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**FIELD ARTILLERY DOCTRINE:
DOES IT SUPPORT MANEUVER WARFARE?**

**A Monograph
by
Major Michael J. Bradley
Field Artillery**



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**School of Advanced Military Studies
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This study examines the relationship of current U.S. Field Artillery Doctrine to the concept of maneuver warfare. The impetus for the work is the generally poor results of fire support at the National Training Center (NTC). The purpose is to determine what, if anything, is wrong with FA doctrine.

The analysis begins with an examination of the Relative Combat Power Model which relates the combat elements of maneuver, firepower, protection, and leadership. This model is the backdrop for the remainder of the study which looks at the Army's experience at the NTC, the Arab-Israeli wars of the last twenty years, and evolving artillery doctrine.

The study concludes that the maneuver and fire support communities are at odds over the adequacy of artillery doctrine due to a shared misconception of the relationship between maneuver, firepower, and protection. Each fails to recognize that the elements of combat power are, at times, at odds with each other. This relationship requires that the leader synchronize all warfighting assets in a combined arms (continued on other side of form)

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Does It Support Maneuver Warfare?

by

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ABSTRACT

FIELD ARTILLERY DOCTRINE: DOES IT SUPPORT MANEUVER WARFARE? by
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I. INTRODUCTION

Since 1981 the United States Army has been putting its warfighting doctrine into practice at the National Training Center (NTC) located at Fort Irwin, California. The mission of the NTC is to provide tough realistic training in accordance with AirLand Battle Doctrine...and to provide a data source for training, doctrine, organization and equipment improvement. (1) By all accounts the NTC is a training success.

The nature and size of this desert training facility make it more suitable for exercising the army's heavy mechanized forces than any other. The usual training restraints and constraints are less noticeable at the site which occupies hundreds of square miles of desolate terrain. "The National Training Center provides five unique elements to mitigate some of these restrictions: the ground to accommodate maneuver and live fire exercises for multiple task forces, sophisticated targetry, a professional and dedicated Opposing Force (OPFOR), an instrumented battlefield and a full time cadre of observer controllers consisting of some of the best officer and non-commissioned officers in the Army." (2)

Needless to say the Army has invested a lot of money and effort into this new training facility. It expects a commensurate return of increased readiness in terms of trained units, improved equipment, efficient organization and validated doctrine. To date, the Army is satisfied with

the NTC concept and is building on it. A center for exercising lighter forces (light infantry, air assault and airborne units) known as the Joint Readiness Training Center (JRTC) at Fort Chaffee, Arkansas is now in operation. Future plans call for a like type capability for heavy forces to be available to forces located in Germany.

The NTC has provided an environment where the full potential of the Army's improved family of mechanized and armored vehicles could be tested. The M1 Abrams tank and the M2 Bradley infantry fighting vehicle have proved capable of conducting what some senior army leaders call "Mobile Armored Warfare". The focus of mobile armored warfare is offensive war-fighting oriented on the enemy rather than terrain. The key to its success is to be able to focus combat power at critical points and times to seize the initiative from the enemy and using speed and violence to destroy his most dangerous equipment and will to fight.

(3)

However, not all results from the NTC have been as positive. One of the most glaring shortfalls is the area of fire support. Using the standards currently in use at the NTC approximately 60% of the indirect field artillery and mortar fire missions have been considered ineffective. (4) This apparent weakness in our modern force's ability to conduct modern warfare is generating both great concern and debate. One senior observer-controller at the NTC went so far as to say that "the fire support system is broken". The

Army recognizes that such a situation, if true, would spell disaster on the next battlefield. It is important to note that NTC exercises are single Task Force drills. This skews findings since; 1) the direct support artillery always responds and, 2) the larger force fire plan and assets don't affect outcomes.

As in any debate there are two sides to this question. Field Artillerymen, as the fire support coordinators, agree that more can be done to improve the equipment, methods, and training of fire supporters to achieve better results at the NTC and prepare them for their wartime mission. However, they are quick to point out that the effects and effectiveness of indirect fires have never been realistically portrayed at any training facility. This applies to the NTC where plans are in being to incorporate a training device known as CATIES (Combined Arms Training Integration and Evaluation System) to solve this problem. At the same time, the artillery points to modernized equipments of its own, to include; the Multiple Launch Rocket System (MLRS), the M109 Advanced Howitzer Improvement Program (AHIP), and the Army Tactical Missile System (ATACMS), which they believe will help improve current fire support capability. In general, the field artillery branch believes it can perform operate successfully under the umbrella of current FA doctrine.

