

FORCE PROTECTION THROUGH SECURITY OF THE GROUND LINES OF COMMUNICATION (GLOC)

A Monograph
By
Major David J. Kolleda
Transportation Corps



19960617 031

School of Advanced Military Studies
United States Army Command and General Staff College
Fort Leavenworth, Kansas

First Term AY 95-96

Approved for Public Release; Distribution is Unlimited

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED MONOGRAPH		
4. TITLE AND SUBTITLE <i>Force Protection through security of the Ground Lines of Communication (GLOC)</i>			5. FUNDING NUMBERS	
6. AUTHOR(S) <i>MAJ David J. Kellea</i>				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) School of Advanced Military Studies Command and General Staff College Fort Leavenworth, Kansas 66027			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) Command and General Staff College Fort Leavenworth, Kansas 66027			10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION / AVAILABILITY STATEMENT APPROVED FOR PUBLIC RELEASE. DISTRIBUTION UNLIMITED.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) SEE ATTACHED				
14. SUBJECT TERMS <i>Force Protection, Security Operations, CSS, Ground Lines of Communication, Logistic Operations</i>			15. NUMBER OF PAGES 54	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT UNLIMITED	

ABSTRACT

FORCE PROTECTION THROUGH SECURITY OF THE GROUND LINES OF COMMUNICATION (GLOC) by MAJ David J. Kolleda, USA

This monograph discusses the importance of understanding the impact that a failure to provide for security of the Ground Lines of Communication (GLOC) can have on the successful execution of tactical operations. The problem facing military planners is a lack of knowledge and guidance to provide for deliberately establishing conditions to protect against threat actions upon the GLOC and enable the service support forces to provide continuous support. There is no single reference in the common professional soldier's library that addresses and analyzes methods of conducting defensive techniques to protect the ground, and specifically highway, lines of communication during times of conflict.

This monograph first identifies the theoretical applications of GLOC security as presented by the early military theorists, then provides analysis of the occurrences and outcomes of pertinent events in past conflicts, analyzing the relevance of ensured sustainment support. It further addresses GLOC security operations in the US Army Force XXI concept and during more contemporary Operations Other Than War (OOTW) deployments.

This monograph concludes by identifying what US Army doctrine states relative to GLOC security guidance and operations, what history demonstrates as true, what is lacking between the two, and recommendations on how to bring the doctrinal base and historical knowledge in line in an attempt to provide appropriate planning guidance for the operation and security of ground lines of communication during military operations. The study recommends changes or improvements in the following areas: countermine and survivability doctrine, and the tactical concept of operations required to maintain unity of effort over GLOC security. The primary element is to provide tactical planning guidance that includes techniques for developing an integrated plan for providing tactical support to sustainment convoys operating from the communications zone into the combat zone.

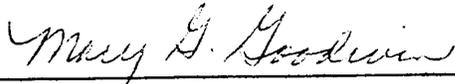
SCHOOL OF ADVANCED MILITARY STUDIES

MONOGRAPH APPROVAL

MAJOR DAVID J. KOLLEDA

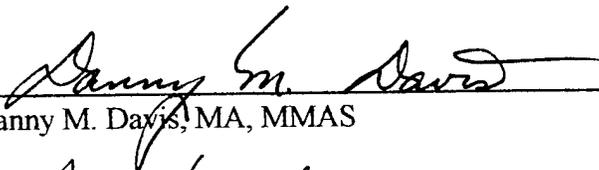
Title of Monograph: Force Protection Through Security of the Ground Lines of Communication
(GLOC)

Approved by:



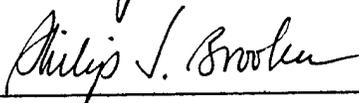
LTC Mary G. Goodwin, MA

Monograph Director



COL Danny M. Davis, MA, MMAS

Director, School of
Advanced Military
Studies



Philip J. Brookes, Ph.D.

Director, Graduate
Degree Program

Accepted this 14th day of December 1995

Table of Contents	Page
I. Introduction	1
II. Case Study Analysis	8
III. Doctrine	27
IV. Force XXI Implications	34
V. Conclusions	38
Endnotes	45
Bibliography	51

CHAPTER 1. Introduction

The classic military theorists set the standard for identifying the importance of establishing security for the ground lines of communication (GLOC). The early Chinese military theorist, Sun Tzu, was very specific in recognizing the importance of the proper use of high ground along supply routes. Clausewitz, the great Prussian General of the early 1800's, and the seminal military theorist, was not noted for his attention to logistic considerations. He nevertheless, placed enough importance on addressing lines of operation, and announced that in planning operations, one must also plan the defense of the "area left in the rear of the advancing forces, an area vital to their [the armies] existence, is not necessarily covered by the attack and needs special protection." ¹ Furthermore, in addressing flanking operations against an enemy, he stated, "Pressure on lines of communication is aimed at enemy convoys, small detachments in the Army's wake, couriers, travelers, minor enemy depots, and so forth -- at anything, in fact, that the enemy needs to keep his Army in a healthy, vigorous condition." ²

Jomini, the great Napoleonic disciple and noted Swiss military theorist, in addressing principal points relating to the movement of forces includes "Providing for the successive arrival of convoys. . ." ³ and, when describing incursions into enemy territory, advises caution against unprotected use of the lines of communication lest the enemy "destroys the detachments left to guard it, surprises his convoys and his depots, and carries on a war so disastrous for the invader that he must inevitably yield after a

time." ⁴

Obviously, given that Sun Tzu addressed GLOC security over two centuries ago, it is not a new issue. It is one, however, that receives little direct contemporary attention. The problem facing military planners is a lack of knowledge and guidance to provide for deliberately establishing conditions to protect against threat actions upon the GLOC and enable the service support forces to provide continuous support. Lines of communication are routes that connect a military force with its base of operations as it executes tactical operations against an enemy force. Sustainment supplies and military forces move along the LOCs in support of the tactical effort. ⁵ There is no single reference in the common professional soldier's library that addresses and analyzes methods of conducting defensive techniques to protect the ground, and specifically highway, lines of communication during times of conflict. While there exists a common agreement among professional soldiers that LOCs must remain open in order to sustain forces deployed for combat operations, most historical accounts of warfare, or those of specific campaigns, only provide simple anecdotal commentary of techniques that worked at the time (i.e., the hardened guntruck in Ambush Alley in Vietnam), or the difficulties, (i.e. establishing the Stilwell Road in the China-Burma-India Theater of WWII). Many military and historical authors simply fail to address the importance of the GLOC because tactical commanders typically assume LOCs will be secure.

But GLOC security is not always certain. There have been instances when specific military doctrine has specified operations directed against lines of communications. Mao Tse Tung's approach during the strategic stalemate stage of

protracted war (the second of Mao's three stages of war), against the imperialistic Japanese in the 1930's, targeted the Japanese LOCs and rear area.⁶ The result of Mao's focusing of tactical action against the GLOC was the eventual collapse of the Japanese campaign. The Russian Civil War hero and later General, Mikail Tukhachevskii, revised the pre-World War II strategy of the Red forces to focus on executing deep spearhead attacks with mechanized forces, for the purpose of cutting the enemy lines of communication.⁷ It is no surprise that GLOCs can be a prime target because without them, the tactical effort can not be sustained.

Typical professional and historical transportation studies of military significance address the physical transportation infrastructure at the expense of an analysis of GLOC security. These studies identify and analyze physical modal capabilities, including rail lines and rolling stock inventories, or inland waterway barge systems and river terminal operations. Normally, the transportation studies address the three doctrinal transportation functions of modal operations, terminal operations, and movement control. The common conclusions in historical writings refer to such logistic problems as cargo tracking, lack of support troop to combat troop ratios, deployment echelonment, and host nation contracting and purchasing difficulties.

This monograph takes a different approach. The paper will concentrate on the tactical implications of GLOC security failure and what can be done to prevent against it. GLOC security contributes to force protection through ensured sustainment support and the preservation of already institutionally constrained logistic forces and equipment. Force protection equates to "the shielding of the fighting potential of the force so that it

can be applied at the decisive time and place." ⁸ In short, any actions taken to conserve the fighting potential of the force to be applied in the future at a decisive time and place against the enemy, are force protection measures. ⁹

Historical accounts demonstrate a direct correlation between the success and failure of military operations and the ability to maintain a safe and operating GLOC. When forces are out of contact with their sustainment base, they become a weak point against which the enemy can direct his forces and assume the initiative. Concurrently, unsupported forces may become too weak to successfully execute their portion of the tactical plan if they cannot be continuously supported.

In the central European campaigns of the Prussian ruler and warrior, Frederick the Great, the Austrians caused him to lift the siege of Olmutz by intercepting a large and important resupply column. Frederick learned an important lesson from this episode. Later in the same year of 1757, he used 15,000 men to escort a convoy from Tropaup to Olmutz. He again used another 30,000 to do the same to Koniggratz, and again with 8,000 secured the GLOC to Glatz. ¹⁰ He succeeded in these endeavors only through deliberate decisions to employ large portions of his forces in protection and security roles along his routes of march.

