemy forces. In this battle, the enemy Dakotans were attacking from the north to seize Kansas City. The Dakotans use former Soviet equipment and doctrine. The Janus simulation is a real-time computer simulation replicating individual systems on the battlefield. Each soldier and each weapon system is portrayed.

Staff group 7B played the part of 3d Brigade, 55th Infantry Division (Mechanized), with the mission of defending just north of Fort Leavenworth between the Missouri River to the east and Stranger Creek to the west. Highway 7 runs north-south through the center of the sector. 3d Brigade had three battalion sized task forces. Task Force 1 defended on the left between Stranger Creek and the town of Potter on one side and Highway 7 on the other side. Task Force 2 defended further south between Highway 7 and the Missouri River. Task Force 3 occupied a battle position oriented to the northeast that connected Task Force 1 and Task Force 2.

Staff group 7B was facing a Dakotan division consisting of one BTR-60 equipped mechanized infantry brigade, two BMP-2 equipped mechanized infantry brigades, and one T-80 equipped tank brigade. The staff group expected the enemy to conduct a deliberate attack oriented on Highway 7. The BTR brigade would advance in the lead to develop the situation. The BMP brigades would follow with one to the east of the highway and one to the west. The tank brigade would follow as the second echelon to exploit the success of either BMP brigade. The enemy might also attempt to cross Stranger Creek at the town of Potter and exit 3d Brigade's sector. Also, there was a

possibility that at least part of one enemy brigade might cross Stranger Creek into the rear of 3d Brigade further south creating a flank threat.

To defeat the enemy division, Task Force 1 on the left was to deny the enemy any crossing of Stranger Creek near the town of Potter and deny the enemy any penetration in sector. Task Force 1 had to turn the enemy from his anticipated main axis of attack along Highway 7 further to the east. Task Force 2, in the east, was to deny the enemy any penetration, holding them, so that Task Force 3, which was hidden behind Task Force 1, could complete the destruction of the enemy.

The only barriers available were mines. Task Force 1 received the majority of the mine effort with a blocking group of minefields in the approaches to Potter and a turning group of minefields in front of their main position to turn the enemy to the east. Task Force 2 built a fixing group of minefields to their front in order to slow the enemy in an engagement area where Task Force 2 and Task Force 3 would destroy the enemy. Staff group 7B determined that Task Force 2 could hold the first echelon enemy brigades but not the second echelon tank brigade. In order to keep the tank brigade out of battle long enough for the first echelon brigades to be destroyed, the staff group selected a choke point on Highway 7 to place an interdiction minefield. Artillery would deliver the minefield using ADAM/RAAM mines after the first echelon cleared the choke point. Once the second echelon encountered the minefield, long range artillery and aircraft would attack the tank brigade to attrit it and further slow it down. This would provide the time needed for Task Force 2 and Task Force 3 to complete the destruction of the first echelon brigades.

The battle played out very much as the plan anticipated. The enemy, encountering the significant obstacles in front of Task Force 1, first tried to cross the creek at the town of Potter. This effort was defeated due to the blocking obstacle and direct fire systems denying this avenue to the enemy. The enemy then turned his attention to the east and

attempted to bypass Task Force 1 to the east of Highway 7, just as staff group 7B had hoped. Simultaneously with this effort to the east, an enemy battalion appeared in the flank approaches. Anticipating this threat, the 3d Brigade reserve employed Volcano mine systems to disrupt the crossing and direct and indirect fire to destroy the flank threat.

The turning obstacle in front of Task Force 1 worked better than expected. Only the remnants of the BMP brigade in the west managed to turn into the fixing obstacle in front of Task Force 2. The other lead BMP brigade moved to the extreme east along the Missouri River. Task force 2 was hard pressed to contain the enemy but managed to do so with some help from a company of tanks sent by Task Force 3. As this engagement was going on, the planned interdiction minefield was installed in the face of the approaching tank brigade on Highway 7. This minefield, only 400 meters by 400 meters, managed to halt the tank brigade for twenty minutes. In that twenty minutes, artillery and attack aircraft managed to nearly destroy it.

The only significant loss to 3d Brigade was Task Force 1, which was nearly destroyed by the enemy. It was in an exposed and forward position and received the brunt of the attack. The turning obstacle in front of it did not initially convince the enemy to turn in the desired direction and had to function as a blocking obstacle. Once the enemy decided that the avenue was too difficult to force, it turned its efforts in the desired direction. The other task forces in 3d Brigade were basically unscathed. The enemy suffered a significant defeat. The two BMP brigades were annihilated. The tank brigade was reduced to less than battalion strength, and the BTR brigade was rendered combat ineffective. The difference between victory and defeat was the timely and accurate use of one small interdiction minefield. Had 3d Brigade fought the enemy tank brigade at the same time the enemy was threatening the far east sector and threatening the flank, the enemy would have won the battle. By using minefields to shape the engagements and by

keeping the tank brigade out of the battle, staff group 7B was able to decisively defeat the enemy.

Role of Antipersonnel Landmines in US Mine Fields

The functions of US minefields are protective, tactical, interdiction, or nuisance. US Army doctrine has minefield types to conform to these functions, with the additional type of the phony minefield. What role, then, do antipersonnel landmines play in these minefields?

Protective Minefields

Protective minefields are either hasty or deliberate. Hasty protective minefields provide close-in security for small units. Deliberate protective minefields provide protection to fixed installations. In both cases, the protection is from infiltration. Infiltration is a task for dismounted soldiers much more so than mounted soldiers. Antipersonnel landmines provide deterrence from dismounted infiltration. When deterrence fails, APLs cause casualties to the infiltrators or force the infiltrators to conduct a slow and deliberate breaching of the protective minefield. Either situation aids the defenders in detecting the infiltration. When an infiltrator trips a mine, the explosion alerts the defenders. Deliberate breaching of an APL minefield takes on the order of one hour to breach one meter. This significant delay provides time for the defenders to discover, and then counter, the infiltration.

Tactical Minefields

Tactical minefields fix, turn, disrupt, or block enemy formations. When these enemy formations are primarily dismounted, the tactical minefields should be primarily composed of APLs, but this situation is probably not likely. A US Army mechanized

division could probably defend against a dismounted attack without the aid of minefields. Although a dismounted attack on a mechanized force is improbable, the Iranians attacked on foot against the mechanized Iraqis in the Iran-Iraq War. These attacks were generally unsuccessful, in part because the Iraqis used antipersonnel minefields to aid in their defense.

Standard tactical minefield designs found in FM 20-32 are based against a Soviet-style, mechanized foe. This is the more probable scenario. It is important to keep in mind that the purposes of APLs discussed in this chapter consider operations against a mechanized enemy. In mine warfare directed against light forces, antipersonnel landmines achieve the tactical effects by themselves.

The fixing minefield in the fixing obstacle group does its job if the enemy bypasses or breaches it. APLs are not required in a turning minefield arrayed against a mechanized foe.

The blocking obstacle must resist enemy attempts to breach. In order to protect the antitank mines in the minefield, direct and indirect fires are planned to cover the minefield and the minefield remains under constant observation. Measures are taken in the construction of the minefield to make it more difficult to breach. The antitank mines are buried (when possible) to make them more difficult to detect. Antihandling devices are placed on some of the mines to prevent the enemy from lifting them out of the way. Antipersonnel mines may be used throughout the minefield to protect the antitank mines from dismounted breaching parties. The standard design calls for antipersonnel mines on the leading edge of the minefield and with the leading antitank mines. These APLs on the leading edge deter not only breaching parties, but deter scouts from entering the minefield to determine its size and composition.

The standard design for the turning minefield does not call for APLs, but the turning minefield must be robust enough to act like a blocking minefield in the event the

enemy is not turned. FM 20-32 does not preclude using APLs in the turning minefield. If the enemy relies on dismounted breaching to support mounted operations, APLs should be placed in the turning minefield for the same reasons they are found in the blocking minefield.

Disrupting minefields are not generally protected by direct fire, but they may, as the situation requires, be protected by antipersonnel landmines. Having APLs in these minefields keeps the enemy "honest." If no APLs are present in the disrupting minefield, and the enemy is well aware of this, then the enemy need only kick the mines out of the way. If the enemy fears antihandling devices, he can use a remote lifting technique. The presence, or even the suspected presence, of APLs forces the enemy to reject these techniques and use deliberate mine clearing methods, or accept risk.

For the tactical minefields, APLs serve two functions. They deter rapid dismounted breaching, and they deter reconnaissance of the minefield. In the case of the fixing minefield, APLs do not add to the purpose of fixing the enemy, and may even deter the enemy from entering the engagement area.

Nuisance Minefields

Antipersonnel landmines perform the same functions in nuisance minefields as they do in disrupting minefields. APLs are the dominant mine used in nuisance minefields located in buildings, bivouac areas, or other areas where dismounted soldiers may go. The purpose of nuisance mines is to slow the enemy and to attack his morale. Without APLs, nuisance minefields will not slow the enemy as much, and will have a reduced impact on his morale.

Nuisance mining is also conducted in conjunction with other types of delaying obstacles. Road craters, wire obstacles, and other barriers designed to slow an enemy

may be reinforced with APLs. APLs used to reinforce other obstacles deter or slow down the removal of these obstacles.

Phony Minefields

Because phony minefields contain no mines, APLs have no direct function in the phony minefield. Using APLs in other minefields, however, may lead the enemy to suspect the presence of APLs in the phony minefield. Should the enemy know that there are no APLs on the battlefield, he could direct a scouting party into the phony minefield to determine its composition. Dismounted scouts could quickly determine that the minefield is phony. With this information, the enemy commander would quickly disregard the phony minefield. APLs elsewhere on the battlefield give credence to phony minefields and deter a quick reconnaissance of them.

Summary of the Role of Antipersonnel Landmines in US Minefields

The functions of APLs from interpreting US mine warfare doctrine are:

1. Protect small units and installations from infiltration by (1) deterring the infiltrators and (2) providing early warning of infiltration.
2. Protect antitank mines from rapid hand breaching.
3. Protect antitank minefields from dismounted reconnaissance.
4. Slow the enemy in pursuit or a general withdrawal.
5. Sap the enemy's morale.
6. Deter removal of other types of barriers.
7. Give credibility to phony minefields.

Antipersonnel landmines cause casualties, expend enemy resources, and in the case of mines designed to maim instead of kill, expend medical resources. In many

sources these are listed as the purposes of antipersonnel landmines. These are simply the effects of APLs, and it is by these effects that they produce their purposes as listed above.

Nondoctrinal APL Purposes

There are two uses of antipersonnel landmines that this study has uncovered that are not included in the seven purposes derived from US mine warfare doctrine. The first of these purposes has been widespread in the numerous wars of insurgency that have erupted since the onset of the Cold War. "One of the most pernicious uses of AP mines has been for purposes of population control and terrorism."⁶ In Afghanistan, the Soviets airdropped butterfly mines on hostile villages. In Cambodia, "The Khmer Rouge . . . used mines to 'fence off' villagers' land, which was then 'leased' back to the villagers."⁷

Combatants have used mines against the populations in Mozambique, Somalia, and Iraq. The first use of mines to control civilian populations was by the East Germans, who mined the border with West Germany not to keep Western forces out, but to keep East German citizens in. According to the March 1996 Red Cross Report, "the only purpose for which mines have been used with total success by the layer and total impact on the target is for the containment and harassment of civilians."⁸ Antipersonnel landmines have been effective to meet this purpose, but to state that this is the only purpose which mines have succeeded is questionable.

The second nondoctrinal purpose is somewhat trivial, but is stated here in the interest of completeness. According to a Reuters news item dated 29 January 1999,

⁶International Committee of the Red Cross, *Anti-personnel Landmines: Friend or Foe?* (Geneva: March 1996), 22.

⁷*Ibid.*, 21.

⁸*Ibid.*, 48.

villagers in northeast Cambodia were using antipersonnel mines to catch and kill tigers. The villagers then sold parts of the tigers on the black market.

Both of these additional purposes are unlikely requirements for US Army operations. Although population control with landmines is predominately carried out by the ill-trained, semiprofessional armies of insurgency, it has been carried out by the professional and modern armies of the former Soviet Union and East Germany. Neither of these two additional purposes will be included in the next part of this analysis which will compare the purposes of APLs with other systems on the battlefield.