Others hold a different view. They believe that the inability of the field artillery to provide adequate fire

support lies in the artillery's unwillingness to change its fire support doctrine. They believe that the development of the Army's AirLand Battle Doctrine in 1982, together with its 1986 update, pointed the way to fundamental changes in the way the Army plans to conduct future operations. In their view, artillery has not kept pace with the Army's doctrinal advances. Evidence of this situation is the poor NTC performance of the fire support community.

The result of this debate will certainly be far reaching. Regardless of the stake the Army has in developing training facilities such as the NTC, a far greater price will be paid if it draws the wrong lessons from its training experiences. As Robert Doughty noted in The Seeds of Disaster, prior to World War II, the French army had formulated a doctrine, devised a strategy, organized and equipped its units, and trained its personnel for the wrong kind of war. (5) A like failure by the U.S. Army in regard to fire support could result in a tragedy to rival the Fall of France.

The thrust of this work is to examine if current field artillery doctrine is adequate to support maneuver as envisioned in AirLand Battle. The framework for this examination is the concept of combat power as outlined in the Army's basic doctrinal manual FM 100-5, Operations.

II. THE COMBAT POWER MODEL

Background

The U.S. Army's basic fighting doctrine is called

AirLand Battle. It reflects the structure of modern warfare, the dynamics of combat power, and the application of classical principles of war to contemporary battlefield requirements. (6) My purpose is not to challenge the AirLand Battle concept, but to examine one of its foundation blocks in detail. I believe that in order to shed some light on the current fire support controversy it is necessary to frame the position of both sides within the dynamics of combat power.

FM 100-5 states that, "The dynamics of combat power decide the outcome of campaigns, major operations, battles and engagements. Combat power is the ability to fight." (7) The doctrine states that there are four components that encompass a force's ability to fight. They are maneuver, firepower, protection, and leadership. The combat power of a force is the effect that it creates by combining these four elements against an enemy.

To understand the dynamic nature of combat power we must first understand the terms. Maneuver is defined as the movement of forces in relation to the enemy to secure or retain positional advantage. (8) By maneuver, a force brings its weapon systems to bear on the enemy in such a way that the effect of the weapons are multiplied. Likewise, maneuver should attempt to degrade the effect that enemy weapon systems will have on the friendly force. History has shown that it is possible to maneuver a force into such a tremendous positional advantage that an enemy

force might even surrender before a shot was fired. This was a precept of Sun Tzu. However, maneuver by itself does not kill anyone. That is the job of firepower.

Firepower provides the destructive force essential to defeating the enemy's ability and will to fight. (9) In other words, firepower is the destructive power that can be produced against an enemy by the weapons systems of the force. It is the blast, shock, kinetic, and thermal effects that are produced when modern weapons are aimed at, fired on, and function against the men and material of the opposition. Firepower is what kills the enemy and destroys his combat power.

Protection is the conservation of the fighting potential of a force so that it can be applied at the decisive time and place. (10) Our doctrine sees protection in two components. The first is the actions that are taken to guard against the enemy's maneuver and firepower capabilities. Among those actions are security, air defense, dispersal, cover, camouflage, deception, suppression of enemy weapons, and mobility. (11) The second component is the actions that commanders take to guard the health and welfare of their soldiers and to insure that their equipment and supplies are not unnecessarily exposed to the effects of the elements or other sources of loss or damage.

The most essential element of combat power is competent and confident leadership. Leadership provides purpose,

direction, and motivation in combat. (12) For the purposes of this study, we will not examine this component of combat power. It is assumed that both sides see the role and value of leadership in the same way. It is the leader who will determine the degree to which maneuver, firepower, and protection are maximized; who will ensure these elements are effectively balanced; and who will decide how to bring them to bear against the enemy. (13)

The Model

As important as it is to understand the definitions of the elements of combat power, it is equally important to understand that the elements are interrelated. Doctrine again clarifies the issue when it notes that maneuver would rarely be possible without firepower and protection. (14) It is easy to visualize that to move forces in relation to the enemy on a modern battlefield would require some protection against the firepower assets that the enemy could employ against the friendly force in the course of the maneuver. Firepower might be necessary to suppress the enemy's capability to employ his firepower or to prevent his ability to maneuver concurrently against us. Likewise, firepower depends on maneuver to ensure that the delivered fires will be in a position relative to the enemy where they will have the greatest impact.