During the French invasion in Algeria in 1840 for example, the Algerians were able to wage a very successful campaign against the French forces' logistics system and rear areas. The French developed a system of outposts across the Algerian desert, effectively anchoring themselves to fixed points, with little opportunity for supporting operations throughout the desert. The Algerians recognized the shortcomings in this plan

and continuously tormented the French fixed points through raids on the supply lines and rear positions. ¹¹ In the 1916 Arab revolt against the Turks, the Arab blockade of Mecca, and the Arab's ability to interdict the Turk's supply line forced them into surrender. The GLOC was "too long and rough to be held by the Turks." ¹²

U.S. history features similar situations. In the American Revolutionary War against Britain, the patriots used hit-and-run guerilla style tactics against the British General Burgoyne's flanks and line of communications during Burgoyne's 1777 Lake Champlain campaign toward the Hudson River. The interdiction of Burgoyne's GLOC helped force the British surrender at Saratoga. ¹³ The American Civil War experiences showed similar vulnerabilities. On the first of several attempts to secure the southern fortifications in Vicksburg, Mississippi, the Northern General U.S. Grant had to abort his attack and fall back when Confederate forces interdicted his GLOC. ¹⁴ In early 1863 in Murfreesboro, Tennessee, General W.S. Rosecrans refused to accept the impending defeat of his northern force by General Bragg's Southern Army. Though opposed by superior and mobile enemy forces, Rosecrans "spent his time improving the capacity of his communications and supply arrangements." By securing his GLOC and building his offensive power he was ultimately able to counterattack and force the enemy into a withdrawal. ¹⁵ General U.S. Grant was able to exploit the Southern General R.E. Lee's lines of communication in Virginia in 1864, when he separated Lee's forces from their support base in Richmond by placing the Union forces along the Confederate GLOCs.

The Union forces had to plan for security of their GLOCs more systematically than did the Confederate forces. The Union forces had fewer and longer LOCs to

accommodate their offensive efforts into southern territory. They had to deliberately secure these routes through hostile Confederate lands. In January 1863, the Union used 51,000 men to protect their railroad lines and the routes of their forces and raider parties. Throughout the vulnerable Baltimore-West Virginia-Ohio-Kentucky line, the North used 56,000 men to protect against an estimated threat of approximately 15,000 enemy.¹⁶

The issue of GLOC security rises to further importance in the U.S. Army's future concept of Force XXI operations. Force XXI is the Army vision for operations in the 21st Century. It is a reconceptualization and redesign of the Army based upon information technologies. Inherent in Force XXI is the Army's versatility to respond to a broader range of missions on the peace-war spectrum. Operations other than war (OOTW) deployments are part of that broader range and are important and increasingly frequent missions.

As the nation's primary ground combat force, the Army frequently deals in these more variable and nonlinear applications of military power. Recent OOTW operations in Rwanda, Haiti, and Somalia illustrate a more liberal policy toward deployments for these more constabulary type of affairs. In each case, freedom of movement over the road network was instrumental in successful mission completion.

Planners must understand that in these nonstandard types of operations, the combat service support (CSS) forces' risk of facing direct contact with enemy forces increases substantially. The informal, partisan nature of the threat force, increased contact with native personnel while providing humanitarian or peacekeeping support, and restrictive rules of engagement under which soldiers can fire their weapons, leave the

support forces with relatively unrestricted direct contact with any hostile faction that may want to raid their life- sustaining cargo, or the transport equipment itself.

The Force XXI warfighting concept in conventional maneuver warfare consists of massing light and armored maneuver forces for very short periods of time to achieve mass against the enemy force. These 21st Century forces operate under knowledge-based frameworks, on digitized battlefields, providing enhanced situational awareness. The result is an elongation of the battlefield in all dimensions, creating greater dispersion for supporting forces, and longer, less secure ground lines of communication.

CHAPTER 2. Case Study Analysis

The U.S. Army has employed various techniques to counter threats to their main supply routes (MSRs). GLOC security measures have evolved from World War I (WWI) to the present. Rail operations and stable front lines were the conditions under which military forces operated during WWI. Motor vehicles were few in number and did not contribute substantially to combat operations. The concern for GLOC security was minimal and little deliberate action was taken to secure the GLOCs. The main issue for convoy security was for the drivers to be properly armed or supplied with appropriate munitions to destroy the cargo if it was in danger of falling into enemy hands. The American leadership determined this was the best approach since the threat, and the opportunity for recapture of the supplies, was slight.¹⁷

The result of the 1914 European countries being but little beyond the birth of motorization of the armies, and of the appearance of fixed front lines at the German culmination of the Schlieffen Plan, led to a very linear battlefield through Central Europe. There was virtually no rear area threat. Once the Germans over-extended their lines of communication after pushing to within 30 miles of Paris (and possible victory), they fortified the existing front line and concentrated on establishing an improved logistic flow. The French and British Armies did the same on their side of the battlefield. The continuing campaign strategy resulted in little more than frontal assaults against fixed positions. GLOCs remained intact.

WORLD WAR II (WWII)

By WWII, the amount of available vehicles, and semi-improved roads throughout Europe considerably lengthened the GLOCs. In the war's early years, unlike the rail system for WWI, highway transportation provided unit movement support and the majority of supply shipments. Enemy interdiction of the GLOC was always a threat.

Strategic LOCs across the oceans became of vital importance at this time. From January, 1942 to July, 1942, the Germans sank nearly 650,000 tons of ocean shipments per month, mostly in the coastal zones of the United States. The U.S. was finally able to get these losses under control only when the Navy organized and executed an effective interlocking naval convoy system and security program to provide security over the sea lines of communication.¹⁸ The Navy learned a vital lesson on command of the sea. The U.S. Army Air Corps, too, experienced many lessons in air superiority, and in using fighter escorts of bombers, in developing procedures to achieve and maintain air superiority. As a result of these experiences, the Navy and Air Force placed great emphasis on command of the sea and in maintaining air superiority to protect strategic LOCs. The Army should place as much professional emphasis on maintaining security of the tactical ground LOCs. The campaigns of WWII provide numerous examples to learn from.

In the China-Burma-India (CBI) Theater of WWII, the Americans pressed the British to open a GLOC from India to China as the only legitimate way to prosecute the war against Japan.¹⁹ This was known as the Burma (or Stilwell) Road. The road extended a distance of over 1700 miles from Siliguri, India to Kunming, China.²⁰

Simultaneously the boon and bane to General Stilwell's operation, the sole supply route upon which the entire theater campaign rested could not be kept open and secure except by concentrated effort for short periods of time and at specific locations, much like fighter escorts for air cover.

A standard Japanese technique in ambushing Allied forces moving on the Burma Road was to hold "us in front, to send a mobile force, mainly infantry, on a wide turning movement round our flank through the jungle to come to our line of communication. Here, on a single road, up which all our supplies, ammunition, reinforcements must come, they would establish a 'roadblock' sometimes with a battalion, sometimes with a regiment." ²¹ This routine attack on the only life-line, and relatively high speed route available, would have a distinctly negative impact upon the morale of any soldier.

The requirement to protect the roads in the Pacific Theater of War was entirely different, and nearly nonexistent. Allied forces constructed and operated over thousands of miles of roads,²² but the enemy threat to these roads was relatively little as they were constructed primarily after the defeat of Japanese forces on the islands. Tactical and operational level campaign execution required little attention be turned to securing long GLOCs.

The island campaign in the Pacific was nothing like the North Africa campaigns waged along great lengths of desert where the British concentrated much of their effort against Rommel's GLOCs, and achieved significant success. The British "shot to pieces" 50 per cent of the Panzerarmee's logistic truck columns during Rommel's retreat from Tripoli. ²³ Rommel's experience, along with the aforementioned French experience in

Algeria in 1840, may indicate that successful military operations conducted in desert environments may be conditional to establishing long GLOCs, and requiring specific attention to their security.

The more well-known activities of WWII took place in the European Theater of Operations (ETO). Combat operations on the European continent were characterized by vast land maneuvers, large scale force on force operations, and significant air operations.

GLOCs are not only a major consideration in the ground combat effort, air operations also have an impact. Allied or Axis, no GLOC was safe from air interdiction. The ETO Allied strategic bombing campaign centered around elements of the logistic system, and German lines of communication, which were second and third in Allied bombing priority. German sources of war materiel were the first priority target for strategic bombing.²⁴

Under the protection of the air umbrella, the push across the continent during 1944 resulted in extreme measures to continue to supply the forward forces. The famed Red Ball Express became the best known of a capillary system of a half dozen routes designed to keep the allied forces supplied from the south of France to the north of Berlin. At the greatest length of a nearly 700 mile round trip, the Red Ball delivered 412,000 tons of supplies over an 80 day period between August and November of 1944. The XYZ route, delivering east of the Rhine, hauled 630,000 tons from late March until 8 May, 1945 (V-E Day).²⁵ While these are impressive tonnage figures, the lengths of these routes were excessive and dangerous. Routes, such as the Red Ball, were undertaken as a result of the strategic success of the Allied forces across the ETO. Had

the Axis forces retained the ability to strike deep by ground or air forces, the elongation of the battlefield and inability to sustain those forward forces could have resulted in a disastrous defeat for the Allied effort.

The German distribution and transportation system did not fare nearly as well as the American's system. Faced with even worse road conditions in the snow and ice of their Eastern Front, plus the unceasing Russian attacks on their extended supply lines, the German Grosstransportraum losses of support vehicles reached 25 per cent within 19 days of the start of their campaign into Russia.²⁶ The one-way distance from the German-Soviet demarcation line from Brest-Litovsk to Moscow was 600 miles,²⁷ nearly twice the distance of the Red Ball route. Here one can easily compare the difference in the results of long, difficult to defend GLOCs. While the successful Allied support effort operated over long, but relatively secure GLOCs by late 1944 and into 1945, the failed German support effort operated under more extreme distances, through hostile territory, without an integrated protection plan for maintaining a generally secure distribution and transportation network.