The APL Inventory of the United States

Before looking at replacement options provided by other systems on the battlefield, this thesis examines the nature of the weapons being replaced. By looking at each antipersonnel landmine in the US inventory, the purpose of these weapons will be further illustrated. This portion of this investigation will also show which munitions would be banned should the United States abide by the Ottawa Convention.

Non-Self-Destructing APLs

Except in the defense of South Korea, non-self-destructing or “dumb” APLs are no longer in use in the US Army. Prior to the President’s ban of these types of mines, the US Army employed the M16 “Bouncing Betty” and the M14 “Toe Popper.” Currently, these mines are only employed along the demilitarized zone (DMZ) between North and South Korea. Should hostilities break out, they may be used in the defense of South Korea.

The M16 is pressure or trip wire activated. When activated, the mine discharges a munition from its housing buried in the ground to about one meter in the air. This munition explodes, sending lethal fragmentation to a radius of thirty meters.

The M14 is pressure activated. It weighs only three and one half ounces and fits easily in a man's hand. The M14 is designed, as its nickname "Toe Popper" indicates, not to kill, but to maim. When stepped on, the mine explodes with enough force to maim the victim's foot. By creating a nonambulatory wounded soldier, an enemy force is burdened with transporting and treating the casualty.

Both the M16 and the M14 are banned under the Ottawa Convention.

The US Army employs one other dumb landmine: the M18 Claymore. The Claymore is either trip-wire activated or command detonated. US policy does not allow using the Claymore in the trip-wire activated mode. In the command detonated mode, it is not technically a landmine, but a munition. The Ottawa Convention bans using the Claymore in the trip-wire mode, since this use conforms to the definition of an antipersonnel landmine. The Ottawa Convention does not ban the command detonated mode.

The Ottawa Convention and the Presidential Directive of 1996 ban these dumb mines, although the President has allowed their use in the defense of South Korea. US forces use M16 and M14 mines in the minefields along the DMZ. The minefields along the DMZ might be categorized as blocking obstacles, to block North Korean forces coming south, or as an incredibly large deliberate protective obstacle to protect South Korea from infiltration. Under either categorization, the APLs in these obstacles deter infiltration, protect the integrity of the obstacle system as a whole, and deter enemy reconnaissance of the obstacles. If the United States were to abide by the Ottawa Convention, this use of APLs would not be allowed.

Self-Destructing APLs

Other than in Korea, the only types of antipersonnel mines available to the US Army are self-destructing, or "smart" mines. All US smart APLs self-destruct with the

passage of time. Self-destruct times are either factory-set or set in the field. Self-destruct times may be from four hours to fifteen days depending on the mine. Self-destructing APLs in the US inventory are the Area-Denial Artillery Munition, M74 Flipper, BLU 92/B Gator, M77 Modular Pack Mine System, Volcano, and the Pursuit Deterrent Munition. The Ottawa Convention bans all of these weapons.

Area-Denial Artillery Munition

The area-denial artillery munition (ADAM) is an artillery-delivered APL. One ADAM artillery round fired from a 155 millimeter howitzer delivers thirty-six mines to the target. Each ADAM mine is wedge shaped and about the size and weight of a smoke grenade. When delivered, it deploys trip wires. When activated, the munition bounds (like the M16 Bouncing Betty) and inflicts casualties up to ten meters away.

FM 20-32 prescribes the ADAM for many uses including to close gaps in obstacles, disrupt attacking forces, area denial, disrupting second echelon forces, reinforcing other obstacles, and disrupting river crossings. They can also be used in offensive operations to assist in flank protection, suppress enemy security elements, hinder enemy withdrawal, and hinder enemy artillery. ADAM mines are designed for use with the Remote Anti-Armor Munition (RAAM) which is also fired from artillery.

Applying the seven uses for APLs, the ADAM can be used in five. Because of the short life of the ADAM (four or forty-eight hours), it is not suitable to protect fixed installations from infiltration. Because it is artillery delivered, it is not practical for close-in protection of small units. ADAM is unsuitable to lend credibility to phony minefields. This is because artillery delivered mines are not usually found in a conventional, marked minefield. The presence of ADAM mines behind the front line from the enemy's perspective does not deter reconnaissance of phony minefields encountered by lead elements.

The ADAM is the only mine capable of protecting RAAM minefields from rapid hand breaching and reconnaissance. Without this protection, RAAM minefields meant to disrupt or interdict the enemy will be less effective.

Gator, Modular Pack Mine System, Volcano

Each of these antipersonnel mines is a variation on the same design. These mines resemble a large can of tuna. They are two and one-half inches high and four inches in diameter. The mine works with either side up. When delivered, the mine dispenses four tripwires from whichever side is up to a distance of seven to thirteen meters. When a tripwire is pulled, the mine explodes producing casualties up to fifteen meters away. The difference between these four mines is in the arming mechanisms, delivery means, and the self-destruct options.

All three of these systems are composed of mixed munitions. Each munition in these systems contains a mix of antitank and antipersonnel mines. Because of the presence of APLs in the mix, these systems are banned under the Ottawa Convention.

The airdropped version of the scatterable APL is the BLU92/B Gator. This is a US Air Force and US Navy munition. It is part of the Gator system, which was used in the Gulf War. The BLU92/B is a submunition that scatters from a bomb dropped by aircraft. The Navy version of the bomb contains forty-five antitank and fifteen antipersonnel mines. The Air Force version contains seventy-five antitank and twenty-two antipersonnel mines.

The Modular Pack Mine System (MOPMS) is a man-portable system weighing 165 pounds. It contains seventeen antitank mines and four M77 antipersonnel mines. The M77 is a variation of the APL found in the Volcano and Gator systems. It differs from the other versions in that it is recyclable. When the MOPMS is discharged, the twenty-one mines in the box dispense forward into a semicircle with a radius of

thirty-five meters. The mines are factory-set to self-destruct in four hours. The operator of the system can recycle the self-destruct time up to three times. By re-setting the internal clock in the mines, the duration of the MOPMS minefield can be extended up to sixteen hours.

The Volcano is the primary mine warfare system in the US inventory. One Volcano system has four dispenser racks mounted on a ground vehicle or on a helicopter. Each rack has forty tubes. A Volcano canister is placed into a tube to arm the system. Each canister contains five antitank and one antipersonnel mine. These mines look and function the same as the mines employed by the Gator and the MOPMS.

When fully loaded, one Volcano system has 160 canisters containing a total of 800 antitank and 160 antipersonnel mines. The ground vehicle or the helicopter mounting the system proceeds down the centerline of the minefield, dispensing the canisters as it goes. The canisters fire from both the left and right side of the vehicle, producing a minefield of two rows with a gap about fifty meters in the middle. Each row is thirty-five meters wide and up to 1,100 meters long. A ground based system can employ a complete Volcano load in as little as five minutes depending on the nature of the ground. The limiting factor is the best constant speed that the driver of the vehicle can make. On a helicopter, the nature of the ground is immaterial. The helicopter flies along the center line dispensing mines from both sides of the helicopter. The recommended air speed is forty knots, allowing the helicopter to dispense an entire load in less than one minute.

The ability to quickly emplace large and effective minefields in exact locations gives ground commanders a very effective tool for installing tactical minefields. The drawbacks of the Volcano system are inherent in the scatterable mines in the US inventory. Because these mines are scattered, and therefore not feasibly recovered, they are self-destructing. Volcano allows the operator to select a self-destruct time before

emplacing the minefield. The options run from four hours to fifteen days. These options require detailed planning to coordinate. Another drawback is expense. The Volcano system is not particularly expensive or complicated, but the mines are. Because they are programmable, they are much more expensive than conventional mines. Another disadvantage is that they require the Volcano system to function. A typical heavy division has twenty Volcano systems. The loss of any one system significantly reduces the Volcano mine laying capability of the division.

Compared to its capabilities, the drawbacks of the Volcano are slight. Augmented with conventional mine laying, the Volcano provides an awesome addition to the defensive power of a US division. Because it is a mounted system and because it dispenses mines so quickly, it adds a feasible countermobility capability to the US division in offensive operations.

Pursuit-Deterrent Munition

The final self-destructing antipersonnel landmine in the US inventory is a special purpose weapon. The pursuit-deterrent munition (PDM) is issued to special operations forces. This weapon is a modified ADAM mine. Instead of being fired from a canon, the PDM is used like a hand grenade. To employ the PDM, a soldier pulls the safety pin and throws the munition. After a short delay, the mine employs trip wires and arms itself. If not tripped in four hours, it self destructs. This mine was specifically designed to deter an enemy in pursuit. Imagine a special forces team is being chased by an enemy element. The special forces team pulls the pin on a PDM and drops it as they run from the enemy. The pursuing enemy, hurrying along to catch the team, trips the PDM and loses at least one soldier. The special forces team continues to evade at top speed, but it is hard to imagine the pursuers continuing to hurry after them.

US Landmine Inventory and the Ottawa Convention

The Ottawa Convention bans the use of antipersonnel landmines. It directly renders all APLs in the US inventory illegal except for the Claymore used in the command detonated mode. These purely antipersonnel systems are the M14 and M16 conventional mines, ADAM, and the PDM. Because most scatterable mine systems include APLs in the mine mix, these systems are banned as well. The Gator, MOPMS, and Volcano systems are banned because they contain APLs in the munition mix.

Mine systems allowed are conventional antitank mines and the RAAM. If antipersonnel mines were removed from the munition mix, Gator, MOPMS, and Volcano could be used.

Part 1 Summary

The US Army uses minefields for protection, to influence the enemy's maneuver, as a nuisance to a pursuing or rapidly withdrawing enemy, and to interdict the enemy in territory he controls. Mine field types conform to these functions. Hasty protective minefields augment small unit close defense and deliberate protective minefields augment the protection of fixed installations. Tactical minefields are in the form of fixing, turning, disrupting, or blocking with the intent to have the corresponding effect on the enemy's maneuver. Nuisance mines are placed in areas the enemy may occupy or traverse in order to slow the enemy down. When very small, these minefields are sometimes called point minefields. Interdiction minefields are placed between enemy units engaged and enemy units moving forward or in support of front line units to hamper the enemy's ability to influence the battle. An additional form of minefield is the phony minefield, which contains no mines at all. Phony minefields are used in any of these applications.

Antipersonnel landmines are found in most of these minefield types. They serve to protect small units and installations from infiltration, protect antitank minefields from

rapid hand breaching and dismounted reconnaissance, slow the enemy in pursuit or a general withdrawal, sap the enemy's morale, deter removal of barriers, and give credibility to phony minefields. There are other uses for APLs, but they are not in US Army doctrine.

Should the United States abide by the Ottawa Convention, the only landmines available to the Army would be conventional antitank mines and RAAM. Volcano, MOPMS, and Gator would be banned because they contain APLs in the munition mix. The Claymore used in the command detonated mode would still be allowed.

Part 2: Replacement Options

Would removing APLs from the US inventory necessarily mean that the functions of APLs would be lost? Perhaps other systems on the battlefield can perform the functions of APLs. This part of the investigation determines what other tools could be employed to provide the service provided by antipersonnel landmines. Each battlefield operating system is looked at in turn and compared to the seven identified functions of APLs.

Intelligence

"Intelligence operations are the organized efforts of a commander to gather and analyze information on the environment of operations and the enemy."⁹ This information must be disseminated and acted upon in order to be effective. Accurate knowledge of where the enemy is and what he is doing can fill the need of APLs in certain applications if this information is relayed in a timely manner to those who can act on it.

⁹U.S. Department of the Army, FM 100-5 *Operations* (Washington, DC: June 1993), 2-12.

In the protection function, intelligence can, to some degree, replace APLs. Antipersonnel landmines aid in protection by deterring and providing early warning of infiltration. APLs provide deterrence in the form of fear of death or injury. An infiltrator can attempt to disengage if he is discovered, but he cannot disengage from an APL. Mines detonate before the infiltrator or even the defenders can do anything about it. For intelligence to replace this deterrence, it must be linked to a lethal system that is employed before the infiltrator can react. Other than APLs, no systems currently exist that provide this link.