In his work titled "Understanding Combat Power", Colonel Huba Wass, de Czege outlined what he called the Relative Combat Power Model. Essentially, the model is an

equation by which one could determine the outcome of a battle. (15)

THE RELATIVE COMBAT POWER MODEL

$L_f(F_f+M_f+P_f-D_e)-L_e(F_e+M_e+P_e-D_f) = \text{The Outcome of Battle}$

where;

$L_f/L_e =$ friendly/enemy leadership effect

$F_f/F_e =$ friendly/enemy firepower effect

$M_f/M_e =$ friendly/enemy maneuver effect

$P_f/P_e =$ friendly/enemy protection effect

$D_e/D_f =$ enemy/friendly degrading of opponent's
firepower, maneuver and
protection effects

Key to understanding the model is to note that the equation does not give value to the elements of combat power per se but rather to their effects! For example, it is the effect of firepower, i.e., the killing, wounding, or paralyzing the enemy's soldiers and damaging or destroying his materiel that contributes to combat power and not simply the unapplied or misapplied potential of the force to produce firepower. In other words, the impact of the accuracy and timeliness of the firepower is what gives it value in relation to the enemy. (16)

Secondly, we should understand that the terms of the model are themselves comprised of many variables. Not all of which are quantifiable. Therefore, the equation is not likely to yield a determinate result.

What then is its value? The best answer seems to be that it is another tool for the leader. We can see in the model the leadership effect is the dominant value in the equation as it impacts as a multiplier on the other elements. The equation then is of value in reminding the leader that he must do all that is possible to maximize the effects of his elements of combat power while minimizing those of the enemy.

III. NTC OBSERVATIONS

The Problem

A study of indirect fire effects at the NTC conducted in 1987 concluded that over half of the fire missions were ineffective. (17) Since that time the numbers have remained consistently in the range of 50-70% ineffective fires. Many reasons have been given for this phenomena. It has been noted that the NTC methods and systems for measuring the impact of indirect fires do not do justice to the devastating effect that massed artillery fire has in modern battle. Safety has always precluded the actual firing of indirect systems in proximity to troops. Firemarker schemes have always suffered from lack of resources and responsiveness. The scope of operations at the NTC has magnified these restraints.

Others point out that the NTC experience is unlike any other. Replicating it at home stations is impossible. This argument is countered by those who point out that many

units, to include artillery, do well at the NTC. The common thread between them is that they trained in combined arms operations before they arrived at Fort Irwin.

Fire Support and the Scheme of Maneuver

While the trainers devise ways to measure the effect of artillery legitimately, it is agreed by both the maneuver and fire support communities that other steps need to be taken to integrate fire support with the scheme of maneuver. One method currently in use is the Fire Support Execution Matrix. As shown at figure 1, the matrix is designed to link targets to the specific systems and initiators for servicing by phase of the battle. The objective is to ensure that there are no gaps in the fire support. Additionally, it ties the firing of indirect weapons to the maneuver of enemy or friendly forces as opposed to keying on time or terrain.

	AA	LD/LC	PL RED	PL BLUE
Co A	Sec A Mort FA FPF	Mort A TGT CB1001	Mort A Series Ed	Mort A TGT CB1002
Co B	Sec B Mort Mort FPF	Mort B TGT CB1011	FA C6B	
Co C	FA FA FPF	FA Pri TGT CB1021	Mort B Series Joe	FA Pri TGT TGT CB1022
Bn		FA C7B	ACA Green TOT 0800 CAS	FA C8B

Figure 1. Example Fire Support Matrix

Lessons Learned

Observations by senior officers and controllers at the NTC have generated other lessons applicable to the fire support community. These have been captured by the Center for Army Lessons Learned (CALL) at Fort Leavenworth. Selected titles are located at Appendix A. (18)

The thrust of these observations is that for fire support to fulfill its battlefield function it must be truly integrated with and supportive of the scheme of maneuver as developed by the force commander. They suggest that fire support planning springs from the concept of the commander, and that fire supporters must understand his concept and intent and be able to explain how fire support assets can contribute to the accomplishment of the mission.

Others call on the artillery to give priority to fire support functions in the training and assignment of quality officers. Finally, they point out that ultimate responsibility for the execution of fire support lies with the supported maneuver commander. He must clearly state what he wants fire support to do in his operation. This includes outlining the what, where, and when parameters for the fire supporters. It remains for artillerymen to figure out the how or advise the commander that the scheme must be modified or more assets assigned in order to achieve the desired tactical effect.