WWII provided conventional, academic conclusions for war on a grand scale. GLOCs for both the Axis and Allied Powers became extremely long on occasion, with sustainment support being tied to them. Mechanized maneuver forces required supplies in large quantities and losses of CSS transport assets could greatly affect the tactical plan. Air interdiction of GLOCs was also a common threat. For the first time in modern warfare, a logistic operation, the Red Ball Express, becomes the story of how support troops continued the fight to save Europe.

KOREA

The Korean Conflict posed an entirely different war from the comparatively linear lines of battle characterizing WWI and WWII. Still, the Korean resupply effort was carried out principally on the ground. The highway transportation function was critical to supporting the maneuver forces. The road network was little better than primitive, distances were long, and turnarounds were lengthy.²⁸ Given the critical impact of the roads upon sustainment of the maneuver forces, and the guerilla techniques of the North Korean forces, convoy self-protection became a very important function. Supply trucks were modified to carry caliber .50 and caliber .30 machine guns.²⁹ These armed cargo trucks were first employed as the convoy trail vehicle to defend against the routine guerilla attack attempts to destroy the rear vehicle.³⁰

Enemy guerilla forces operated almost invisibly amongst the South Korean populace. This nonconventional force took advantage of large areas of contested military dominance to harass United Nations (UN) Forces' convoys and small units, and were a "constant menace to supply lines."³¹ "They could, almost with impunity, block bridges, destroy elements of the infrastructure, drop grenades from bridges on United Nations troops below, toss grenades into passing military vehicles, and so on. All of this caused confusion and delay in the distribution processes."³²

One major action demonstrating the importance of the GLOC involved the 1st Marine Division move to the Chinese border in November 1950 to support the US 10th Corps against the Chinese counterattack. The Marines achieved success during the large scale withdrawal from the Chosin Reservoir largely because of General Smith's slow

advance, and concentration of his attention on the road that he knew was his only likely avenue of escape. He secured the exposed LOC with outposts on the high ground along the route.³³ By first establishing security, he fought a delaying action while securing his escape route, and coordinated the mutual support of both the security teams and withdrawing force.

The nature of the Korean War required rear echelon units to protect themselves because convoy routes were not always through secure areas. Convoys could no longer be considered as rear elements traveling within the relative safety of a battlefield framework of linear characteristics. The nonlinear application of warfare characterized by multiple terrain ownership changes and guerilla tactics put a premium on the need for convoy self-protection

VIETNAM

There were no safe rear areas in Vietnam. The support soldiers were often exposed to the same dangers as the infantry. Roads open during daylight hours often were enemy property at night. Yet, motor transport was the primary means to support more than a million men dispersed over 66,000 square miles of operational territory.³⁴ The problem with this concept was that these same support forces were too institutionally constrained in resources to successfully provide for an internal security mission along with their operational requirements. Additionally, communications capability in service support organizations was minimal.³⁵ Truck companies often operated with an 80 per cent availability of drivers because of security and housekeeping details, leaves, and rest and relaxation (R&R) rotations. This often left them short of

"shotgun drivers" in the cabs.³⁶ The shortage of assistant drivers further reduced the security capability.

Despite these realities in operational shortfalls, truckers often developed habitual direct delivery methods with their front line soldier customers. The 7th Transportation Battalion during Operation Cedar Falls in the Iron Triangle of central South Vietnam, daily hauled 7,000 tons of cargo to the combat forces. Often these deliveries went straight to artillery firing sites.³⁷ The frequent direct delivery of large amounts of ammunition and supplies resulted in convoy movements that were under nearly continuous enemy observation, and combat and communications zone (COMMZ) areas that were distinguished, not by actual terrain dominance, but by wishful map board graphics where the support soldier faced the same danger as the line soldier.³⁸

Motor transport units could do relatively little to protect themselves against enemy action. Convoy commanders and planners continually faced the prospect of how to gain relative security during movement. When the tactical situation allowed for it, commanders requested support from any unit in the area, fire support, air support, infantry, and military police.³⁹ MPs often conducted convoy security using gun jeeps and armored personnel carriers (APCs), or a hardened convoy escort vehicle called the XM-706, an armored car.⁴⁰ Frequent MP escorts remain a routine occurrence in today's program of rear security and in noncombat operations.

Tactical operations in Vietnam often included prepositioned or on-call combat units to support supply operations. Maneuver elements often provided reaction forces in the event of a large ambush within their area of operation. Preplanned artillery fires were

sometimes available to convoys, but the transportation elements proved to be nearly untrained on artillery fire request techniques. Visible air cover of convoys by armed helicopters was an effective deterrent to enemy action.⁴¹ Helicopter cover indicated a proactive plan to counter enemy action and enough immediate firepower to cause the normally lightly supported small enemy units to avoid contact. Division tactical SOPs sometimes provided procedures for providing tactical assistance to support convoys. Generally, the procedure required the senior tactical commander to assume command of the convoy. The convoy would immediately become OPCON to the tactical force. The tactical commander would then assume responsibility for the action and security for the convoy. During after action interviews, convoys commanders stated that this procedure normally was not executed.⁴²

Enemy mines were another major GLOC threat in Vietnam. Reaction to the mine threat required continuous and extensive abatement efforts. Daily clearing of mines from the roads was a routine engineer mission in the forward areas.⁴³ This mission is again, one that persists today. The U.S. improved upon the WWII countermine doctrine, developing specific techniques for surveillance, land clearing, interdiction, and detection. Informants were also an important intelligence source and were used as much as possible. In some high risk areas, paving reduced the opportunity for successfully mining and increased the possibility of detection.⁴⁴

The threat situations that the transporters faced in Vietnam caused the evolution of the armed supply truck of Korea, into the armored gun trucks of Vietnam. Often the transport companies would modify organic jeeps and cargo trucks by adding

antifragmentation kits or locally fabricated armor plating to harden the vehicle, while mounting various gun systems to provide fire power.⁴⁵ Quad caliber .50's and 7.62 millimeter minicannons that delivered 6,000 rounds a minute were two of the more devastating weapons.⁴⁶ In some cases stripped APC hulls were mounted to the cargo decks of five-ton trucks.⁴⁷ The gun truck crew normally consisted of the driver, two gunners and an NCO crew leader.⁴⁸ Gun trucks, often named for purposes of pride and identity (i.e., Eve of Destruction, Ho Chi's Hearse, VC Undertaker) were very successful in providing immediate defense and counter-fire. The immediate action drills for convoy defense and availability of immediate fire to reduce the enemy ambush saved many lives, vehicles, and cargo. These units also demonstrated heroism in defense against ambushes. On two occasions, gun truck crew members were decorated with Medals of Honor in recognition of their bravery and response to enemy action.

An important side-affect of self-protection of support convoys by these measures is the reduction in hauling capacity due to the use of task vehicles for other purposes. From 1967 - 1968, the 8th Transportation Group suffered the equivalent loss of one light transportation company's cargo hauling capability because of conversions to hardened vehicles for convoy security.⁴⁹ A standard ratio developed for a convoy to average one hardened security vehicle to every ten task vehicles.⁵⁰

Combat in Vietnam was characteristically in the nonlinear application of combat forces. The areas of operation were noncontiguous and ownership of routes that comprised the tactical GLOC was often contested. A possible solution to this problem is that GLOCs without relative security must be protected by both ground and air combat

elements, along with an organic capability for convoy defense for those forces operating over it. Support units should be properly equipped and organized for self defense. Equipment authorizations should include crew-served weapons and communications assets. Operations in a territory of disputed control results in deliberate action to secure movement along the GLOC or acceptance of an increased risk for the loss of unprotected convoys. Tactical plans now include procedures for assuming OPCON of support convoys passing through areas of operation, although this procedure was often not executed by the tactical commands. Delivery techniques take support forces closer to the front lines, but with an inherent inability to provide self protection.

GULF WAR/OPERATION DESERT STORM (ODS)

One of the "great lessons of the operational art for Desert Storm . . . is in the extent to which logistics dominates the operational offensive."⁵¹ Despite this declaration, principle transportation characteristics of ODS were the lack of transportation motor truck assets and driver shortages in the theater. Combine with these asset shortages the fact that one-way distances exceeded those of the Red Ball express, and the result is a large shortfall in transport capability. "The primary risks recognized [by the planners] at the outset were the dependence of any attack on extended lines of communication over unimproved roads, the possibility of terrorist attacks in the coalition's rear areas, and the difficulty of judging with any accuracy residual Iraqi capabilities . . ." ⁵²

This sounds like a recipe for disaster. With rail capability limited to only one line

between the port of ad Dammam to Riyadh, a line not strategically advantageous, the lifeline between the strategic ports of reception in the theater and the operational support base for the forward tactical forces was limited to roads. In this case, one east-west road near the Saudi Arabian northern border, which was the tapline road following the trans-Arabian pipeline, one north-south road, the coastal highway that runs from Qatar to Kuwait, and one southwest highway linking the port areas to Riyadh, then turning north to the tapline. All movements toward the Kuwaiti/Iraqi border area from the ports, went one of two ways, the tapline road (334m), or the southern route through Riyadh (528m). Though significantly different in distance, because of the speed of travel, both routes took a similar time for wheeled vehicles to transit.