The South Africans are developing a system that deploys mortars when it detects infiltration. The Swedes are developing a sniper system which employs direct fire against a remotely identified target. These systems separate the triggering mechanism from the munition in an attempt to comply with the Ottawa Convention. Under the Ottawa Convention, a munition designed to explode due to contact with a person is an APL. The Swedish sniper system is not explosive. The South African mortars explode due to contact with the ground. The delivery in both systems is triggered by contact with a person, but this is apparently allowed.

Similar systems could be developed for use in the US Army. The intelligence community's All Source Analysis System (ASAS) is in the process of being linked to lethal systems. Once ASAS has identified a target, the target is nominated and automatically relayed to a lethal delivery system. The system automatically cues the target and issues firing instructions. In the case of infiltration, mortar or artillery systems could be alerted by ASAS through a sensor detecting the infiltration. Indirect fire could quickly be brought to bear to deter the infiltration. The existence of such a system would provide the deterrent effect of APLs in protective minefields, but such a system is not yet completely mature. Once matured, ASAS or some other remotely triggered system would not only deter infiltration, but also provide early warning.

For early warning of infiltration, increased surveillance and the use of trip flares could completely fill the function of APLs. Increasing surveillance means increasing the number of soldiers involved in over-watching the protective obstacle. The reason armies use APLs for protection is to reduce the number of soldiers required for this function. Any increase in army personnel is unlikely, even if the US signed the Ottawa Convention. The continued drawdown of military forces and the inability of the US Army to meet recruiting goals means that replacing APLs with increased force structure is not a feasible option. Trip flares, on the other hand, are in use and do not require any additional manpower. An infiltrating enemy triggers the flare, which burns brightly and illuminates the infiltration. Sentries overwatching the obstacle are alerted to the infiltration and can react. Trip flares, however, do not give the defenders as much time to react as APLs. If the enemy knows that there are APLs in the obstacle, he cannot move more quickly without the risk of becoming a mine casualty. If he has engaged a trip flare, he must move quickly to complete or abort the infiltration before the defenders react. The trip flare, then, spurs both the infiltrator and the defender to act quickly. APLs deter fast action on the part of the infiltrator while alerting the defenders to act. A silent intruder detection system integrated with physical barriers such as fences could provide sufficient time for defenders to react.

Many intelligence systems can be used to protect tactical minefields from rapid hand breaching and reconnaissance. ASAS, once matured, provides the most promise for the same reasons that it could deter infiltration. Doctrine calls for all tactical minefields to remain covered by observation and fire. Direct fire systems linked with observation provide the greatest threat to dismounted breaching operations because this threat can come into play quickly. Attacking units employ techniques to suppress these overwatching fires, but they are not always effective. Indirect fire is a great threat as well, but even the best trained armies cannot immediately call for and receive indirect fire

support. It takes on the order of ten minutes for a defender to call for the fire, have the fire mission analyzed, aim the guns, and fire the mission. ASAS linked digitally to indirect fire systems could cut the ten minute wait to perhaps two minutes. APLs currently provide immediate protection.

Should ASAS develop into a system that can truly link all sources of intelligence and prepare that information for targeting by direct and indirect fire systems, then the intelligence BOS could nearly replace APLs in the functions of protection, deterring the removal of other obstacles, and giving credibility to phony minefields by deterring dismounted reconnaissance. ASAS, however, is not yet a mature and fully linked system.

Maneuver

Maneuver is the movement of forces and the application of direct fire to put the enemy at a disadvantage. Mine warfare and maneuver warfare have evolved simultaneously. The development of the tank in World War I inspired the invention of the modern land mine to hinder the maneuverability of the tank. Modern APLs were invented initially to protect the antitank mines. As maneuver warfare evolved, so did mine warfare. Scatterable mines now permit soldiers to effectively use mines to hinder enemy maneuver in both defense and when attacking.

Adding force structure--more tanks and soldiers--could replace some functions of APLs, but this option has already been discarded as not feasible. Maneuver forces augmented with increased intelligence gathering means could assist in replacing some APL functions as discussed, but these systems are not quite mature. All the purposes of APLs can be thought of as augmenting the ability of maneuver forces to conduct operations. Maneuver forces can perform all APL functions, but the purpose of using APLs is so that maneuver forces do not have to.

Command detonated Claymores can be considered a direct fire system. As such, they can perform the functions of protection from infiltration and protecting tactical minefields from dismounted breaching and reconnaissance. Employing Claymores gives credibility to phony minefields by deterring minefield reconnaissance. Remote firing systems are required to provide enough distance between the munition and the observer for tactical minefields. These systems exist and can be adapted for use with the Claymore.

Command detonated Claymores are not feasible for use in nuisance mining. With an enemy in pursuit or rapidly withdrawing, mines must be employed relatively indiscriminately from the enemy's perspective. Manning each mine is not feasible. Likewise, Claymores have limited use in protecting other barriers unless those barriers are part of a tactical obstacle system.

Fire Support

Fire support is the employment of aircraft, indirect fire systems, and electronic warfare systems against ground targets in support of land combat.¹⁰ Already discussed is the potential for indirect fire systems linked to intelligence gathering systems to perform many APL functions. These systems are not mature enough to rely on today but will be available sometime in the future. Indirect fire systems require that someone or something identify the target for the indirect fire system. Ground troops (maneuver BOS) call for artillery support. The artillery provides the munition, but at the direction of observers integrated with maneuver forces. Close air support requires that friendly troops in some way mark the target and direct the application of force even in a manned weapons platform such as a fighter-bomber.

¹⁰U.S. Department of the Army, FM 100-5 *Operations* (Washington, DC: June 1993), 2-13.

Remotely triggered indirect fire systems such as the mortar system the South Africans are working on has some promise for performing at least one APL function. The key to any of these developing systems is that they link the fire support system to an intelligence gathering mechanism. No system currently exists that can do this in a timely manner.

Air Defense

This battlefield operating system seems to have no potential to replace any APL function.

Mobility and Survivability

This BOS has much potential. Landmines are considered a countermobility asset which falls into this operating system. If any BOS has applications that can replace APLs, it is probably the BOS that APLs are a part of.

Survivability measures are commonly employed to protect small units and installations from infiltration when it is politically impractical to use APLs. In training exercises where APLs can obviously not be used, units rely on barbed wire or concertina wire fences. In operations other than war, US forces use fences, walls, and other physical barriers to augment vigilant sentries to prevent infiltration by threat forces and thieves. Deterrence requires viable use of force by the sentries as well as vigilance. Early warning comes from trip flares and audible alarms including devices as crude as tin cans containing stones hung in the wire obstacles. The deterrence value of these barriers is good but cannot approach the swift and sure punishment administered by an antipersonnel mine. The deterrence effect of APLs is additive to the other measures of barriers and sentries. No amount of additional concertina fence will replace the deterrent

effect of several antipersonnel mines. Deterrence exists with just the barriers and sentries, but not as much as when mines are present.

Physical barriers can also assist in protecting antitank mines from hand breaching when these barriers are observed and covered by fire. The fence slows the enemy soldier enough to bring fires on him. This method is not as effective as using APLs because the unobserved enemy soldier runs no risk. Physical barriers may slow down a reconnaissance of the minefield, but for the same reasons discussed with infiltration, the fence will provide little deterrent value.

APLs protect antitank mines from rapid hand breaching. Antitank mines can be fitted with antihandling devices to achieve this same purpose. Antihandling devices are secondary fuses that activate the mine when it is moved. These devices deter soldiers from simply lifting antitank mines and moving them out of the way. They do not deter soldiers from applying an explosive charge to the mine to blow it in place. Antihandling devices do not deter remotely lifting the mine. To displace the mine remotely, a soldier attaches a length of rope to the mine, moves back a safe distance, then pulls the rope. If the mine does not explode when moved, the soldier concludes that it is not equipped with an antihandling device and that the mine is safe to move out of the way. Antihandling devices are not banned by the Ottawa Convention, so they may continue in use to deter hand breaching of antitank minefields.

Twenty percent of RAAM scatterable antitank mines are factory equipped with antihandling devices. Antipersonnel mines in the munition mix protect the other types of scatterable antitank mines. Because the RAAM mine is very similar to the antitank mine in the MOPMS, Gator, and Volcano systems, there should be little difficulty equipping these antitank mines with antihandling devices.

Although antihandling devices are a deterrent to removing antitank mines by hand, they do not provide the same deterrent effect as APLs. In a minefield containing

APLs, the soldiers must conduct a deliberate search for antipersonnel mines before approaching the antitank mines. In the US Army, a grapple hook is thrown into the minefield and dragged back. As the grapple encounters trip wires, the APL mines detonate, clearing the way for the soldiers to enter the minefield and deal with the antitank mines. APLs provide an additional deterrent to the possibility that the antitank mines are fitted with antihandling devices.

Antihandling devices do not deter scouts from entering a minefield. The scouts avoid the mines so as not to risk setting them off, but even if a soldier steps on an antitank mine fitted with an antihandling device, the mine should not detonate. It will detonate only if it is moved enough to spring the trigger on the antihandling device. Stepping on an antitank mine equipped with an antihandling device not set it off. Kicking it could cause a detonation. The risk of disturbing an antitank mine enough to cause a detonation is slight compared to the risk of encountering an APL.

To deter reconnaissance of minefields, one option is booby traps. A booby trap is a munition adapted to serve as an APL. The Ottawa Convention does not specifically ban booby traps. Because the definition of antipersonnel landmine is based on the designed purpose of the munition, this thesis assumes that booby traps, because the munitions they employ are not designed as APLs, are allowed. A booby trap can be as simple as a hand grenade with a trip wire attached to the pull ring. When the trip wire is pulled, it pulls the ring from the grenade and the grenade explodes. Booby traps can completely replace the function of APLs in protective minefields and tactical minefields. They can deter infiltration and provide early warning of infiltration. They can deter hand breaching and reconnaissance of minefields. They can also fill the APL function in the case of nuisance minefields. They fill these roles so well because an antipersonnel landmine is simply a manufactured booby trap.

Replacing all APLs with booby traps does pose some problems. First, booby traps are not generally as effective as APLs. This is because the triggering mechanism is adapted to the munition. The trigger in an APL is integral to the mine. Because of the adaptation required, the firing chain for a booby trap is at least one step longer, and therefore somewhat less reliable. Booby traps are less effective because they do not bound. Most US APLs bound to about one meter before detonating. This increases the lethal effect. To design a bounding hand grenade with the intent to use it for booby traps would probably violate the Ottawa Convention. Another problem with booby traps is safety. APLs are built with certain safety features to protect the soldier emplacing the mine. Because the trigger for a booby trap must be adapted to the munition, these safety features are not present. This means that more time is required to safely employ booby traps than to employ APLs. The final problem with booby traps is that they are not scatterable. Scattered tactical minefields will require a slow, manpower intensive additional step to emplace booby traps. Scattered nuisance minefields placed to slow a pursuing enemy will suffer the same problem. Scattered interdiction minefields and nuisance minefields placed to slow a retreating army will not have the benefit of booby traps, since they are placed out of the reach of friendly troops.

Booby traps can provide for all APL functions but not in all situations. When they can be employed, they can do the job but not as effectively and not as safely.

Physical barriers, antihandling devices, and booby traps can cover most of the purposes of APLs but not as effectively. Whether or not this loss of effectiveness translates into a vulnerability is left to the conclusions of chapter five.

Battle Command

This battlefield operating system involves decision making and leadership. Leadership can be useful in alleviating some of the impacts of losing APLs since

leadership is related to vigilance and determination. Assuming that US forces are highly disciplined and vigilant now, no great gain from increased leadership will be expected.

Decision making does have some utility in replacing the functions of APLs. Mines decide for themselves when to detonate. If a human makes this decision, as one does in a command-detonated Claymore, then the mine is no longer a mine, but an allowed munition. Other than the Claymore, no mines are currently available that rely on human permission to fire. Perhaps a system could be devised where the mines ask for permission to detonate, or sensors alert a human operator who selectively triggers munitions in place to achieve an effect similar to that of a minefield. The United States is currently working on such a "man-in-the-loop" system.