IV. THE MID EAST EXPERIENCE

Perhaps only by coincidence, but the terrain at the

NTC is similiar to that of the Middle East. This is significant since that area of the world has been a stage for modern mechanized warfare for the last two decades.

Combat Power Out of Balance

In 1967, the Israeli Defense Force (IDF) fought a six day war against her Arab neighbors. Sensing imminent attack, the Israeli Air Force (IAF) conducted a preemptive air strike against the Egyptian air force, catching it unprepared and destroying it on the ground. This advantage allowed the IDF to attack on the ground into the Sinai Peninsula. These attacks were spearheaded by tank forces which left halftracked infantry and semi-mobile artillery far behind. (19) As its name implies, the war was over quickly, primarily due to the success of Israeli tanks. IDF commanders believed the results proved that the tank could operate without the support of other arms. They advocated an operational concept in which the tank became the primary weapon, operating virtually by itself. (20)

From 1967 to 1973 the IDF continued to emphasize the tank and the fighter-bomber to the neglect of other arms. (21) The close and constant assistance of the IAF prior to 1973 made air defense and field artillery seem unimportant, especially in fluid operations when the air force could arrive more quickly than the artillery could deploy. Consciously or otherwise, Israel came to rely largely on the tank-fighter-bomber team for its victories. (22)

Disaster Averted

On 6 October 1973, Israel was again at war. The forces of Egypt and Syria conducted a two front attack. The Egyptian army crossed the Suez Canal in an operation that caught the IDF by surprise. The Egyptian infantry quickly overran the Israeli forward fortifications known as the Bar-Lev Line. With little artillery support, Israeli tank forces counterattacking the Egyptians were decimated by the fire of anti-tank SAGGER missiles. The Egyptians had massed over 55 such weapons per kilometer. (23)

The Syrians attacked along the Golan Heights. Greatly outnumbered by Syrian guns, Israeli artillery in this area was vulnerable to counterbattery attacks. They had to displace 12-15 times a day. (24)

Most conventional and mechanized infantry units were in the reserve component, where they received less training and priority than the tanks. The three armored brigades located in the Sinai when the 1973 war began had all their tanks and crews at a high level of availability, but their mechanized infantry were still in the unmobilized reserve. These brigades went into battle as almost pure tank forces. (25)

When the local Israeli armored reserves counterattacked to relieve the Bar-Lev outposts, the Egyptian infantry faced perfect targets of pure tank units without infantry or fire support. (26) It became clear that the IDF lacked the firepower to counter the enemy tank-killer teams.

The Egyptian decision to defend only a few kilometers east of the canal allowed them to seek shelter under the integrated air defense system that they had constructed with Soviet materials on the western bank. Israeli aircraft suffered heavily when they tried to support their armor inside the range of the Egyptian SAMs. (27)

The IDF concluded that they had to change their way of fighting. Rash cavalry-like charges against the Egyptian positions gave way to a more cautious approach of engaging the enemy from long range, using artillery support and armored infantry to deal with the SAGGER missile teams. (28) As the artillery rained fire down on the Egyptian forces the IDF infantry was able to assault the anti-tank systems and clear the way for the advance of the Israeli tanks. This ad hoc organization was subsequently able to maneuver behind the Egyptian forces and win the war.

Combat Power In Balance

Lessons learned in the Yom Kippur War caused the IDF to change from a doctrine based solely on the tank to a more balanced combined arms approach to warfare. (29) The foremost lesson of the October War was the urgent need for reorganizing the IDF into a combined arms team. (30) In June of 1982 Israel launched "Operation Peace for Galilee". The objective of the operation was "...to put all settlements in Galilee out of reach of terrorist artillery" positioned in Lebanon." (31) The plan called for a three pronged attack to advance toward Beirut where Israeli

forces would link up with Lebanese Phalangist forces clearing the Palestinian Liberation Organization (PLO) out of the city. Israel would also have to contend with Syrian forces located in the Bekaa Valley of eastern Lebanon.

The IDF was organized into 9 division-sized formations for the attack and crossed the border at three locations.

(32) This force was very different from the one which had fought the '73 war. The IDF had increased its artillery from 300 towed guns in 1973 to over 950 (mostly self-propelled) pieces. (33) During a 1976 visit, the TRADOC Commander noted that the IDF had changed their method of employing their artillery. Based on the results of '73, the IDF saw a need for tight centralized control to insure that all firing units would be able to keep up with the mechanized forces and remain within range of the enemy.