"Planning was based on the assumption that forces and supplies, both of which depended upon a fixed and fairly predictable rate of arrival in theater, would be prepositioned in tactical assembly areas (TAAs) east of Wadi al Batin by 31 January and that the corps would have two weeks, during the preliminary air campaign, to move into attack positions west of the wadi. These assessments are important precisely because they were fixed."⁵³ The critical components of the assumption were significant because they relied exclusively on the only two highway routes available to deliver combat vehicles and sustainment. When "the pipeline was flowing at full speed, an average of eighteen trucks per minute was crossing through a single point on the northern route."⁵⁴

The Army drivers, augmented by a large number of contract commercial drivers, accumulated almost 52 million miles within the nearly 2,700 miles of designated main supply routes in the theater.⁵⁵ GLOCs were long and had to be followed. Cross-country

movement of wheeled sustainment vehicles through the sandy and broken desert was impossible. The theater logistic support plan required that materiel be shipped from rear area stockage locations to logistic bases that were positioned up at the front lines to support the tactical plan. This meant that all sustainment supplies as well as the VII Corps movement, had one route for movement. Ammunition convoys, fifty trucks long, departed the port of ad Dammam every six hours during the massive logbase stockpiling effort.⁵⁶ The theater movement control command alternately scheduled the logistic movements of the wheeled vehicle and the heavy equipment transporter (HET) movements for the VII Corps to increase route utilization.

Coalition forces defeated Iraq soundly. Possibly the result would have been different had Iraq actually been capable of affecting the Allied plan by destroying the operational timetable for positioning forces and materiel. Not without historical precedent, an army is again waging war in the desert, operating under conditions of extended supporting distances and limited road networks. Allied success was a result of the inability of the enemy forces to interdict the GLOC by air or ground forces, thus allowing freedom of movement. The development and execution of the operational plan was a direct result of the planning of logistics and transportation operations within the capability of the restricted highway structure.

OPERATIONS OTHER THAN WAR

U.S. military has a long history of conducting operations other than war. Military operations since ODS have been purely of an OOTW nature. Though different from the

conventional military perspective of force application to achieve strategic victory, the primary consideration of OOTW deployments is significantly like wartime operations. The ability to maintain freedom of movement along the GLOCs is just as important to successfully conducting humanitarian or peacekeeping responsibilities as it is to conducting purely conventional style military operations.

Before ODS, in the early 1980's, the two primary long term OOTW missions for U.S. military forces were the multinational observer forces in the Sinai Peninsula and in Beirut, Lebanon. In Beirut, ". . . a high degree of freedom of movement -- an essential element for a successful peacekeeping mission -- proved impossible after the October 23 (1982) terrorist attacks on the U.S. and French multinational force elements." ⁵⁷ For the U.S. this unfortunate incident led to an even more tragic ending when over 200 Marines were killed in a terrorist car bombing of their combination living quarters and operational base.

Every OOTW environment has the potential for violent clashes of armed forces. In many situations this may occur between nonprofessional military or partisan forces. No one can escape the news of attempted peacekeeping activities in the former Yugoslavia, which was described by one individual as ". . . filled with ambushes, raids, and sniper activities reminiscent of the Vietnam environment." ⁵⁸

The highways are an obvious focus of attention and strife in an OOTW environment. They are the only (maybe tenuous) means of contact to food, medicine, and even safety. Serbian women and children were known to block food convoys enroute to "enemy" forces and create havoc, chanting that they were themselves starving

and would not let the supplies through to feed the enemy.⁵⁹ Once again, freedom of movement for the peacekeeping forces in the former Yugoslavia was denied through a combined program of fires, mines, civilian interdiction, and a lack of local authority to impose good order and discipline.⁶⁰

One of the biggest threats to freedom of movement along the GLOC is by nuisance mining. Nuisance mining is nonsystematic, terroristic use of explosive devices planted periodically along routes for the purpose of causing death and destruction without direct contact between forces. The purpose is to generally erode confidence and cause fear. This technique was used extensively in Somalia during Operation Restore Hope (ORH). Primary tasks for the UN and US soldiers in Somalia consisted of force protection measures, maintaining the lines of communications to support humanitarian assistance, and to redeploy the force.

ORH was the American response in December, 1992, and the subsequent support to the United Nations (UN) operations in the North African country of Somalia. The U.S. Army mission in support of the Joint Task Force, was to conduct peacekeeping and peace enforcement operations to provide security for the starvation relief efforts of the private volunteer organizations (PVO) and the nongovernmental organizations (NGO). The nexus of these actions was the road network.

Military engineers constructed or improved 2,000 kilometers (over ,1300 miles) of roads to support the relief effort in Somalia. Two hundred and forty-five miles were hard surface, two lane road, 540 miles were unimproved two lane, and the rest were one lane, dirt roads.⁶¹ The highway mode operating organization, the 7th Transportation

Group, traveled nearly 250,000 miles on this road network from 3 January to 8 March 1993. Security for the convoys and their humanitarian supplies was a constant requirement.

The violence directed against the UN (including U.S.) forces by the warring Somalia factions caused the U.S. forces to restrict movement along the MSRs to daylight hours only.⁶² This is reminiscent of similar restrictions during Vietnam. Movement was further restricted to minimum three-vehicle convoys. A minimum of two vehicles had to be mounted with crew-served weapons for protection, with pepper spray available on all vehicles. The force protection measures for convoy movement included techniques and procedures for specific preconvoy checks, actions against unruly crowds during convoys, and post convoy debriefs.⁶³

Convoy security and escort duty was a shared effort between the MPs and the infantry. An MP quick reaction force (QRF) of one platoon was also always on standby to be airlifted to the ambush site if the enemy strength was too great for the convoy self-defense capability. The Army provost marshal (PMO) maintained control of the QRF. An adequate communication capability was the key to successful response.⁶⁴ The infantry secured a second road, a Mogadishu bypass route, by establishing squad and platoon size strong points along hilltops astride the GLOC. These strongpoints were supported by helicopter runs for air support.⁶⁵ Like in Vietnam, air support was an effective deterrent to enemy interdiction attempts.

The five mile, 25 minute route from the seaport through Mogadishu was a particularly troublesome area for the supply convoys since it was "rife with potential

chokepoints." ⁶⁶ It was common for the 7th Transportation Group to operate two to three convoys daily from the port and at least one would normally report some sort of threat action against it. The action may have only been rock throwing, but drive-by shootings and sniper fire were frequent. A grave concern was that these convoys usually had no organic communications capability to use if they required assistance. During one tactical convoy escorted by Marines in LAVs, it was obvious that the natives did not want to fool with the ominous-looking vehicles. They had become quite used to HMMWVs (High Mobility Multipurpose Wheeled Vehicle) however, and were not deterred at the sight of them.⁶⁷

During the month prior to the redeployment of U.S. forces, the Joint Task Force (JTF) instituted even tougher security requirements. Shipments were limited to one morning and one afternoon convoy. Armored personnel carriers were included as convoy escorts under predetermined guidance. One each would be at the lead and trail of the convoy, with additional APCs based on a ratio of approximately eight task vehicles to one APC.

The characteristic use of wheeled vehicles throughout Somalia offered a high susceptibility to interdiction of mines. Mining of the roads was the primary cause of U.S. casualties in Somalia, accounting for 26 per cent of American casualties.⁶⁸ The ratio of mine related casualties to overall casualties would have been much higher except for the large number of US casualties taken during the raid against Gen Aideed's forces.

The mine threat required a daily program of route clearance. Unfortunately, a deliberate manual sweep was effective at a rate of only 1/2 mile per hour, also, there is

no standard vehicle available for "proofing" the road after a mine detection sweep. Deployed forces sometimes improvised by constructing rollers for this purpose. To protect against mine blast effects, most cargo trucks carried 4-5 tons of sandbags for personal protection. Many of the lighter HMMWVs were overloaded by sandbags, resulting in deterioration in the suspension system, and ultimately, reductions in payload and operational rates.⁶⁹

The Somalia mine threat generated renewed visibility over the countermine techniques and procedures employed during the Vietnam war. Paving some of the most travelled roads was somewhat prohibitive, so attention was focused more on other passive defensive measures and crew survivability. One technique used in Somalia was to replace the normally column-leading HMMWV with a cargo truck, with the "gunjeep" HMMWV becoming the second vehicle. U.S. forces found the HMMWV to be too light to be effective in dispersing the crowds in the streets. Other crew survivability techniques and procedures included hardening of vehicles, use of seat belts (not always used in tactical situations), reducing speeds to 25 miles per hour or less, and filling vehicle tires with 25 gallons of water to reduce the mine blast effect.⁷⁰

Vehicle protection kits received a rebirth into the Army inventory. HMMWV and cargo truck (5 ton) retrofit kits came under heavy demand from the deployed command. The cargo truck kits provided good protection against direct mine blasts. The kits consisted of wheel deflectors, debris screens, ballistic windshields, door armor, and floor plates. HMMWV kits provided a fair level of protection, which would at least reduce the severity of casualties, but the vehicle itself has a poor design for protection against mine

blast.⁷¹

The ability to secure the lines of communication and ensure the continued flow of supplies in order to support the humanitarian relief effort in Somalia was one of only two driving forces for U.S. participation in Sub-Saharan Africa. The other became the political motivation to maintain peace between the warring factions, but this too had an effect on the ability to secure the GLOC. The critical task of the entire deployment effort for ORH was essentially the ability to assist the relief agencies in operating a distribution and transportation infrastructure to feed the starving people. The key was maintaining freedom of maneuver.

The results of what military forces witnessed during these OOTW operations was not significantly different than wartime experiences. During direct military conflict, wartime threats to the GLOCs were more direct and specific. The threat was reasonably well defined and possibly even predictable by the intelligence community. The threat to GLOCs during OOTW deployments was much less defined, even though the focus of operations by both the force providing the aid, and on the part of the native personnel was on the ability to control the roads. Freedom of movement remained the primary concern. Convoy security techniques and survivability measures were fundamental issues to defend against an enemy threat characteristic of small unit guerilla tactics, sniping and interdiction measures, and nuisance mining.