Part 2 Summary

There are several existing and many potential systems that can at least in part perform the functions of APLs. Other than mines that ask for permission to detonate, none of these systems can replace APLs outright. A combination of existing systems could come close to replacing the functions of APLs, but none of the systems reviewed are as effective as APLs. The following table summarizes the battlefield operating systems and the APL functions each could replace. The air defense BOS is omitted since no replacement application was found.

APL Function	Intelligence	Maneuver	Fire Support	Mobility & Survivability	Battle Command
Deter Infiltration	Potential if linked with lethal system	Claymore, potential auto-sniper	Potential auto-mortar	Booby traps, barriers	Potential for on-command mine
Provide early warning of infiltration	Surveillance, trip flares, alarms linked with barriers		Potential auto-mortar	Booby traps	Potential for on-command mine, increase vigilance
Protect antitank mines	Potential once ASAS matured	Potential for remote Claymore		Booby traps, antihandling devices, barriers	Potential for on-command mine
Deter recon of mine fields	Potential once ASAS matured	Potential for remote Claymore, auto-sniper	Potential auto-mortar	Booby traps, barriers	Potential for on-command mine
Slow the enemy				Booby traps in some applications	
Sap morale	Potential once ASAS matured			Booby traps	
Deter removal of obstacles	Potential once ASAS matured	Direct fire in some applications	Potential for auto-mortar in some applications	Booby traps	Potential for on-command mine
Give credibility to phony mine fields	Potential once ASAS matured	Claymore, potential for auto-sniper	Potential auto-mortar	Booby traps	Potential for on-command mine

Currently available systems are the Claymore, trip flares, alarms, barriers, antihandling devices and booby traps. Without booby traps, many of the functions cannot be performed by the remaining existing systems. Together with increased surveillance and vigilance, these existing systems can perform the function of antipersonnel landmines, although not as well, in six of the seven identified functions of APLs. The one function that these existing options cannot perform is that of slowing the enemy in pursuit or general withdrawal. Booby traps can partially perform this function when the enemy is in pursuit, but for the most part no existing system can perform this function nearly as well as APLs can.

Many potential systems could help replace APLs if they were available. These potential systems are sensors linked to direct fire or indirect fire means with a more capable ASAS system, remotely operated Claymores, autonomous direct fire and mortar systems, and a munition very much like a land mine except that it asks for permission to detonate. Even these systems would fail to adequately perform the function of slowing the enemy in pursuit and withdrawal when the tempo of operations is extreme and coordinated activity is difficult.

Conclusions

Antipersonnel landmines perform seven functions. Other existing systems and several potential systems can perform six of these functions to some degree but not in all situations. The APL function of slowing the enemy in pursuit or general withdrawal has no clear replacement option.

The second conclusion of this chapter is that US mine warfare doctrine cannot realistically be executed without the scatterable systems currently available. Because the majority of these systems employ a mix of antitank and antipersonnel mines, the US Army would not be allowed to employ them if the United States was to abide by the Ottawa Convention.

Six of the seven APL functions can be performed by other systems at a reduced level. Other systems cannot adequately perform the seventh function. Abiding by the Ottawa Convention will cause a serious degradation of US mine warfare capability until APLs can be removed from the scatterable mine mix. Do these conclusions constitute vulnerabilities? This question is addressed in chapter five.

CHAPTER FIVE

COMPARISON WITH OTHER STUDIES TO DETERMINE VULNERABILITIES CREATED BY AN ANTIPERSONNEL LANDMINE BAN

Chapter five compares the findings of chapter four with other studies on the impacts of an antipersonnel landmine ban. This cannot be a direct comparison, because none of these studies looked at exactly the same question. Despite the differences in focus, each of these studies reached conclusions as to the effectiveness of APLs and the impacts of eliminating their use. The studies examined are "Military Consequences of Landmine Restrictions," by the Dupuy Institute; "The Military Utility of Landmines: Implications for Arms Control," by the Institute for Defense Analyses; and the 1998 reports to Congress by the Secretary of Defense and by the Chairman of the Joint Chiefs of Staff on the effects of a landmine moratorium.

The results of these three studies are compared to the findings in chapter four. Chapter four found that there are seven functions for APLs for the US Army and that most of these functions can be performed by other means but at reduced effectiveness. Based on the conclusions of these three studies, this thesis determines if this reduced effectiveness poses vulnerabilities to the US Army.

"Military Consequences of Landmine Restrictions"

The Department of Defense in April 1996 commissioned this study. The Dupuy Institute prepared the study in two parts. The first part sought to provide quick guidance for policy makers addressing the landmine ban issue. A seven-man group prepared the first part in ten days. One month after submitting the first part, the Dupuy Institute completed an addendum with a more thorough analysis.

The conclusions of the first "quick look" report were based on two scenarios. The first scenario assumed that APLs are banned but some Third-World nations would

continue to use them. In this case, the Dupuy Institute concluded that the United States would be at some disadvantage with some Third-World nations in conventional warfare, at a small disadvantage in guerrilla warfare, and at no disadvantage in operations other than war. In general, US forces could expect a 3 percent increase in casualties should the United States unilaterally ban APLs.

The second scenario was based on a ban that would preclude nations from acquiring APLs. The Ottawa Convention attempts to do this by banning the manufacture and sale of these weapons. In this case, the Dupuy Institute concluded that the United States would gain some advantage in conventional wars due to US reliance on offensive operations. The United States would gain an advantage in guerrilla wars and operations other than war. This advantage would come from denying the enemy the use of mines as they were used in Vietnam.

These initial Dupuy Institute conclusions suggest that the US Army will suffer no serious vulnerabilities if the United States were to abide by the Ottawa Convention. One assumption of this thesis was that US opponents will still use APLs against US forces. Nations that cannot manufacture APLs or procure them from nonsignatory countries will have some difficulty in employing them in sufficient quantity, but the shortfall will be made up in part by using booby traps. In the end, threat forces will be either unaffected by the Ottawa Convention, or their APL effort will be partially degraded.

The Dupuy Institute's initial findings can be summarized to state that the US Army would find itself in the worst situation at some disadvantage in conventional wars with non-signatory countries or those that decided to ignore the ban. This disadvantage does not constitute a vulnerability since it occurs in a conventional operation and not in a guerrilla war or an operation other than war. The United States tends to be less sensitive to casualties in conventional operations than in unconventional operations. The 3 percent increase in casualties, although significant, does not constitute a vulnerability.

One month after presenting these findings, the Dupuy Institute submitted an addendum that presented some different conclusions based on a more in-depth look at the problem. The initial findings were based mostly on historical models. These subsequent findings looked at modern mine laying methods and mine warfare in offensive operations. The addendum summary states, "If this analysis is correct . . . it should remove any lingering doubt that depriving ourselves of AP mines . . . would very seriously hamper our fighting ability."¹

What is it about modern mines that completely changed the conclusions of the Dupuy Institute? In a future conventional war, the United States is likely to enjoy air supremacy and information dominance. In this situation, US forces will be able to interdict enemy facilities and units almost at will. Mines will be a favored interdiction munition because of their lasting effects. The Dupuy Institute states that the United States is the only country capable of installing interdiction minefields in remote locations nearly instantly. To ban this capability "is a little like both sides banning bombs when only one side has airplanes."²

Failure to exploit the separation of force that interdiction minefields can produce would, according to the Dupuy Institute, double or triple US casualties. Antipersonnel mines are the only system currently available which can protect these remote minefields from rapid enemy breaching. As discussed in chapter four, there are no other systems available to provide the functions of APLs at remote locations where interdiction minefields are employed. The Dupuy Institute assumes a nearly complete degradation of effectiveness if APLs are not a part of the minefield. This places too much importance on the role of APLs in these minefields since a pure antitank minefield will have some

¹"Military Consequences of Landmine Restrictions," Research paper prepared by the Dupuy Institute (McLean, VA: 10 April 1996), addendum page 1.

²Ibid., addendum page 2.

effect. That minefields without antipersonnel systems are degraded is undeniable. When these minefields are close to friendly troops the antipersonnel systems can come from direct fires or the other systems discussed in chapter four, but even then at some degradation. With interdiction minefields, APLs offer the only current solution. Failure to use them could have serious impacts.

"The Military Utility of Landmines: Implication for Arms Control"

This study was conducted by the Institute for Defense Analyses in June 1994 and looked at the results of not using landmines at all. It concentrated on antitank mines but did look at the implications of not using antipersonnel minefields to oppose a dismounted threat. This study did mention a few uses for APLs independent of countermobility operations at large. APLs can be used to counter night infiltration, stealthy attempts to hand breach antitank minefields, and enemy attempts to place dismounted infantry between mined defensive positions.

The study was conducted using the Janus computer simulation. An opposing force (OPFOR) was placed against a US force and battles were run using six different situations. In one case, neither side used any mines. In others, only the OPFOR used mines. In one case, neither side used antipersonnel mines. This case is most interesting for this study.

The results of removing APLs from both sides amounted to a modest increase in US losses. This finding conforms to other studies and historical casualty figures. A 3 percent increase in casualties seems to be a consistent figure when considering the loss of APLs in conventional mine warfare. The study further concludes that increasing the number of Bradley fighting vehicles available to US forces can replace the loss of APLs. Depending on terrain the number of Bradleys must be increased by a factor of 150 to 350 percent. APLs perform a function so that soldiers do not have to. As discussed in

chapter four, adding to the force structure to replace APLs is not a feasible option. To use additional manpower to replace APLs, even in the form of Bradley fighting vehicles, is comparable to increasing the number of soldiers available to mitigate the additional casualties an APL ban would produce.

The Institute for Defense Analyses study showed that there are consequences to a ban of APLs. The replacement options it considered are not feasible. It identified uses for APLs similar to the uses this thesis identified, but exploring the effects of losing these functions was beyond the scope of the study. One important consideration regarding this study is the weakness of the Janus computer simulation. The soldiers emulated in the computer model know no fear. They will do whatever they are ordered to do.

Consequently, APLs have no deterrent effect on them. In reality, such as at the Anzio beachhead, APLs can generate so much fear in attacking forces that they will not advance until minefields are cleared. Because Janus soldiers are immune to fear, they are also immune to the deterrent effect of APLs.

Reports to Congress

As a result of the recently revoked US APL moratorium, the Secretary of Defense and the Chairman of the Joint Chiefs of Staff were required to submit annual reports to Congress outlining the effects of the legislation. These reports are considered together as one report, although in fact they are two distinct documents.

These reports conclude that banning APLs would have unacceptably negative consequences for US forces. In Korea, APLs are needed to block North Korean forces on the DMZ and remotely delivered mines, including APLs, are needed to break up North Korean exploitation forces.

The reports state that two-thirds of the US mine inventory would be illegal under an APL ban. This is because of the mixed nature of US mine systems. The remaining

third of the inventory would be vulnerable without the protection of APLs for reasons discussed in chapter four.

In specific tactical situations, the reports cite three studies that were unavailable for this thesis because they are classified. The reports make three conclusions regarding the operational and tactical implications based on these three studies. Operationally, losing the mixed systems decreases US effectiveness particularly in the early stages of a campaign. This will cause increased casualties and put current war plans at significant risk. Tactically, APLs reduce friendly casualties and increase enemy casualties. In some situations this increase can be as much as 22 percent.³ The final conclusion is that antihandling devices are not an effective substitute for scatterable APLs.

These reports did not specifically address the Ottawa Convention. They referred to a Congressional APL moratorium, but because the moratorium was very similar to the Ottawa Convention, these findings are applicable. These reports cite important vulnerabilities to US forces in the event of an APL ban. The purpose of protecting antitank mines is the most important feature in these reports, but they do address the degradation of US capabilities in deterring infiltration and affecting the morale of enemy forces.

Conclusion

These three explorations of the impacts of an antipersonnel landmine ban have similar conclusions when considering the conventional way that mines have been used. Based on a Janus computer simulation, "The Military Utility of Landmines" concluded that US forces would suffer a modest increase in casualties. "Military Consequences of

³General Henry H. Shelton, "Report on Effects of Moratorium Concerning Use by Armed Forces of Anti-Personnel Landmines as directed by Section 1402 Defense Authorization Act, FY 1996" (27 April 1998), 7.