(34) Artillery, which had essentially been only a support arm for the tank was now a full partner in a combined arms team. (35)

Victory Achieved

"Operation Peace for Galilee" was planned as a swift advance in depth, bypassing minor resistance and moving deep quickly. Ground operations would "...create a severe threat to the Syrian positions in the Bekaa from the flank and rear and finally threaten to cut the Syrian lifeline to Lebanon." (36) Artillery would play a major role.

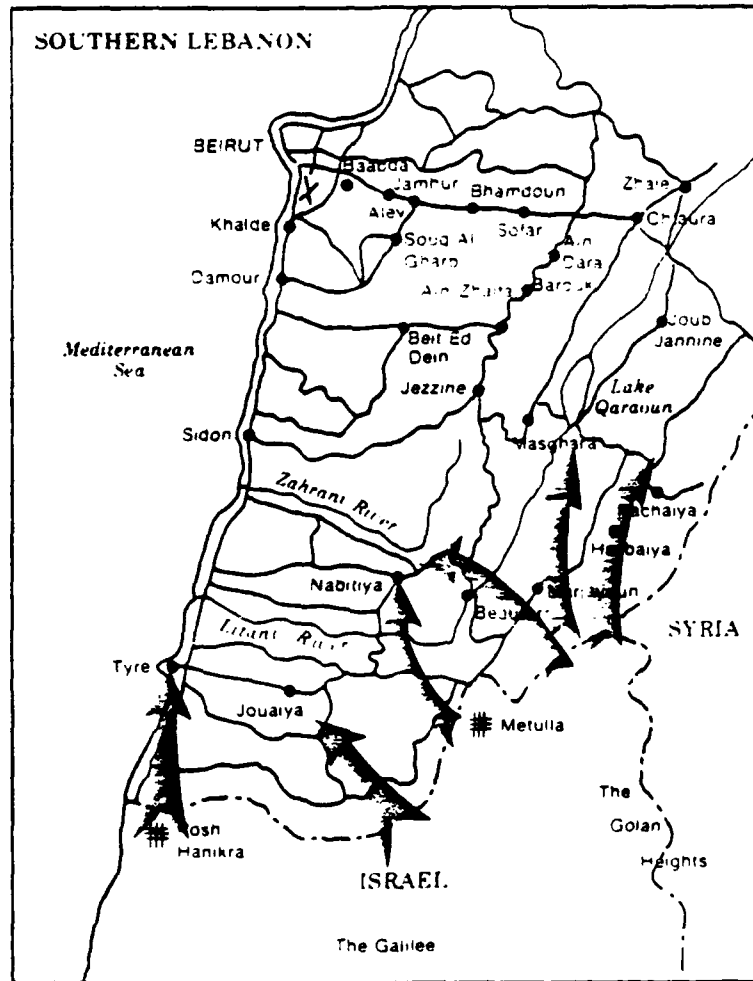
Once considered an extremely backward service, IDF artillery provided superb fire support. It was noted that

the artillery fired with "unprecedented precision and with quick real-time reaction in a modern battle." (37) The success of the operation was due to the IDF's ability to mass superior firepower at critical point of the operation. (38)

The '73 experience also pointed to a need for less reliance on the IAF. (39) However, Israel was unwilling to leave her air force out of the operation. The firepower and flexibility inherent in modern aircraft could provide a great amount of combat power if they could safely enter the action. Israel undertook a specially planned operation to ensure that the IAF would be able to participate in the operation. This required that the Syrian SAM network of 19 batteries in the Bekaa Valley be neutralized.

The strike to take out the Syrian air defense forces in the Bekaa Valley took place on 9 June 1982. (See Map A.) The Israelis used a combination of electronic warfare, Remotely Piloted Vehicles (RPVs) and improved air-to-surface missiles to locate, deceive and destroy 17 of the SAM batteries. (40) The IAF was then able to engage the Syrian Air Force without an air defense threat. By the next day, they had shot down 65 MiGs without losing a plane. (41) Taking advantage of their air superiority, the IDF attacked up the valley and drove off the Syrian ground forces. (42)

Map A - Operations, 9 June 1982 (43)



V. THE FIELD ARTILLERY PERSPECTIVE

The capstone field artillery doctrinal manual is FM 6-20, Fire Support In Combined Arms Operations. (44) It outlines the current prescriptions for employing fire support on the AirLand Battlefield. As the methods, tactics and procedures to implement the AirLand Battle tenets of initiative, depth, agility, and synchronization evolve so does artillery doctrine. A follow-on manual, Fire Support

In The AirLand Battle will soon be fielded along with publications directed toward fire support concerns of differing levels of command.