CHAPTER 3. Doctrine

Army Field Manual (FM) 100-5, entitled Operations, is the Army's foundation warfighting doctrine. FM 100-5 establishes the fundamental precepts that are subsequently addressed and explained in supporting doctrinal works. In order for a concept to gain institutional credibility, it must first have reference in the keystone doctrine. The importance of tactical/operational lines of communication is addressed on twelve different pages, and six different chapters of FM 100-5. The foundation is solid.

"Strategic concentration and operational maneuver and the exploitation of operational or tactical success often hinges on the adequacy of logistics and the ability of the force to safeguard its critical LOCs, materiel, and infrastructure." ⁷² This statement from FM 100-5 clearly establishes the precedent for developing supporting doctrine for planning the security of GLOCs and protection of transiting forces. The subject receives further weight in the explanation of the tenets of Army operations.

U.S. Army operations have five basic tenets: initiative, agility, depth, synchronization, and versatility. One critical component to the tenet of depth is to determine how long GLOCs need to be to support extended operations.⁷³ Interdiction of LOCs has been a long standing part of threat doctrine. Soviet and Warsaw Pact forces depend on highly mobile armored operations to create breaks through allied forces and exploit support forces in the rear. "A campaign or major operation should never depend on a single LOC. Moreover, where austere logistics resources limit multiple LOCs,

security for air and ground LOCs is particularly important. Protecting LOCs at minimum cost to committed combat units includes using geographic features, friendly civil security forces, and uncommitted combat units." ⁷⁴ Fighting forces are not self-contained entities. They require significant resources and replacements to maintain combat power.

"Because divisions depend on CS [combat service] and CSS [combat service support] units for their mobility, protection of these units is itself a paramount combat task." ⁷⁵

FM 100-5 credits the possible impact in reaching a culmination point that lines of communication may have on tactical forces in contact. The point of culmination is the point in time and space when a fighting force can no longer maintain the ability to continue to fight to success in battle. The importance is that to protect the GLOC, the tactical commander must divert forces from direct combat with the enemy, and use them for security of the GLOC. The French emperor Napoleon was able to use the vulnerability of his enemy's GLOCs to his considerable advantage. He "sought to strike at the lines of communications of his enemy, while keeping his own heavily protected." ⁷⁶ U.S. Army battle doctrine indicates that it is possible for logistical lines to be long and vulnerable. "Rear areas would be subjected as never before to attack and disruption by subversive and terrorist actions and by airmobile, amphibious, and airborne forces, as well as by long range fires." ⁷⁷

This acknowledged threat clearly illustrates the need for an integrated, effective program of tactical response to protect the rear areas and lines of communication. The U.S. Army developed a rear area protection doctrine and in it, separated activities and responsibilities at the theater, corps, and divisional levels. The following is a brief

summary of pertinent material.

THEATER OPERATIONS

Theater structure is a vital consideration to determining LOC requirements. The combat zone (CZ) may be connected to the communications zone (COMMZ) only by thin lines.⁷⁸ The length of the zone at the forward edge of the battle during WWI was 455 miles across Central Europe, during WWII the front was 570 miles in the Eastern Theater of Operations.⁷⁹ Vietnam had no distinctive front line, but had over 900 miles of land borders to secure. In Korea, with just over a 123 mile front, the engineers maintained 2,700 miles of roads for military use, exclusive of the forward unit areas.⁸⁰

The transportation plan designed to support a theater force structure is a product of the materiel manager's distribution program for how supplies should flow, and the geographic setting within the theater. "If the transportation system will support or can be developed in time to support, the forces necessary to carry out the operational plan, the rest of the logistics can usually be brought into line . . ." ⁸¹ Establishing the mechanics for how a transportation program should work is a function of designing an efficient program based upon pick-up and delivery locations and requirements. Military forces rarely have the luxury of organizing a structure on a mature logistic system, or one that even has sufficient transportation assets. The important aspect is to preserve the constrained transportation resources and plan for efficient, continuous use.

LOCs are obvious targets for disrupting the movement of sustainment supplies

and destruction of support resources. Commanders must consider the impact of extended LOCs and requirements for establishing temporary lines in support of combat operations.⁸² A typical battlefield framework for planning tactical operations consists of the close, deep, and rear battle areas. The area of the rear battle includes the service support forces that provide the logistic base in support of the forward combat elements. Rear battle directives include providing unimpeded movement within and from the rear areas. The planner must include not only the terrain and forces in the rear when planning security operations, but also the GLOCs upon which the supplies and forces must move to the front. Assets available to support security operations in the rear area typically include the military police (MP) and a small element of combat forces.⁸³

Theater level doctrine also identifies LOCs as targets but does not specifically address procedures to counter threats to the GLOC. The doctrine provides guidance to plan for dispersion, distribution, and protection, with sound planning as the key to a systematic approach to protecting the rear forces. It calls for a minimum use of combat forces to preserve combat strength, and no degradation of the CSS mission. The two concepts are not mutually supporting.

FM 63-4, Combat Service Support Operations-Theater Army Area Command, further states that the rear forces should have on-call forces capable of responding to a tactical threat, an early warning system with an adequate command and control structure for employing the tactical force, and a graduated response system to minimize combat service support degradation. The graduated response system is rear area protection (RAP) doctrine. There are three levels of response to threat activities in the rear area.

Level I threats are those that should be defeated by organic support unit security and defense measures. Level II threats involve mobilizing a response force. MPs may likely perform the function of a response force. Level III responses include employment of a tactical combat force (TCF), which is a designated maneuver force element.⁸⁴

The Army Operational Support manual gives more attention to the GLOC with specific guidance: US Army doctrine states that it is the Army Service Component Commander (ASCC) that arranges and coordinates operations of the GLOC. The commander's CSS planning cell will identify methods and procedures required to meet the needs of air, sea, and land LOCs.⁸⁵ It does not continue to provide guidance on how to do this.

Furthermore, operational logistics focuses on establishing and maintaining LOCs and sustaining the operating forces.⁸⁶ "One of the ASCCs most important responsibilities is to conserve the fighting potential of his force. . . ." ⁸⁷ The commander must develop an integrated security plan that includes all force capabilities. He must establish an intelligence program that provides the information he needs to determine the proper threat level.⁸⁸

CORPS OPERATIONS

The U.S. Army corps operations doctrine does not address the GLOC security issue except to say that the logistic link must be able to support the reassigning of divisions between corps.⁸⁹ This guidance deals more with the sufficiency of the support structure and less with actual GLOC security. Corps operations does identify in the

Battlefield Operating System (BOS) for mobility, countermobility, and survivability (M/C/S), that the engineers have the responsibility to keep the GLOC open.

Additionally, the rear area commander controls the employment of the TCF against large-scale threats that organic forces cannot repel. The TCF is a combat element held in the rear for protection against large scale threat action. The TCF represents the next level of tactical forces available to respond to rear area threats, beyond MP protection and organic unit level security.

DIVISION OPERATIONS

"Failure to anticipate needs properly and to provide security for LOCs . . . undermines the success of combat operations." ⁹⁰ Division level support doctrine identifies that logistic traffic is an enemy high priority interdiction target. Assigning escorts to protect convoys may be done by using MPs, engineers, or tactical forces. Air support and air defense may also be important based upon the threat. Positioning of protective forces should be accomplished if escorting is not possible. ⁹¹

MILITARY POLICE OPERATIONS

MP assets are critical to rear area operations and deserve specific mention. MP guidance states that GLOC protection extends from the rear to the forward locations and is a shared responsibility. It would, indeed, take significant MP forces to secure routes through hostile territory. Some combat forces would be needed to secure any LOCs that may transit unoccupied or unprotected areas. MP responsibilities in the rear battle

include the battlefield circulation and control (BCC) mission. The foundation of this mission is that MSR travel is dangerous and requires a systematic plan for protection. The BCC mission includes reconnoitering and monitoring routes, maintaining a tactical awareness and rerouting forces to alternate MSRs, if they are less dangerous, and maintaining small formation integrity.⁹² The MP structure for the battlefield includes only one MP company per theater level transportation command. Most of these assets are employed along LOCs within areas of high troop concentrations. The MPs also have additional missions to provide security support for the protection of special and conventional ammunition,⁹³ and for the control of prisoners of war and displaced civilians. The Military Police forces are overwhelmed with missions and clearly require a prioritized mission list for efficient allocation of effort.

CHAPTER 4. Force XXI Implications

The U. S. Army represented in its Force XXI vision is one with a functional and operational redesign of forces and doctrine. The nexus for the change is in electronic leveraging of the battlefield; digitization, enhanced command and control systems, and information warfare. The actual impact on the force and doctrine, though still under development by the Army's generals and high level think tanks, most assuredly will change the way we do business at the tactical level.

"The relationship between fire and maneuver may undergo a transformation as armies with high technology place increasing emphasis on simultaneous strikes throughout the battle space, maneuver forces may be physically massed for shorter periods of time." ⁹⁴ This is the context for operations in the U.S. Army Force XXI battlefield. The conditions for conducting warfare on this future battlefield may have a direct impact on the way support forces operate, and combat forces receive supplies. It may mean greater attention to maintaining a higher level of protection for maintaining GLOC security in order for the support system to be responsive enough to maintain a continuous supply to highly mobile tactical operations.