Landmine Restrictions” initially reached a similar conclusion using different methods and quantified this increase at three percent. Historical records support the conclusion that three to ten percent of casualties are APL-related, depending on the intensity of the conflict.

When the Dupuy Institute looked at interdiction mining it was forced to amend its initial findings. Modern mines and modern mine delivery systems have increased the relevance of mine warfare and there are no historical cases to prove this. The Gulf War gave us an example of the effectiveness of interdiction, but only a glimpse of the effectiveness of interdiction mining. The Battle of Potter training scenario described in chapter four seems to provide further insight on the devastating effect that one small interdiction minefield can have on the enemy’s tempo. When amended, “Consequences of Landmine Restrictions” determines that without the ability of interdicting the enemy the way remotely delivered mines can, US casualties could increase by 33 percent.

Quoting studies other than the two previously stated, the Secretary of Defense and the Chairman of the Joint Chiefs echo the potentially dire consequences of losing this interdiction capability. In their reports to Congress, they quote a 22 percent increase in casualties. The loss of the traditional roles of minefields further jeopardize US war plans in the initial stages of a conflict, presumably when small numbers of rapid reaction forces are defending while awaiting heavy force reinforcement.

In these three sources, the primary degradation in US capability comes when the antipersonnel mine is no longer available to protect the antitank mine. In the traditional minefield, there are some replacement options considered such as increasing the number of direct and indirect fire systems. This thesis rejects these options as not feasible and offers other options. Where this thesis and these studies agree is about the interdiction minefield. Because of the remote location of these minefields, nothing currently available

can adequately deter the enemy from removing them except the presence of antipersonnel landmines.

“Consequences of Landmine Restrictions” and the reports to Congress note the mixed nature of most US mine delivery systems. Because a ban of APLs would deny the US the use of mixed systems, over two-thirds of the inventory would be unavailable. This would dramatically reduce the ability of placing any type of interdiction minefield and severely hamper the emplacement of traditional tactical minefields.

This degradation in capability does result in vulnerabilities. The Ottawa Convention would deny US forces the majority of its scatterable mine systems because they contain APLs. Removing APLs from the mix is technically feasible, but would be costly. Even the removal of APLs from the mine mix would result in a serious degradation in the effectiveness of tactical and interdiction minefields. Not considered by these, or any other studies, is the degradation in nuisance mining. This situation has not been considered because nuisance mining is used primarily by an army in retreat and this is not a scenario considered likely by US planners. The loss of APLs for nuisance mining would make nuisance mining virtually ineffective.

The functions of APLs are not currently replaceable by other means in scatterable systems, interdiction minefields, or nuisance minefields. The loss of these capabilities would increase US casualties and, according to most studies, could even jeopardize the success of US operations. This constitutes vulnerability to the US Army.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

Antipersonnel landmines serve seven functions in support of US Army combat operations. Abiding by the Ottawa Convention would adversely affect all of these functions to some degree. In some cases, this degradation would make the US Army vulnerable to enemy action. In many situations, other means and methods can be employed to at least partially replace the need for APLs. In the case of interdiction minefields and nuisance minefields, however, the loss of APLs could severely hamper US military capability.

Impacts on the Seven APL Functions

This chapter reviews the functions of APLs and describes the ability of other systems to perform these functions. Based on the ability of other systems to perform these functions and on the work of others, this chapter determines the degree of vulnerability the US Army can anticipate due to compliance with the Ottawa Convention. This chapter concludes with recommendations in the event of an APL ban. Landmines serve an additive role in military operations. APLs enhance the ability of soldiers to have the following effects on the enemy.

Function One: Protection from Infiltration

Antipersonnel landmines are a bedrock system in providing protection to small units and fixed installations from infiltration by dismounted enemy soldiers. The presence of APLs deters infiltration in the first place. Failing in deterrence, APLs provide early warning by alerting the defenders and by slowing down the infiltration. There are many other systems available that are routinely used to assist in this function when APLs

may not be used. These systems include wire fences and other physical barriers, trip-flares, and alarms. Potentially, automatic direct fire and indirect fire systems such as automatic mortar and autonomous sniper systems could provide a lethal deterrent. Command detonated Claymores or a permission-seeking APL derivative could also nearly replace APLs in this role when added to the other nonlethal systems. Banning APLs would degrade the US Army's ability to protect itself from infiltration, but not to the point of causing vulnerabilities.

One exception is along the DMZ in Korea. The size of the obstacle system separating North and South Korea is so large that any degradation in capability is magnified. The costs of employing automated or even command detonated systems on a barrier of this size are prohibitive. Currently available replacement systems, while adequate for small protective obstacles, are not sufficient along the DMZ. Potentially available systems would not be cost effective.

Function Two: Protect Antitank Mines from Hand Breaching

This is a critical role for APLs. Breaching minefields while under fire is a complicated and dangerous undertaking. Hand breaching is not a favored method because of the threat to dismounted and therefore exposed soldiers. The presence of APLs in a minefield further encourages breaching soldiers to use mechanical means to breach minefields.

The most glaring vulnerability of abiding by the Ottawa Convention is the inability to capitalize on the full effect of interdiction minefields. Antitank mines equipped with sensitive antihandling devices will have some effect on enemy movement behind the front, but without the presence of APLs, any reasonably disciplined enemy can rapidly clear these obstacles by hand. The loss of the full interdiction capability means US forces could suffer increased losses as high as 33 percent. The inability to influence

the enemy outside of direct fire range constitutes a real vulnerability to US forces and puts current war plans at risk.

When minefields are covered by direct fire systems, APLs enhance the enemy's desire to avoid hand breaching and force the enemy to complicate the operation by employing specific minefield breaching equipment or to avoid the minefield altogether. Direct and indirect fire can be enough of a deterrent. When combined with physical barriers and remotely command detonated Claymores or other munitions, the deterrent effect would be equal to that of APLs.

Function Three: Protect Mine Fields from Reconnaissance

When in direct fire range and vigilantly guarded, dismounted enemy scouts will have difficulty conducting a thorough reconnaissance of US minefields. Using replacement systems listed for protective obstacles will also replace APLs in this role to some degree. Tactical minefields are often constructed in the face of the enemy. Time consuming methods, such as booby traps and wire fences, may not always be feasible. This reduced effectiveness in guarding minefields will allow the enemy better intelligence on US defensive measures and could increase US vulnerability to enemy deliberate attacks. Based on the studies of others, this vulnerability could equate to a three percent increase in US casualties.

Function Four: Slow the Enemy in Pursuit or General Withdrawal

Failing to slow the enemy in a general withdrawal or a route will not create any vulnerability to the US Army. In these situations, failure to employ nuisance mining may decrease the level of punishment US forces can inflict on a retreating army, but will not put the US Army in any particular danger. Should the US Army find itself in a situation

where it is suffering from a general withdrawal, the inability to employ APLs as a nuisance to the pursuing force could easily cause vulnerabilities.

In the Italian Campaign of World War II, the German Army effectively delayed Allied forces with mines and booby traps to augment their fighting withdrawal. In the Korean War, communist and free-world forces used this tactic at different times. In both of these wars, nuisance mining contributed significantly to salvaging the defending forces. This scenario is not covered by the current studies exploring the impacts of an APL ban because few military forces expect to find themselves in this situation. Booby traps can provide some impact, but because of the inherent problems with booby traps, they cannot completely provide this function. To deny the US Army APLs in this situation would create a vulnerability. The US Army plans to fight outnumbered in most situations. In the event of a tactical defeat, US forces may not be able to regain the initiative without the ability to slow down an army trying to exploit its success.

Function Five: Sap the Enemy's Morale

Nothing can sap the enemy's morale like defeat. Short of defeating the enemy, making his life as dangerous as possible will degrade his morale and therefore degrade his fighting ability. Antipersonnel mines greatly contribute toward degrading the enemy's morale. In set-piece battles, unexpected minefield encounters cause concern and increased anxiety. When linked with effective direct and indirect fires, morale can break. Mines and booby traps slowly, but more effectively, sap morale when used between battles. In unconventional wars, where there are few, if any, battles, long-term exposure to the unseen threat of APLs can have a significant impact on morale. US forces have been on the receiving end of the morale-sapping function of APLs and booby traps. For the foreseeable future, not having this capability does not create any vulnerabilities to US

forces. Denying APLs to a potential adversary, if this were actually possible, could enhance US security by denying the enemy this capability.

Function Six: Deter the Removal of Other Barriers

APLs are used to reinforce physical barriers so that they are not easily removed. The US Army does not rely on physical barriers. Mechanized US divisions are equipped with earthmovers designed to enhance mobility, not dig tank ditches. Wire obstacles are not suited for influencing a mechanized enemy's maneuver. Offensive in nature, the US Army specializes in mobility. There is little capability in the US Army today to construct large physical obstacles. Booby traps can begin to replace this function since the decreased ability of booby traps to perform this function is offset by the lack of reliance of physical barriers.

Function Seven: Give Credibility to Phony Mine Fields

Here again, booby traps can perform this function almost to the level that APLs can. Not having phony minefields will not create any significant vulnerabilities. It follows then that not having APLs to give phony minefields credibility will not create any vulnerabilities.

All seven of these functions can be performed by existing systems or systems that could be developed. Claymores, physical barriers, and alarms can perform many of these functions. Automated mortar and sniper systems can be developed along with remotely detonated antipersonnel munitions. A man-in-the-loop mine which asks permission to detonate is also a possible replacement option. Should the ASAS system develop into the mature system that it promises to, antipersonnel mines may cease to have any purpose at all.

Booby traps can perform many functions of APLs. This thesis assumes that booby traps are allowed under the strict definitions of the Ottawa Convention. Because booby traps are victim-actuated, long-lived, and autonomous, they produce the same problems as APLs. Booby traps have the same disadvantages as non-self-destructing APLs without the advantages of ease and safety of employment. Using booby traps as a replacement for APLs must be considered a stop-gap measure. The same political forces that have objected to APLs will eventually focus on banning booby traps should they become more commonly used.

Even though other systems can perform most of the APL functions today, and perhaps all of them in the near future, vulnerabilities would still exist should the US abide by the antipersonnel landmine prohibitions of the Ottawa Convention. These vulnerabilities exist because the replacement options are not viable for all situations of mine warfare. The two most significant vulnerabilities occur in the massive protective obstacle separating North and South Korea, and in the protection of interdiction minefields. No suitable substitute currently exists in these two cases and no foreseen new technology promises to replace APLs in these situations. A third, less potential vulnerability exists in the nuisance role of APLs. Even though the United States cannot now imagine a situation where US forces are withdrawing under pressure, the potential for this situation does exist.

Because two-thirds of the US inventory of mines is composed of mixed antipersonnel and antitank mines, the Ottawa Convention would severely handicap US forces in a conventional war at least until the inventory could be replaced with purely antitank munitions. This is possible, but even replacing these mixed munitions would still leave vulnerabilities in the demilitarized zone (DMZ) between North and South Korea and in interdiction minefields.

Although all seven functions of APLs can possibly be covered by other systems, they do so at a degraded capability compared to APLs. The cumulative effect of these reduced capabilities could constitute a vulnerability to the US Army. Computer and historical studies suggest an increase in casualties in the US forces by 3 percent in the event of an APL ban. Whether or not this 3 percent constitutes a vulnerability in itself is debatable.

Recommendations

This study looks at the operational and tactical considerations of an antipersonnel landmine ban. Beyond the scope of this study are the political issues behind the Ottawa Convention, but these political considerations exist and must be dealt with by decision makers. In other words, the decision whether or not to abide by the Ottawa Convention cannot be made solely on military reasons. It is interesting to note, however, that those nations with high levels of military commitment and complicated military issues have, for the most part, not joined in the Ottawa ban. The United States, Russia, and China, as well as most nations currently at war or on a wartime footing, such as South Korea, Israel, India, and Pakistan, have not joined in the international movement to ban antipersonnel mines. For these countries, security needs have outweighed political pressure.