Logistic support is no longer just a rear area activity. Support units will position materiel for the sustainment of forward tactical forces as far forward as possible in supply and distribution points, based upon the tactical scenario. This concept of contemporary logistics operations was also the intent of the senior logistical commander

for conducting support and sustainment operations during ODS. The principle characteristic of the forward positioning of logistics forces and capability in Saudi Arabia was the establishment of logistics bases in forward areas in the vicinity of tapline road. In particular, during the 1st Corps Support Command's (COSCOM) establishment of Logbase Charlie, northwest of Hafar al Batin, it was forward of the main ground attack forces. This is a "new, forward thinking logistic philosophy"⁹⁵ that will carry us into the next century. Planners and operators should both be aware of its impact.

Digitization technologies applied to the battlefield provide a revolution in tactical level command and control that set conditions for improved coordination and communication between combat and combat service support forces. The intent of digitization is to link all levels and types of forces, maneuver and logistic, to provide a common picture of situational awareness. This provides the maneuver commander a better opportunity to see not only his assault forces, but also the locations and movements of the support forces. The result is a quicker and more direct information flow, less disturbed by the fog of war. Digital technologies provide a common picture that should reduce the decision cycle time to synchronize support movements with the tactical situation and improve support responsiveness.

The Force XXI concept thus offers significant operating efficiencies from a purely logistical standpoint. The ability to "pull" desired logistical data based on the commander's friendly force information requirements (FFIR), and automate associated logistic monitoring and accounting files, substantially reduces logistic staff work and manual production of reporting data. With effective construction of automated systems

reporting, support units can have the right stuff available to the right unit at the right time, at the expense of very little staff energy.

The problem that Force XXI presents to the support soldier is primarily the ability to maintain a viable delivery system to forward units. The effects of digitization and "recent military-technological developments point toward an increase in the depth, breadth, and height of the battlefield." ⁹⁶ These systems also provide a near real-time information flow that allows support forces to respond quicker, even under expanded support distances. What they don't provide is a secure route for delivery. Instead, they substantially increase the danger to support forces by the elongation of the battlefield and separation of the combat forces from the support forces.

Force XXI maneuver characteristics decry the use of institutionally understood decision support graphics. Contiguous areas of responsibility, and distinct supporting MSR's will disappear. Impermanent, dashed lines of communication will replace the fixed GLOCs that had once been relatively secure through tactical unit ownership. Maneuver will be through domination of battle space in temporary locations and for temporary purposes only. This is a new look for land warfare.

In maritime operations, the U.S. Navy dominates the battle space within which the fleet operates. Obviously, the open ocean is too vast an expanse to try and do much more than that. What sets the conditions to enable the Navy to execute this style of warfare are significant capabilities to "see" surface, subsurface, and air threats at distances that allow them to take preventive measures in time to protect themselves from attack. The Army does not work on the same "tabletop" surface as the Navy, or have

systems that allow the ground troops, and certainly not support troops, to acquire threat forces with the same degree of accuracy or distance. Yet, ground forces will continue to need daily provisioning over secure GLOCs. To prosecute warfare the Navy way, the Army will need to develop some enablers to link maneuver with support.

"Survival technologies that assist and protect U.S. forces conducting operations, especially in constrained environments such as jungle and urban areas and in operations other than war situations, will greatly increase the effectiveness of U.S. armed forces." ⁹⁷

The enhanced situational awareness provided by sensors, robotics, and unmanned aerial vehicles certainly increases the opportunity for increased protection measures. The impact of these technologies on a convoy of cargo trucks and HMMWVs is nonexistent. Support convoys are not equipped with the sophisticated command and control systems that provide situational awareness, or to acquire enemy forces. They depend on intelligent convoy planning based on the current threat and movement requirements. In case of attack, any support beyond their organic weapons must come from tactical units.

Military operations under a digitized, possibly noncontiguous battlefield, without clearly defined areas of responsibility, create a cognitive dissonance for support forces. The ability to link ground forces with internetted systems, and provide all leaders with a horizontally linked picture of common information, may provide the means to visualize how they will execute combat operations in a synchronized manner, but does not provide protection to a support element that is on the road trying to deliver goods to a forward unit. Only direct or indirect fire systems, close enough for effective support, can provide what a lightly armed sustainment convoy needs against interdiction threats.

CHAPTER 5. Conclusions

Conclusions for this paper identify what doctrine states, what history shows, what is lacking between the two, and recommendations on what to fix to bring the doctrinal base and historical knowledge in line in an attempt to provide appropriate planning guidance for the operation and security of ground lines of communication during military operations.

Logistics is combat power. Planners and operators must ensure that our operational forces are successfully guaranteed freedom of operation through providing a basis of ensured logistical support just as we would ensured communications or fire support. This paper concludes that security of the GLOC is critical to force protection and continuous sustainment of the combat forces.

DOCTRINE

The theoretical and doctrinal underpinnings for the requirement to maintain security over GLOCs is solid. From the greatest military theorists to the U. S. Army's fundamental warfighting doctrinal manual, FM 100-5, the importance of the GLOC to conducting successful military operations is clear. The importance of a secure GLOC to achieving tactical success loses emphasis in supporting doctrine.

U. S. Army theater level operational guidance in FM 63-4 primarily covers

organization of the area of operation, theater level commands, and support requirements. Key elements indicate the GLOCs to be obvious targets, and may be of considerable length. Rear area protection organization and responsibility is covered, but it does not address additional measures on how to conduct GLOC defense.

Corps doctrine (FM 63-3) identifies measures for supporting offensive and defensive operations but provides no definitive guidance on how support commands can operate over protected GLOCs or how combat commands can provide tactical support to do the same. Division doctrine provides no mention of security of the GLOC.

FM 55-30, Army Motor Transport Units and Operations, provides instructions on how to conduct convoy defense. These techniques, and instruction provided at the Army Transportation School, are effective against direct fire contact. This observation comes from transportation officers who had to deal with convoy defense in Somalia, the only time since Vietnam, which is the time frame from which most of the current doctrine is based.⁹⁸

Much of the U.S. Army countermine and survivability doctrine is also based on the Vietnam experience. Route clearance measures devised 30 years ago were validated during ORH. Doctrine on conducting hasty sweeps, deliberate sweeps, and mine reconnaissance in FM 20-32, Mine/Countermine Operations remains current. Survivability doctrine is not sufficient and only identifies the use of asphalt armor panels for passenger protection on cargo trucks.⁹⁹

HISTORY

"For the most part, (U.S.) Army schools and the War Department General Staff in peacetime planned, trained for, and studied combat operations. To a great extent the Army neglected the logistics problems of operations. This was a deficiency that proved to be costly." ¹⁰⁰ This after action comment from the the Army Service Forces about U.S. Army activities preceding WWII provides a lesson on the importance of mutual study of a systemic view of logistics and tactics. In the linear context of WWII, the impact of long GLOCs, vulnerable to air and ground interdiction, required a massive effort to maintain. The operation drained support assets from the overall combat effort.

The more nonlinear warfare experienced in Korea and Vietnam shaded the academic lessons from WWII. The need for convoy self-protection became a major element for sustainment operations and transporters developed a very effective guntruck for that purpose. To develop an integrated security program, convoy self defense must be combined with the support of both air and ground combat elements. Tactical plans should include responsibilities for response of maneuver elements to counterattack against strong enemy actions.

The operational timetable for conducting combat operations in the desert for ODS was constructed around the ability to move forces and sustainment along the limited road network. The entire campaign could have been completely upset had the Iraqi forces been able to successfully interdict the GLOC.

The same active and passive threats to the GLOC are inherent in OOTW deployments. Convoys in Somalia were just as vulnerable to ambush and mines as if the

forces were at war. Logistical convoys cannot leave their security concerns to the MPs, or to the chance of gaining additional tactical firepower support.¹⁰¹ The units who conducted convoys in Somalia again developed their own hardened vehicles and instituted self-protection measures reminiscent of Vietnam. They used sandbags and hardening procedures to reduce damage and injury in case of mine strikes.

MP support was a necessity. Some MP assets were focused on route security but the MPs were task saturated and were never able to respond to a request for convoy escort by the division transportation officer of the 10th Infantry Division.¹⁰²

DEFICIENCIES

Two significant shortfalls exist between what history illustrates and what is addressed in contemporary U.S. Army doctrine. First, patterns of behavior and experience indicate the need to evaluate and refine countermine doctrine, and the need to field a mine-protected vehicle that can withstand mine detonations with the ability to offer crew protection. The vehicle should further be able to continue to be operated until brought under cover or out of the kill zone.¹⁰³ A gun truck variant should also be available for appropriate MP and support forces.

The use of retrofit kits instead of an inherent vehicle redesign is a secondary consideration that may provide the optimum solution. This course of action would have its own opportunity costs in mounting and demounting logistics aspects. The use of removable armored side panels similar to those used on the M-2 Infantry Fighting Vehicle is another possible solution.

The U.S. Army removed armor kits for jeeps and cargo vehicles from the inventory after the Vietnam War. During ORH, the Ft Belvoir Research, Development and Engineering Center placed great effort into procuring modern hardening systems to prevent casualties to the soldiers conducting operations in Somalia, and improve countermine and survivability doctrine. ¹⁰⁴

The second U.S. Army doctrinal shortfall in GLOC security is the disregard in providing guidance on how to develop an integrated tactical concept of operations. An integrated plan should include maneuver force actions and responsibilities and command and control structures to produce unity of effort in safeguarding sustainment operations conducted over the GLOC in support of tactical forces.

RECOMMENDATIONS

This monograph study recommends changes or improvements in the following areas: countermine and survivability doctrine, and the tactical concept of operations required to maintain unity of effort over GLOC security. The primary element is tactical planning. Tactical planning guidance should include techniques for developing an integrated plan for providing tactical support to sustainment convoys operating from the COMMZ into the CZ.

Two general applications for tactical support are available if the risk to the sustainment effort is significant enough to use tactical forces to secure the GLOC and protect convoys. One technique is to build the convoy organization with tactical forces organic to it. The alternative is to coordinate for support based on area coverage. The

important point for either option is to enable the support force to maintain continuity of support with forward elements.

U.S. forces in Somalia joined tactical forces with sustainment/relief convoys for the specific purpose of convoy security. This may become a prominent technique in OOTW operations where combat forces have no direct role against an armed enemy force, and the focus is on security of routes and conducting humanitarian missions. Support forces play a large role in these types of operations but would operate at considerable risk in threat situations without tactical forces available to provide a credible armed force to deter direct action.

Force XXI operations also would seem to require coordinated and simultaneous effort of support and tactical forces. Conducting operations by dominating battle space between noncontiguous objective areas implies that the terrain between them is not owned by friendly forces and is thereby not clear of enemy forces. This translates to unacceptable risk to support forces and the need for an integrated tactical and sustainment organization capable of countering a tactical threat while conducting sustainment operations. Such an integrated organization provides the unity of command necessary for conducting successful operations.

Security operations executed on an area basis allows for the institutional separation of tactical and support command structures. It does not provide a clear unity of effort and requires response and tactical contingency plans on the part of any organization which may have responsibility of transitted areas. The more units involved, the more complicated the process.

Doctrine changes must integrate tactical and support operations that provide the support forces sufficient survivability to operate during future conflicts. Force XXI operations and OOTW requirements indicate that land forces place new emphasis on maintaining a secure GLOC. The US Army doctrine clearly indicates the Army Service Component Commander has responsibility for security operations in the rear, including the GLOC. This responsibility must be accompanied with the techniques and considerations identified in these conclusions.

Convoy self-protection measures and countermine operations are the next fundamental elements. The convoy defense measures presented in FM 55-30, and taught in the US Army Transportation School are effective. What is absent is sufficient firepower to allow transportation elements to be somewhat self-sufficient in protecting convoys. The U.S. Army currently has no vehicle (or any intent to field one) designed to withstand mine strikes, no armor modification kits in the inventory system to provide additional protection to support vehicles, and no hardened guntruck program available to produce survivable, hardened weapons platforms. Integrated employment of support and tactical forces along with the means for crew and convoy survivability through vehicle hardening and providing immediate and effective counterfire will contribute significantly to force protection for support forces in the future battle and during OOTW deployments.

ENDNOTES

1. Carl von Clausewitz, On War, ed. and trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1973), 524.
2. Ibid., p. 487.
3. Antoine Jomini, "The Art of War" in Roots of Strategy. Book 2, (Harrisburg: Stackpole Books, 1987), p. 530.
4. Ibid., p. 445.
5. U.S. Army, Field Manual 100-5, Operations, (Washington: Department of the Army, 1993), p. 12-15.
6. Mao Tsetung, Selected Military Writings (Peking: Foreign Language Press, 1972), p. 212.
7. Mikhail Tukhachevskii, "New Problems in Warfare," SAMS Reprint, p. 48.
8. John L. Romjue, "From Active Defense to AirLand Battle," (Ft Monroe VA: TRADOC Historical Office, 1984), p. 69.
9. FM 100-5, p. 2-20.
10. Martin Van Creveld, Supplying War (London: Cambridge University Press, 1977), p. 28.
11. Douglas Porch, "Bugeaud, Gallieni, Lyautey: The Development of French Colonial Warfare" in Makers of Modern Strategy, ed. Peter Paret, (Princeton: Princeton University Press, 1986), p. 377.
12. T. E. Lawrence, "The Evolution of a Revolt," Combat Studies Institute, Fort Leavenworth KS. Reprint from Army Quarterly, (Oct 1920): p. 1.
13. Russel F. Weigley, "American Strategy from its Beginnings through the First World War" in Makers of Modern Strategy, ed. Peter Paret, (Princeton: Princeton University Press, 1986), p. 410.
14. Richard E. Beringer, Herman Hattaway, Archer Jones, and William W. Still, Jr., Why the South Lost the Civil War (Athens: University of Georgia Press, 1986), p. 243.
15. Ibid., p. 241,242.
16. Ibid., p. 246-249.
17. Murray Harris, Lifelines of Victory (New York: G.P. Putnam's Sons, 1942), p. 10.

18. Eliot A. Cohen and John Gooch, Military Misfortunes (New York: The Free Press, 1990), p. 59-63.
19. Julian Thompson, The Lifeblood of War (London: Brassey's, 1991), p. 76,77.
20. Joseph Bykofsky and Harold Larson, The US Army in World War II, The Technical Services, The Transportation Corps: Operations Overseas (Washington DC: Office of the Chief of Military History, 1957), p. 584.
21. William Slim, Defeat into Victory (London: Cassell and Compant LTD), p. 119.
22. Jerome G. Peppers, A History of U.S. Military Logistics 1935-1985 (Huntsville AL: Logistics Education Foundation Publishing, 1988), p. 97,98.
23. Van Creveld, p. 190. Van Creveld provides original references to captured German documents.
24. James Gibson, The Perfect War. Technowar in Vietnam (Boston: The Atlantic Monthly Press, 1986), p. 341.
25. Richard C. Biggs, Eric R. Criner, and Benjamin King, Spearhead of Logistics. A History of the US Army Transportation Corps (Ft Eustis VA: US Army Transportation Center, 1994), p. 30,31,238.
26. Van Creveld, p. 155.
27. Ibid., p. 182.
28. John G. Westover, Combat Support in Korea (Washington DC: Combat Forces Press, 1955), p. 47.
29. Ibid., p. 55.
30. Ibid., p. 237,238.
31. Jay Allen Cassino, Pictorial History of the Korean War (New York: WM. H. Wise and Co, Inc, 1951), p. 277.
32. Peppers, p. 176.
33. Thompson, p. 122.
34. Gerald L. Peterson, "Final Report, Vehicle Convoy Operations in the Republic of Vietnam." Army Concept Team in Vietnam, APO San Francisco 96384, 30 September, 1971, p. I-3.

35. Joseph M. Heiser, Logistic Support (Washington: US Government Printing Office, 1974), p. 34.
36. Peterson, p. II-34.
37. Biggs, p. 355.
38. Heiser, Logistic Support, p. 37.
39. Ibid., p. 35,36.
40. Peterson, p. II-12.
41. Ibid., p. II-24.
42. Ibid., p. II-32.
43. Ibid., p. II-3,7,8.
44. Ibid., p. II-80.
45. Ibid., p. II-21 - II-23.
46. Ballard, Larry A, "Guntrucks of Ambush Alley," Army Logistician (July-August 1986): p. 31.
47. Joseph M. Heiser, A Soldier Supporting Soldiers (Washington: Center of Military History, 1991), p. 195.
48. Biggs, p. 357.
49. Heiser, Logistic Support, p. 162.
50. Ballard, p. 29.
51. Richard M. Swain, Lucky War. Third Army in Desert Storm (Fort Leavenworth, KS: US Army Command and General Staff College Press, 1994), p. 332.
52. Ibid., p. 79.
53. Ibid., p. 105.
54. William G Pagonis, Moving Mountains (Boston: Harvard Business School Press, 1992), p. 146.
55. Ibid., p. 1,9.
56. Biggs, p. 435.

57. David A. Mosinski, "U.N. Peacekeeping in Yugoslavia," (MMAS Thesis, U.S. Army Command and General Staff College, 1993). p. 32.
58. Mosinski, p. 29.
59. Ibid., p.18.
60. Ibid., p. 87,88.
61. Operation Restore Hope Lessons Learned Report, 3 December, 1992 - 4 May, 1993, (Fort Leavenworth KS: Center for Army Lessons Learned). p. V-1,V-9.
62. William C. Schneck, "After Action Report, Operation Restore Hope," (Fort Belvoir VA: US Army Aviation and Troop Command, 1994). p. 1.
63. US Army Operations in Support of UNOSOM II, 4 May, 1993 - 31 March, 1994, (Fort Leavenworth KS: Center for Army Lessons Learned). p. I-8-1.
64. Operation Restore Hope Lessons Learned Report, p. III-8.
65. Schneck, p. 5.
66. Operation Restore Hope Lessons Learned Report, p. V-1.
67. Brian Waters, interview by author, electronic mail, Fort Leavenworth, KS, 12 October, 1995. Major Waters was the operations officer for the 6th Transportation Battalion, 7th Transportation Group during the initial deployment of forces in December, 1991. His duties included port clearance operations from the Mogadishu seaport.
68. Schneck, p. 23.
69. Ibid., p. 13,18,24.
70. Ibid., p. 7.
71. Ibid., p. 11,27.
72. US Army, FM 100-5, Operations (Washington: Department of the Army, 1993), p. 12-3.
73. Ibid., p. 2-14.
74. Ibid., p. 12-15.
75. Edwin J. Arnold and L. D. Holder, "Moving the Heavy Division," Military Review (July, 1988): p. 41.