The unique security commitments of the United States have so far prevented it from accepting an APL ban. The United States has often been called the world's policeman. To continue in this analogy, even in countries that have banned guns, the police remain armed. The United States, like the cop on the beat, deserves to have all reasonable measures to enforce security.

For the United States, technology allows for dominance on the battlefield. The US arsenal of self-destructing APLs is no different from other US weapons in this respect. Surrendering this technological edge comes at a higher price for the United

States. Providing a level playing field is a setback for US forces which currently enjoys the upper hand.

Based on the vulnerabilities US forces would face without the one-sided capabilities that APLs enable, the United States should not abide by the Ottawa Convention. This thesis, understanding that such a decision cannot be based purely on military consequences, presupposes adherence. Assuming the United States were to abide by the Ottawa Convention, what should the US military do to minimize the vulnerabilities created?

The first requirement would be to replace and upgrade current mixed mine systems. Antipersonnel mines would have to be removed from the Volcano, Gator, and MOPMs systems. Each antitank mine in the replacement munitions should be equipped with a very sensitive antihandling device. In the RAAMs artillery munition, every antitank mine should also be so equipped.

The next requirement is to develop remote fire systems. Claymores are command detonated using an electrical impulse sent through a wire. A remote detonation device needs to be furnished with the Claymore so that it can be fired from as far away as two kilometers. Automatic mortar and sniping systems need to be developed and fielded, particularly along the DMZ in Korea.

If politically feasible, soldiers should be equipped with booby trap kits and trained in making booby traps from existing munitions such as hand grenades and mortar rounds. These kits should increase the safety of employing booby traps and provide an effective detonation trigger.

Reliable and reusable silent alarm systems must be fielded to units to aid in protection from infiltration. Field expedient means can be effective, but a reliable and silent system will go far toward replacing APLs in the role of protecting units.

Finally, the United States must become somewhat more willing to accept casualties. Until the lofty promises of computer-age warfare are realized, there will be a need to deal with the unseen and unforeseen threat. Nothing can completely replace APLs in deterring or countering this threat. Until ASAS can provide all soldiers with nearly complete intelligence and the means to direct lethal fires immediately, the unseen and unforeseen infiltration, minefield breach, and scouting party will exact a toll on US soldiers.

Recommendations for Future Study

There are several areas where the future researcher can focus. One of these areas is technical and another is tactical. In the technical area, the near term systems should be examined. In the tactical area, how these systems impact on the battle and how they should be used should be studied.

Technical studies on the feasibility of the concepts discussed in this paper are lacking. Automatic sniper weapons, automatic mortar systems, mines that seek permission, and remotely fired Claymores are all concepts that need feasibility studies. Will these systems actually perform the tasks that this paper assumes they will? Are there secondary considerations for using these systems that might make them unusable?

This study looked to find other methods to give the US Army what APLs currently provide. Perhaps by changing how the US Army operates, the need for these functions can go away. This thesis did not look to modify current doctrine. Instead of searching for systems or methods to replace APLs, future research could look to modifying US tactical technique to eliminate the need for APLs. The digital army of the future may not have to rely on the silent sentinels in the form of APLs. Changes in doctrine may render APLs as obsolete as the pike or the horse in combat operations. Future research could examine the impact of tactical changes on mine warfare.

Conclusion

One of the reasons there is a worldwide problem with landmines today is because the antipersonnel landmine is such an effective weapon. US landmines are more sophisticated than most. Coupled with extremely advanced US delivery systems, US mine warfare provides a distinct advantage to US forces. Banning APLs would significantly degrade this advantage. This loss in capability would not be equaled in the loss of capability by an adversary also abiding by the APL ban. The net loss in capability would create vulnerabilities to the US Army due to a cumulative relative degradation in effectiveness, particularly in the inability to decisively interdict enemy forces. Other considerations include the ability to protect South Korea and the current mine mix.

These vulnerabilities need not be permanent. Many measures can be used to help offset the loss in capability. Most promising of all is the possibility of every US soldier knowing the location of nearly every enemy soldier, and automated weapon systems acting on this knowledge. In such an environment, the need for mine warfare in any form may go away entirely. Or it may not. This question needs further study.

The United States has unique commitments and unique circumstances that would create vulnerabilities to US forces should the United States abide by the Ottawa Convention at this time. The current US stand opposed to signing the Convention cannot be properly understood without considering these unique circumstances. Political pressure may force a landmine ban despite the serious potential consequences. The US Army must prepare itself for this possibility.

APPENDIX

“Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Antipersonnel Mines and on their Destruction”

Preamble

The States Parties,

Determined to put an end to the suffering and casualties caused by anti-personnel mines, that kill or maim hundreds of people every week, mostly innocent and defenceless civilians and especially children, obstruct economic development and reconstruction, inhibit the repatriation of refugees and internally displaced persons, and have other severe consequences for years after emplacement,

Believing it necessary to do their utmost to contribute in an efficient and coordinated manner to face the challenge of removing anti-personnel mines placed throughout the world, and to assure their destruction,

Wishing to do their utmost in providing assistance for the care and rehabilitation, including the social and economic reintegration of mine victims,

Recognizing that a total ban of anti-personnel mines would also be an important confidence-building measure,

Welcoming the adoption of the Protocol on Prohibitions or Restrictions on the Use of Mines, Booby-Traps and Other Devices, as amended on 3 May 1996, annexed to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects, and calling for the early ratification of this Protocol by all States which have not yet done so,

Welcoming also United Nations General Assembly Resolution 51/45 S of 10 December 1996 urging all States to pursue vigorously an effective, legally-binding international agreement to ban the use, stockpiling, production and transfer of anti-personnel landmines,

Welcoming furthermore the measures taken over the past years, both unilaterally and multilaterally, aiming at prohibiting, restricting or suspending the use, stockpiling, production and transfer of anti-personnel mines,

Stressing the role of public conscience in furthering the principles of humanity as evidenced by the call for a total ban of anti-personnel mines and recognizing the efforts to that end undertaken by the International Red Cross and Red Crescent Movement, the International Campaign to Ban Landmines and numerous other non-governmental organizations around the world,

Recalling the Ottawa Declaration of 5 October 1996 and the Brussels Declaration of 27 June 1997 urging the international community to negotiate an international and legally binding agreement prohibiting the use, stockpiling, production and transfer of anti-personnel mines,

Emphasizing the desirability of attracting the adherence of all States to this Convention, and determined to work strenuously towards the promotion of its universalization in all relevant fora including, inter alia, the United Nations, the Conference on Disarmament, regional organizations, and groupings, and review conferences of the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects,

Basing themselves on the principle of international humanitarian law that the right of the parties to an armed conflict to choose methods or means of warfare is not unlimited, on the principle that prohibits the employment in armed conflicts of weapons, projectiles and materials and methods of warfare of a nature to cause superfluous injury or unnecessary suffering and on the principle that a distinction must be made between civilians and combatants,

Have agreed as follows:

Article 1

General obligations

1. Each State Party undertakes never under any circumstances:
 - a. To use anti-personnel mines;
 - b. To develop, produce, otherwise acquire, stockpile, retain or transfer to anyone, directly or indirectly, anti-personnel mines;
 - c. To assist, encourage or induce, in any way, anyone to engage in any activity prohibited to a State Party under this Convention.
2. Each State Party undertakes to destroy or ensure the destruction of all anti-personnel mines in accordance with the provisions of this Convention.

Article 2

Definitions

1. "Anti-personnel mine" means a mine designed to be exploded by the presence, proximity or contact of a person and that will incapacitate, injure or kill one or more persons. Mines designed to be detonated by the presence, proximity or contact of a vehicle as opposed to a person, that are equipped with anti-handling devices, are not considered anti-personnel mines as a result of being so equipped.
2. "Mine" means a munition designed to be placed under, on or near the ground or other surface area and to be exploded by the presence, proximity or contact of a person or a vehicle.
3. "Anti-handling device" means a device intended to protect a mine and which is part of, linked to, attached to or placed under the mine and which activates when an attempt is made to tamper with or otherwise intentionally disturb the mine.
4. "Transfer" involves, in addition to the physical movement of anti-personnel mines into or from national territory, the transfer of title to and control over the mines, but does not involve the transfer of territory containing emplaced anti-personnel mines.

5. "Mined area" means an area which is dangerous due to the presence or suspected presence of mines.

Article 3

Exceptions

1. Notwithstanding the general obligations under Article 1, the retention or transfer of a number of anti-personnel mines for the development of and training in mine detection, mine clearance, or mine destruction techniques is permitted. The amount of such mines shall not exceed the minimum number absolutely necessary for the above-mentioned purposes.
2. The transfer of anti-personnel mines for the purpose of destruction is permitted.

Article 4

Destruction of stockpiled anti-personnel mines

Except as provided for in Article 3, each State Party undertakes to destroy or ensure the destruction of all stockpiled anti-personnel mines it owns or possesses, or that are under its jurisdiction or control, as soon as possible but not later than four years after the entry into force of this Convention for that State Party.

Article 5

Destruction of anti-personnel mines in mined areas

1. Each State Party undertakes to destroy or ensure the destruction of all anti-personnel mines in mined areas under its jurisdiction or control, as soon as possible but not later than ten years after the entry into force of this Convention for that State Party.
2. Each State Party shall make every effort to identify all areas under its jurisdiction or control in which anti-personnel mines are known or suspected to be emplaced and shall ensure as soon as possible that all anti-personnel mines in mined areas under its jurisdiction or control are perimeter-marked, monitored and protected by fencing or other means, to ensure the effective exclusion of civilians, until all anti-personnel mines contained therein have been destroyed. The marking shall at least be to the standards set out in the Protocol on Prohibitions or Restrictions on the Use of Mines, Booby-Traps and Other Devices, as amended on 3 May 1996, annexed to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects.
3. If a State Party believes that it will be unable to destroy or ensure the destruction of all anti-personnel mines referred to in paragraph 1 within that time period, it may submit a request to a Meeting of the States Parties or a Review Conference for an extension of the deadline for completing the destruction of such anti-personnel mines, for a period of up to ten years.
4. Each request shall contain:

- a. The duration of the proposed extension;
 - b. A detailed explanation of the reasons for the proposed extension, including:
 - i. The preparation and status of work conducted under national demining programs;
 - ii. The financial and technical means available to the State Party for the destruction of all the anti-personnel mines; and
 - iii. Circumstances which impede the ability of the State Party to destroy all the anti-personnel mines in mined areas;
 - c. The humanitarian, social, economic, and environmental implications of the extension; and
 - d. Any other information relevant to the request for the proposed extension.
5. The Meeting of the States Parties or the Review Conference shall, taking into consideration the factors contained in paragraph 4, assess the request and decide by a majority of votes of States Parties present and voting whether to grant the request for an extension period.
 6. Such an extension may be renewed upon the submission of a new request in accordance with paragraphs 3, 4 and 5 of this Article. In requesting a further extension period a State Party shall submit relevant additional information on what has been undertaken in the previous extension period pursuant to this Article.

Article 6

International cooperation and assistance

1. In fulfilling its obligations under this Convention each State Party has the right to seek and receive assistance, where feasible, from other States Parties to the extent possible.
2. Each State Party undertakes to facilitate and shall have the right to participate in the fullest possible exchange of equipment, material and scientific and technological information concerning the implementation of this Convention. The States Parties shall not impose undue restrictions on the provision of mine clearance equipment and related technological information for humanitarian purposes.
3. Each State Party in a position to do so shall provide assistance for the care and rehabilitation, and social and economic reintegration, of mine victims and for mine awareness programs. Such assistance may be provided, inter alia, through the United Nations system, international, regional or national organizations or institutions, the International Committee of the Red Cross, national Red Cross and Red Crescent societies and their International Federation, non-governmental organizations, or on a bilateral basis.
4. Each State Party in a position to do so shall provide assistance for mine clearance and related activities. Such assistance may be provided, inter alia, through the United Nations system, international or regional organizations or institutions, non-governmental organizations or institutions, or on a bilateral basis, or by

- contributing to the United Nations Voluntary Trust Fund for Assistance in Mine Clearance, or other regional funds that deal with demining.
5. Each State Party in a position to do so shall provide assistance for the destruction of stockpiled anti-personnel mines.
 6. Each State Party undertakes to provide information to the database on mine clearance established within the United Nations system, especially information concerning various means and technologies of mine clearance, and lists of experts, expert agencies or national points of contact on mine clearance.
 7. States Parties may request the United Nations, regional organizations, other States Parties or other competent intergovernmental or non-governmental fora to assist its authorities in the elaboration of a national demining program to determine, inter alia:
 - a. The extent and scope of the anti-personnel mine problem;
 - b. The financial, technological and human resources that are required for the implementation of the program;
 - c. The estimated number of years necessary to destroy all anti-personnel mines in mined areas under the jurisdiction or control of the concerned State Party;
 - d. Mine awareness activities to reduce the incidence of mine-related injuries or deaths;
 - e. Assistance to mine victims;
 - f. The relationship between the Government of the concerned State Party and the relevant governmental, inter-governmental or non-governmental entities that will work in the implementation of the program.
 8. Each State Party giving and receiving assistance under the provisions of this Article shall cooperate with a view to ensuring the full and prompt implementation of agreed assistance programs.

Article 7

Transparency measures

1. Each State Party shall report to the Secretary-General of the United Nations as soon as practicable, and in any event not later than 180 days after the entry into force of this Convention for that State Party on:
 - a. The national implementation measures referred to in Article 9;
 - b. The total of all stockpiled anti-personnel mines owned or possessed by it, or under its jurisdiction or control, to include a breakdown of the type, quantity and, if possible, lot numbers of each type of anti-personnel mine stockpiled;
 - c. To the extent possible, the location of all mined areas that contain, or are suspected to contain, anti-personnel mines under its jurisdiction or control, to include as much detail as possible regarding the type and quantity of each type of anti-personnel mine in each mined area and when they were emplaced;

- d. The types, quantities and, if possible, lot numbers of all anti-personnel mines retained or transferred for the development of and training in mine detection, mine clearance or mine destruction techniques, or transferred for the purpose of destruction, as well as the institutions authorized by a State Party to retain or transfer anti-personnel mines, in accordance with Article 3;
 - e. The status of programs for the conversion or de-commissioning of anti-personnel mine production facilities;
 - f. The status of programs for the destruction of anti-personnel mines in accordance with Articles 4 and 5, including details of the methods which will be used in destruction, the location of all destruction sites and the applicable safety and environmental standards to be observed;
 - g. The types and quantities of all anti-personnel mines destroyed after the entry into force of this Convention for that State Party, to include a breakdown of the quantity of each type of anti-personnel mine destroyed, in accordance with Articles 4 and 5, respectively, along with, if possible, the lot numbers of each type of anti-personnel mine in the case of destruction in accordance with Article 4;
 - h. The technical characteristics of each type of anti-personnel mine produced, to the extent known, and those currently owned or possessed by a State Party, giving, where reasonably possible, such categories of information as may facilitate identification and clearance of anti-personnel mines; at a minimum, this information shall include the dimensions, fusing, explosive content, metallic content, colour photographs and other information which may facilitate mine clearance; and
 - i. The measures taken to provide an immediate and effective warning to the population in relation to all areas identified under paragraph 2 of Article 5.
2. The information provided in accordance with this Article shall be updated by the States Parties annually, covering the last calendar year, and reported to the Secretary-General of the United Nations not later than 30 April of each year.
 3. The Secretary-General of the United Nations shall transmit all such reports received to the States Parties.

Article 8

Facilitation and clarification of compliance

1. The States Parties agree to consult and cooperate with each other regarding the implementation of the provisions of this Convention, and to work together in a spirit of cooperation to facilitate compliance by States Parties with their obligations under this Convention.
2. If one or more States Parties wish to clarify and seek to resolve questions relating to compliance with the provisions of this Convention by another State Party, it may submit, through the Secretary-General of the United Nations, a Request for Clarification of that matter to that State Party. Such a request shall be

- accompanied by all appropriate information. Each State Party shall refrain from unfounded Requests for Clarification, care being taken to avoid abuse. A State Party that receives a Request for Clarification shall provide, through the Secretary-General of the United Nations, within 28 days to the requesting State Party all information which would assist in clarifying this matter.
3. If the requesting State Party does not receive a response through the Secretary-General of the United Nations within that time period, or deems the response to the Request for Clarification to be unsatisfactory, it may submit the matter through the Secretary-General of the United Nations to the next Meeting of the States Parties. The Secretary-General of the United Nations shall transmit the submission, accompanied by all appropriate information pertaining to the Request for Clarification, to all States Parties. All such information shall be presented to the requested State Party which shall have the right to respond.
 4. Pending the convening of any meeting of the States Parties, any of the States Parties concerned may request the Secretary-General of the United Nations to exercise his or her good offices to facilitate the clarification requested.
 5. The requesting State Party may propose through the Secretary-General of the United Nations the convening of a Special Meeting of the States Parties to consider the matter. The Secretary-General of the United Nations shall thereupon communicate this proposal and all information submitted by the States Parties concerned, to all States Parties with a request that they indicate whether they favour a Special Meeting of the States Parties, for the purpose of considering the matter. In the event that within 14 days from the date of such communication, at least one-third of the States Parties favours such a Special Meeting, the Secretary-General of the United Nations shall convene this Special Meeting of the States Parties within a further 14 days. A quorum for this Meeting shall consist of a majority of States Parties.
 6. The Meeting of the States Parties or the Special Meeting of the States Parties, as the case may be, shall first determine whether to consider the matter further, taking into account all information submitted by the States Parties concerned. The Meeting of the States Parties or the Special Meeting of the States Parties shall make every effort to reach a decision by consensus. If despite all efforts to that end no agreement has been reached, it shall take this decision by a majority of States Parties present and voting.
 7. All States Parties shall cooperate fully with the Meeting of the States Parties or the Special Meeting of the States Parties in the fulfilment of its review of the matter, including any fact-finding missions that are authorized in accordance with paragraph 8.
 8. If further clarification is required, the Meeting of the States Parties or the Special Meeting of the States Parties shall authorize a fact-finding mission and decide on its mandate by a majority of States Parties present and voting. At any time the requested State Party may invite a fact-finding mission to its territory. Such a mission shall take place without a decision by a Meeting of the States Parties or a Special Meeting of the States Parties to authorize such a mission. The mission,

consisting of up to 9 experts, designated and approved in accordance with paragraphs 9 and 10, may collect additional information on the spot or in other places directly related to the alleged compliance issue under the jurisdiction or control of the requested State Party.

9. The Secretary-General of the United Nations shall prepare and update a list of the names, nationalities and other relevant data of qualified experts provided by States Parties and communicate it to all States Parties. Any expert included on this list shall be regarded as designated for all fact-finding missions unless a State Party declares its non-acceptance in writing. In the event of non-acceptance, the expert shall not participate in fact-finding missions on the territory or any other place under the jurisdiction or control of the objecting State Party, if the non-acceptance was declared prior to the appointment of the expert to such missions.
10. Upon receiving a request from the Meeting of the States Parties or a Special Meeting of the States Parties, the Secretary-General of the United Nations shall, after consultations with the requested State Party, appoint the members of the mission, including its leader. Nationals of States Parties requesting the fact-finding mission or directly affected by it shall not be appointed to the mission. The members of the fact-finding mission shall enjoy privileges and immunities under Article VI of the Convention on the Privileges and Immunities of the United Nations, adopted on 13 February 1946.
11. Upon at least 72 hours notice, the members of the fact-finding mission shall arrive in the territory of the requested State Party at the earliest opportunity. The requested State Party shall take the necessary administrative measures to receive, transport and accommodate the mission, and shall be responsible for ensuring the security of the mission to the maximum extent possible while they are on territory under its control.
12. Without prejudice to the sovereignty of the requested State Party, the fact-finding mission may bring into the territory of the requested State Party the necessary equipment which shall be used exclusively for gathering information on the alleged compliance issue. Prior to its arrival, the mission will advise the requested State Party of the equipment that it intends to utilize in the course of its fact-finding mission.
13. The requested State Party shall make all efforts to ensure that the fact-finding mission is given the opportunity to speak with all relevant persons who may be able to provide information related to the alleged compliance issue.
14. The requested State Party shall grant access for the fact-finding mission to all areas and installations under its control where facts relevant to the compliance issue could be expected to be collected. This shall be subject to any arrangements that the requested State Party considers necessary for:
 - a. The protection of sensitive equipment, information and areas;
 - b. The protection of any constitutional obligations the requested State Party may have with regard to proprietary rights, searches and seizures, or other constitutional rights; or

- c. The physical protection and safety of the members of the fact-finding mission.
In the event that the requested State Party makes such arrangements, it shall make every reasonable effort to demonstrate through alternative means its compliance with this Convention.
- 15. The fact-finding mission may remain in the territory of the State Party concerned for no more than 14 days, and at any particular site no more than 7 days, unless otherwise agreed.
- 16. All information provided in confidence and not related to the subject matter of the fact-finding mission shall be treated on a confidential basis.
- 17. The fact-finding mission shall report, through the Secretary-General of the United Nations, to the Meeting of the States Parties or the Special Meeting of the States Parties the results of its findings.
- 18. The Meeting of the States Parties or the Special Meeting of the States Parties shall consider all relevant information, including the report submitted by the fact-finding mission, and may request the requested State Party to take measures to address the compliance issue within a specified period of time. The requested State Party shall report on all measures taken in response to this request.
- 19. The Meeting of the States Parties or the Special Meeting of the States Parties may suggest to the States Parties concerned ways and means to further clarify or resolve the matter under consideration, including the initiation of appropriate procedures in conformity with international law. In circumstances where the issue at hand is determined to be due to circumstances beyond the control of the requested State Party, the Meeting of the States Parties or the Special Meeting of the States Parties may recommend appropriate measures, including the use of cooperative measures referred to in Article 6.
- 20. The Meeting of the States Parties or the Special Meeting of the States Parties shall make every effort to reach its decisions referred to in paragraphs 18 and 19 by consensus, otherwise by a two-thirds majority of States Parties present and voting.

Article 9

National implementation measures

Each State Party shall take all appropriate legal, administrative and other measures, including the imposition of penal sanctions, to prevent and suppress any activity prohibited to a State Party under this Convention undertaken by persons or on territory under its jurisdiction or control.

Article 10

Settlement of disputes

1. The States Parties shall consult and cooperate with each other to settle any dispute that may arise with regard to the application or the interpretation of this

Convention. Each State Party may bring any such dispute before the Meeting of the States Parties.

2. The Meeting of the States Parties may contribute to the settlement of the dispute by whatever means it deems appropriate, including offering its good offices, calling upon the States parties to a dispute to start the settlement procedure of their choice and recommending a time-limit for any agreed procedure.
3. This Article is without prejudice to the provisions of this Convention on facilitation and clarification of compliance.

Article 11

Meetings of the States Parties

1. The States Parties shall meet regularly in order to consider any matter with regard to the application or implementation of this Convention, including:
 - a. The operation and status of this Convention;
 - b. Matters arising from the reports submitted under the provisions of this Convention;
 - c. International cooperation and assistance in accordance with Article 6;
 - d. The development of technologies to clear anti-personnel mines;
 - e. Submissions of States Parties under Article 8; and
 - f. Decisions relating to submissions of States Parties as provided for in Article 5.
2. The First Meeting of the States Parties shall be convened by the Secretary-General of the United Nations within one year after the entry into force of this Convention. The subsequent meetings shall be convened by the Secretary-General of the United Nations annually until the first Review Conference.
3. Under the conditions set out in Article 8, the Secretary-General of the United Nations shall convene a Special Meeting of the States Parties.
4. States not parties to this Convention, as well as the United Nations, other relevant international organizations or institutions, regional organizations, the International Committee of the Red Cross and relevant non-governmental organizations may be invited to attend these meetings as observers in accordance with the agreed Rules of Procedure.

Article 12

Review Conferences

1. A Review Conference shall be convened by the Secretary-General of the United Nations five years after the entry into force of this Convention. Further Review Conferences shall be convened by the Secretary-General of the United Nations if so requested by one or more States Parties, provided that the interval between Review Conferences shall in no case be less than five years. All States Parties to this Convention shall be invited to each Review Conference.