76. James J. Schneider, "The Theory of Operational Art," Theoretical Paper Number 3. (Ft Leavenworth: School of Advanced Military Studies, 1988): p. 8.
77. Romjue, p. 67.
78. FM 100-5, p. 4-7.
79. Gibson, p. 101.
80. James A. Huston, Guns and Butter, Powder and Rice (Cranbury NJ: Associate University Presses, 1989), p. 254.
81. Carter B. Magruder, Recurring Logistic Problems As I Have Observed Them (Washington: Center of Military History, 1991), p. 42.
82. FM 100-5, p. 7-23.
83. US Army, FM 90-14, Rear Battle (Washington: Department of the Army, 1985), p. 2-2.
84. US Army, FM 100-16, Army Operational Support (Washington: Department of the Army, 1995), p. 15-0.
85. Ibid., p. 3-2.
86. Ibid., p. 3-7.
87. Ibid., p. 1-6.
88. See FM 100-16, Chapter 15 for a thorough presentation of this material.
89. US Army, FM 100-15, Corps Operations (Washington: Department of the Army, 1989), p. 1-1.
90. FM 100-5, p. 12-2.
91. US Army, FM 63-2, Division Support Command (Washington: Department of the Army, 1991), p. A-3.
92. US Army, FM 19-1, MP Support for the AirLand Battle (Washington: Department of the Army, 1988), p. 3-1.
93. Ibid., p. 7-4.
94. US Army, TRADOC Pamphlet 525-5, Force XXI Operations (Ft Monroe VA: US Army Training and Doctrine Command, 1994), p. 2-9.

95. James Ireland, "The Log-Base Concept," Army Logistician (Jan-Feb, 1994), p. 5.
96. TRADOC Pamphlet 525-5, p. 2-9.
97. Ibid., p. 3-23.
98. Waters, E-mail to author, 12 October, 1995.
99. US Army, FM 5-103, Survivability (Washington: Department of the Army, 1985), p. 4-41.
100. Jane S. Allen and David C. Rutenberg, eds., The Logistics of Waging War (Gunter AFS: Air Force Logistics Management Center, 1987), p. 80.
101. US Army, USATCFE Pamphlet, Vehicle Hardening and Convoy Operations (Ft Eustis VA: US Army Transportation Center, 1994), p. 13.
102. Timothy McNulty, interview by author, Fort Leavenworth, KS, 13 November, 1995. Major McNulty was the Division Transportation Officer (DTO) for the 10th Infantry Division in Somalia.
103. Schneck, p. 33.
104. Ibid., p. i.

BIBLIOGRAPHY

Allen, Jane S., and Rutenberg, David C. eds. The Logistics of Waging War. Gunter AFS, AL: Air Force Logistics Management Center, 1987.

Arnold, Edwin J., and Holder L.D. "Moving the Heavy Division." Military Review. (July 1988): 35-49.

Ballard, Larry A., "Guntrucks of Ambush Alley." Army Logistician. (July-August, 1986): 28-32.

Beringer, Richard E., Hattaway, Herman, Jones, Archer, and Still, William W. Jr. Why the South Lost the Civil War. Athens, GA : University of Georgia Press, 1986.

Biggs, Richard C., Criner, Eric R., King, Benjamin. Spearhead of Logistics. A History of the US Army Transportation Corps. Ft Eustis, VA: US Army Transportation Center, 1994.

Burke, Robert L., "Corps Logistic Planning in Vietnam." Military Review. (August 1969): 3-11.

Bykofsky, Joseph, and Larson, Harold. The US Army in World War II. The Technical Services. The Transportation Corps: Operations Overseas. Washington D.C.: Office of the Chief of Military History, 1957.

Cassino, Jay Allen. ed. Pictorial History of the Korean War. New York: WM. H. Wise and Co, Inc, 1951.

Clair, Carol. "Lessons in Combat Service Support Tactical Mobility: The Afghanistan Conflict, Falklands War, and Operation Desert Shield/Storm." ASMP Monograph. US Army Command and General Staff College, 1993.

Clausewitz, Carl von, On War. ed. and trans. Howard, Michael and Paret, Peter, Princeton: Princeton University Press, 1973.

Cohen, Eliot A., and Gooch, John. Military Misfortunes. New York: The Free Press, 1990.

Gibson, James. The Perfect War. Technowar in Vietnam. Boston: The Atlantic Monthly Press, 1986.

Gidley, Norman A. "Support from External Sources." Army Logistician. (Sep/Oct 1984): 4-7.

Harris, Murray. Lifelines of Victory. New York: G.P. Putnam's Sons, 1942.

- Heiser, Joseph M. Jr. A Soldier Supporting Soldiers. Washington, DC: Center of Military History, 1991.
- Heiser, Joseph M. Jr. Logistic Support. Washington: US Government Printing Office, 1974.
- Huston, James A. Guns and Butter, Powder and Rice. Cranbury, NJ: Associated University Presses, 1989.
- Ireland, James. "The Log-Base Concept." Army Logistician. (Jan-Feb 1994): 4-5.
- Jomini, Antoine. "The Art of War." Roots of Strategy, Book 2. Harrisburg: Stackpole Books, 1987, 389-557.
- Lawrence, T. E. "The Evolution of a Revolt." Army Quarterly. (October 1920) : Fort Leavenworth, KS: Combat Studies Institute, Reprint.
- Leigh, Randolph. 48 Million Tons to Eisenhower. Washington, DC: The Infantry Journal, 1945.
- McNulty, Timothy. Phone interview by author,, Fort Leavenworth, KS, 13 November, 1995.
- Magruder, Carter B. Recurring Logistic Problems as I have Observed Them. Washington, DC: Center of Military History, 1991.
- Mao Tsetung. Selected Military Writings. Peking: Foreign Language Press, 1972.
- Mosinski, David A. "U.N. Peacekeeping in Yugoslavia." MMAS Thesis, U.S. Army Command and General Staff College, 1993.
- Pagonis, William G., and Cruikshank, Jeffrey L. Moving Mountains. Boston: Harvard Business School Press, 1992.
- Peppers, Jerome G. Jr. A History of United States Military Logistics 1935-1988. Huntsville: Logistics Education Foundation Publishing, 1988.
- Peterson, Gerald L. (Project Officer) "Final Report, Vehicle Convoy Operations in the Republic of Vietnam." ACTIV Project No. ACG - 78F, Army Concept Team in Vietnam, APO San Francisco 96384, 30 Sep 1971.
- Pike, Douglas. PAVN. Novato, CA: Presidio Press, 1986.
- Porch, Douglas. "Bugeaud, Gallieni, Lyautey: The Development of French Colonial Warfare." Makers of Modern Strategy. Princeton: Princeton University Press, 1986.

Romjue, John L. "From Active Defense to AirLand Battle," Ft Monroe, VA: TRADOC Historical Office, June 1984.

Schneck, William C. "After Action Report, Operation Restore Hope" Ft Belvoir, VA: US Army Aviation and Troop Command, 13 June 1994.

Schneider, James J. "The Theory of Operational Art" SAMS Theoretical Paper No. 3. US Army Command and General Staff College, 1 March 1988.

Shaw, G.C. Supply in Modern War. London: Faber & Faber Limited, 1938.

Slim, William. Defeat into Victory. London: Cassell and Company LTD, 1956.

Sun Tzu. The Art of War. translated by Samuel B. Griffith; New York: Oxford University Press, 1963.

Swain, Richard M. "Lucky War" Third Army in Desert Storm. Ft. Leavenworth, KS: US Army Command and General Staff College Press, 1994.

Thompson, Julian. The Lifeblood of War. London: Brassey's, 1991.

Tukhachevskii, Mikhail. "New Problems in Warfare", SAMS Reprint.

Van Creveld, Martin. Supplying War. London: Cambridge University Press, 1977.

Waters, Brian. Phone electronic mail to author, Fort Leavenworth, KS, 12 October, 1995.

Westover, John G. Combat Support in Korea. Washington, DC: Combat Forces Press, 1955.

Weigley, Russel F. "American Strategy from its Beginnings through the First World War." in Makers of Modern Strategy. Princeton: Princeton University Press, 1986.

US Army Publications:

Field Manual 5-103, Survivability. Washington: Department of the Army, 1985.

Field Manual 19-1, MP Support for the AirLand Battle. Washington: Department of the Army, 1988.

Field Manual 20-32, Mine/Countermine Operations, Washington: Department of the Army, 1992.

Field Manual 63-2, Division Support Command, Armored, Infantry, and Mechanized Infantry Divisions. Washington: Department of the Army, 1991.

Field Manual 63-3, Corps Support Command. Washington: Department of the Army, 1993.

Field Manual 63-4, Combat Service Support Operations, Theater Army Area Command. Washington: Department of the Army, 1984.

Field Manual 90-8, Counterguerilla Operations. Washington: Department of the Army, 1986.

Field Manual 90-14, Rear Battle. Washington: Department of the Army, 1985.

Field Manual 100-5, Operations. Washington: Department of the Army, 1993.

Field Manual 100-15, Corps Operations. Washington: Department of the Army, 1989.

Field Manual 100-16, Army Operational Support. Washington: Department of the Army, 1995.

Field Manual 100-23, Peace Operations. Washington: Department of the Army, 1994.

Operation Restore Hope Lessons Learned Report, 3 Dec 92 - 4 May 93, Ft Leavenworth: Center for Army Lessons Learned, Combined Arms Command.

US Army. America's Army of the 21st Century. Force XXI. Meeting the 21st Century Challenge. Washington: Office of the Chief of Staff, Army, 1995.

US Army Operations in Support of UNOSOM II, 4 May 93 - 31 Mar 94, Lessons Learned Report. Ft Leavenworth: Center for Army Lessons Learned, Combined Arms Command.

US Army. TRADOC Pamphlet 525-5, Force XXI Operations. Fort Monroe VA: US Army Training and Doctrine Command, 1994.

USATCFE Pamphlet, "Vehicle Hardening and Convoy Operations." Ft Eustis, VA: US Army Transportation Center, 1994.