2. The purpose of the Review Conference shall be:
 - a. To review the operation and status of this Convention;
 - b. To consider the need for and the interval between further Meetings of the States Parties referred to in paragraph 2 of Article 11;
 - c. To take decisions on submissions of States Parties as provided for in Article 5; and
 - d. To adopt, if necessary, in its final report conclusions related to the implementation of this Convention.
3. States not parties to this Convention, as well as the United Nations, other relevant international organizations or institutions, regional organizations, the International Committee of the Red Cross and relevant non-governmental organizations may be invited to attend each Review Conference as observers in accordance with the agreed Rules of Procedure.

Article 13

Amendments

1. At any time after the entry into force of this Convention any State Party may propose amendments to this Convention. Any proposal for an amendment shall be communicated to the Depositary, who shall circulate it to all States Parties and shall seek their views on whether an Amendment Conference should be convened to consider the proposal. If a majority of the States Parties notify the Depositary no later than 30 days after its circulation that they support further consideration of the proposal, the Depositary shall convene an Amendment Conference to which all States Parties shall be invited.
2. States not parties to this Convention, as well as the United Nations, other relevant international organizations or institutions, regional organizations, the International Committee of the Red Cross and relevant non-governmental organizations may be invited to attend each Amendment Conference as observers in accordance with the agreed Rules of Procedure.
3. The Amendment Conference shall be held immediately following a Meeting of the States Parties or a Review Conference unless a majority of the States Parties request that it be held earlier.
4. Any amendment to this Convention shall be adopted by a majority of two-thirds of the States Parties present and voting at the Amendment Conference. The Depositary shall communicate any amendment so adopted to the States Parties.
5. An amendment to this Convention shall enter into force for all States Parties to this Convention which have accepted it, upon the deposit with the Depositary of instruments of acceptance by a majority of States Parties. Thereafter it shall enter into force for any remaining State Party on the date of deposit of its instrument of acceptance.

Article 14

Costs

1. The costs of the Meetings of the States Parties, the Special Meetings of the States Parties, the Review Conferences and the Amendment Conferences shall be borne by the States Parties and States not parties to this Convention participating therein, in accordance with the United Nations scale of assessment adjusted appropriately.
2. The costs incurred by the Secretary-General of the United Nations under Articles 7 and 8 and the costs of any fact-finding mission shall be borne by the States Parties in accordance with the United Nations scale of assessment adjusted appropriately.

Article 15

Signature

This Convention, done at Oslo, Norway, on 18 September 1997, shall be open for signature at Ottawa, Canada, by all States from 3 December 1997 until 4 December 1997, and at the United Nations Headquarters in New York from 5 December 1997 until its entry into force.

Article 16

Ratification, acceptance, approval or accession

1. This Convention is subject to ratification, acceptance or approval of the Signatories.
2. It shall be open for accession by any State which has not signed the Convention.
3. The instruments of ratification, acceptance, approval or accession shall be deposited with the Depositary.

Article 17

Entry into force

1. This Convention shall enter into force on the first day of the sixth month after the month in which the 40th instrument of ratification, acceptance, approval or accession has been deposited.
2. For any State which deposits its instrument of ratification, acceptance, approval or accession after the date of the deposit of the 40th instrument of ratification, acceptance, approval or accession, this Convention shall enter into force on the first day of the sixth month after the date on which that State has deposited its instrument of ratification, acceptance, approval or accession.

Article 18

Provisional application

Any State may at the time of its ratification, acceptance, approval or accession, declare that it will apply provisionally paragraph 1 of Article 1 of this Convention pending its entry into force.

Article 19

Reservations

The Articles of this Convention shall not be subject to reservations.

Article 20

Duration and withdrawal

1. This Convention shall be of unlimited duration.
2. Each State Party shall, in exercising its national sovereignty, have the right to withdraw from this Convention. It shall give notice of such withdrawal to all other States Parties, to the Depositary and to the United Nations Security Council. Such instrument of withdrawal shall include a full explanation of the reasons motivating this withdrawal.
3. Such withdrawal shall only take effect six months after the receipt of the instrument of withdrawal by the Depositary. If, however, on the expiry of that six-month period, the withdrawing State Party is engaged in an armed conflict, the withdrawal shall not take effect before the end of the armed conflict.
4. The withdrawal of a State Party from this Convention shall not in any way affect the duty of States to continue fulfilling the obligations assumed under any relevant rules of international law.

Article 21

Depositary

The Secretary-General of the United Nations is hereby designated as the Depositary of this Convention.

Article 22

Authentic texts

The original of this Convention, of which the Arabic, Chinese, English, French, Russian and Spanish texts are equally authentic, shall be deposited with the Secretary-General of the United Nations.

GLOSSARY

Antihandling Device. This is a device intended to protect a mine and which is part of, linked to, attached to, or placed under the mine and which activates when an attempt is made to tamper with or otherwise disturb the mine.¹

Antipersonnel Landmine (APL). See "antipersonnel mine."

Antipersonnel Mine. This is a mine designed to be exploded by the presence, proximity, or contact of a person and that will incapacitate, injure, or kill one or more persons. Mines designed to be detonated by the presence, proximity, or contact of a vehicle as opposed to a person, that are equipped with antihandling devices, are not considered antipersonnel mines as a result of being so equipped.² In this paper "antipersonnel landmine" and "antipersonnel mine" are synonymous and may be abbreviated as APL.

Antitank Mine. This is a particularly type of mine designed to function due to the presence of an armored vehicle. These mines are not designed to function due to the presence of a person.

Area-Denial Artillery Munition (ADAM). The ADAM is an artillery-delivered APL. One ADAM artillery round fired from a 155mm howitzer delivers 36 mines to the target. Each ADAM mine is wedge shaped and about the size and weight of a smoke grenade. When delivered, it deploys trip wires. When activated, the munition bounds (like the M16 Bouncing Betty) and inflicts casualties up to ten meters away.

Avenue of Approach. An air or ground route of an attacking force of a given size leading to its objective or to key terrain in its path.³

¹United Nations. Treaty Series. "Conventions on the Prohibitions of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction," 18 September 1998; available from http://www.un.org/Depts/Landmine/UNDocs/ban_trty.htm; Internet; accessed 12 Oct 98: article 2, section 3.

² Ibid., article 2, section 1.

³U.S. Department of the Army, FM 101-5-1, *Operational Terms and Graphics* (Washington, DC: 30 Sep 97), 1-14.

Booby Trap. Any device or material which is designed, constructed, or adapted to kill or injure, and which functions unexpectedly when a person disturbs or approaches an apparently harmless object or performs an apparently safe act.⁴ These devices are similar to landmines. In general, booby traps are munitions that are adapted to function when triggered by their victims.

CINC. Commander-in-chief. Title of the commander of a unified command which provides warplans and command and control for a particular region of the world.

Claymore. This munition is place on or near the ground and when triggered fires steel pellets in a forward arc. This munition is most commonly triggered by the person who set up the munition. This person sends an electric current along a wire to the munition, causing it to explode. This is know as command detonation. When the Claymore is employed so that the victims initiates the electrical impulse, the Claymore is being used as a landmine.

Command-detonation. This occurs when an explosive device is intentionally and instantly triggered.

Countermobility Operations. The construction of obstacles and emplacement of minefields to delay, disrupt, and destroy the enemy by reinforcement of the terrain. The primary purpose of countermobility operations is to slow or divert the enemy, to increase time for target acquisition, and to increase weapon effectiveness.⁵

Direct Fire. Gunfire delivered on a target, using the target itself as a point of aim for either the gun or the director.⁶

Dumb Mine. See "non-self-destructing mine."

Engagement Area. An area along an enemy avenue of approach where the commander intends to contain and destroy an enemy force with the massed fires of all available weapons.⁷

⁴ United Nations. Treaty Series. "Amended Protocol on Prohibitions or Restrictions on the Use of Mines, Booby-Traps and Other Devices," 3 October 1997; available from <http://www.un.org/Depts/Landmine/UNDocs/protocol.htm>; Internet; accessed 23 Sep 98: article 2, section 4.

⁵U.S. Department of the Army, FM 101-5-1, *Operational Terms and Graphics* (Washington, DC: 30 Sep 97), 1-40.

⁶Ibid., 1-53.

Force XXI. Current name of the “digital” army of the twenty-first century. Force XXI expects to employ digital and computer technology to obtain information dominance of the battlefield.

Indirect Fire. Fire delivered on a target that is not itself used as a point of aim for the weapons or the director.⁸

Interdict. To prevent, hinder or delay the use of an area or route by enemy forces.⁹

Gator. A scatterable mine system dropped by US Air Force and US Navy aircraft.

Landmine. See “mine.”

Mine. This is a munition designed to be placed under, on, or near the ground or other surface area and to be exploded by the presence, proximity, or contact of a person or a vehicle.¹⁰ Although “mine” is not synonymous with “landmine” since there are mines used at sea, this investigation will only consider landmines. “Mine” and “landmine” will be used interchangeably.

Minefield. See “mined area.”

Mined Area. This is an area which is dangerous due to the presence or suspected presence of mines.¹¹ This is synonymous with “minefield.” How can an area be dangerous due to the “suspected presence of mines”? Areas are sometimes made to appear as though they are mined when in fact they are not. These areas are known as phony minefields and are designed to have the same effect on enemy maneuver as real minefields. This definition includes phony minefields as mined areas, although there is little danger inherent in a phony minefield since it contains no munitions.

⁷Ibid., 1-60

⁸Ibid., 1-81

⁹Ibid., 1-84.

¹⁰United Nations. Treaty Series. “Conventions on the Prohibitions of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction,” 18 September 1998; available from http://www.un.org/Depts/Landmine/UNDocs/ban_trty.htm; Internet; accessed 12 Oct 98: article 2, section 2.

¹¹Ibid., article 2, section 5.

Modular Pack Mine System (MOPMS). A man-portable system containing 21 scatterable mines. When detonated, the MOPMS launches the mines into a semi-circle 35 meters from the box containing the system.

Non-Self-Destructing (NSD) Mine. This type of mine will remain active until discharged or rendered safe by a person. NSD mines can not turn themselves off or neutralize themselves. Some of these devices can remain in place and dangerous for more than twenty-five years. US policy currently forbids the use of NSD APLs except in Korea. They are often referred to as "dumb mines."

Obstacle Group. Normally, a task force-level obstacle control measure that specifies the location of one or more obstacles grouped to provide a specific obstacle effect.¹²

Ottawa Convention. This is the short name for the United Nations treaty titled "Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction." This treaty takes its short name from the city where the treaty process began. This treaty is in force as of 1 March 1999 and is included as an appendix to this thesis.

Phony Minefield. See "mined area."

Protective Minefield. A type of minefield placed to protect a military unit or an installation from the presence of the enemy.

Pursuit-Deterrent Munition (PDM). An ADAM mine modified for use by hand. The PDM is employed like a hand grenade.

Self-Destructing Mines. These are the opposite of NSD mines. These mines destroy themselves when certain criteria are met. The most common criterion is time. After a certain amount of time, the mine will destroy itself.

Scatterable Mines. Landmines that are emplaced by scattering them over an area as opposed to being emplaced individually.

Smart Mines. These mines react to events other than being triggered by a target. Self-destructing mines are a type of smart mine because they can react to another trigger, such as the passage of a period of time. Other types of smart mines can render themselves safe if they receive a certain radio signal. Still others only arm themselves after they "hear" an approaching target. Some antitank mines are smart enough to tell the difference between the acoustic and seismic signatures of

¹²U.S. Department of the Army, FM 101-5-1, *Operational Terms and Graphics* (Washington, D.C.: 30 September 1997), 1-112.

different types of tanks. These mines pose little danger to friendly tanks, but are lethal to enemy tanks.

Tactical Minefield. A type of minefield placed to influence the maneuver of an enemy formation.

Volcano. A scatterable mine system employed by the US Army. The system can be mounted on ground vehicles or helicopters.

Vulnerability. A vulnerability is a weakness that can be exploited by others. In the context of this examination, a vulnerability to the US Army is a weakness or a degradation of capability that could seriously hamper operations, or give an adversary a distinct advantage in combat operations against the US Army.

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