"One must remember that artillery best maneuvers by deflection and quadrant." (45) This statement by a field artillery officer speaks volumes to the posture of field artillery doctrine since World War II. Its essence is that the capabilities of field artillery are most efficiently used when the guns can mass their fires on the full range of enemy targets without the need to interrupt support by moving. This bias runs through artillery doctrine.

The realities of the AirLand Battlefield and the concerns of the maneuver community has generated a need for the field artillery to question its orthodoxy. For the most part, the artillery has defended its basic doctrinal position. The mission of the artillery remains "...to destroy, neutralize, or suppress the enemy by cannon, rocket, and missile fire and to help integrate all fire support assets into combined arms operations." (46) Likewise, the roles that artillery performs on the battlefield are close support, counterfire, and interdiction. (47)

Figure 2. FA Tactical Missions and Inherent Responsibilities

AN FA UNIT WITH A MISSION OF--	DIRECT SUPPORT	REINFORCING	GENERAL SUPPORT REINFORCING	GENERAL SUPPORT
1. Answers calls for fire in priority from--	1. Supported unit 2. Own observers ¹ 3. Force FA HQ	1. Reinforced FA 2. Own observers ¹ 3. Force FA HQ	1. Force FA HQ 2. Reinforced unit 3. Own observers ¹	1. Force FA HQ 2. Own observers ¹
2. Has as its zone of fire--	Zone of action of supported unit	Zone of fire of reinforced FA	Zone of action of supported unit to include zone of fire of reinforced FA unit	Zone of action of supported unit
3. Furnishes fire support team (FIST/FSS) ²	Provides temporary replacements for casualty losses as required	No requirement	No requirement	No requirement
4. Furnishes liaison officer--	No requirement	To reinforced FA unit HQ	To reinforced FA unit HQ	No requirement
5. Establishes communications with--	Company FSOs, FSOs, and supported maneuver unit HQ	Reinforced FA unit HQ	Reinforced FA unit HQ	No requirement
6. Is positioned by--	DS FA unit commander or as ordered by force FA HQ	Reinforced FA unit or as ordered by force FA HQ	Force FA HQ or reinforced FA unit if approved by force FA HQ	Force FA HQ
7. Has its fire planned by--	Develops own fire plans	Reinforced FA unit HQ	Force FA HQ	Force FA HQ
¹ Includes all target acquisition means not deployed with supported unit (radar, aerial observers, survey parties, etc.)				
² A fire support section (FSS) for each maneuver brigade/battalion/cavalry squadron and one FIST with each maneuver company/ground cavalry troop are trained and deployed by the FA unit authorized these assets by TOE. After deployment, FISTs and FSSs remain with the supported maneuver unit throughout the conflict.				

Doctrinally adequate fire support is provided to maneuver units through a process of allocation and retention of specific fire support assets. Field artillery units are assigned decentralized missions: direct support or reinforcing, or centralized missions: general support or general support reinforcing. Responsibilities inherent in

these missions are shown at figure 2. Unfortunately, the standard relationships tend to replace tactics. The key to effective support lies in the force commander's ability to bring these assets to bear on the enemy in an integrated and coordinated manner that is synchronized with the scheme of maneuver. (48)

The challenge for the field artillery is always to provide timely, accurate, and effective fire support. For its part, the artillery has done much to learn the right lessons as it adapts and adjusts to the AirLand vision of future battle. New procedures, weapons, and organizations have been fielded to meet the current challenges. Systems such as MLRS, ATACMS, and AHIP are improving the capability to generate more firepower. Placing more howitzers in direct support units increases the protection potential of the artillery while providing the supported force with more responsive and continuous fire. Stressing the responsibility of the maneuver commander to ultimately direct the fire support effort aligns with the doctrinal tenet that Synchronization is a command function. (49)

VI. ANALYSIS

The field artillery as a branch of the Army has begun to address the differences between the fire support and maneuver communities in regard to the adequacy of field artillery doctrine in support of AirLand Battle. The thrust of these efforts is that, while problems in fire support

exist, there is no need to change the main features of field artillery doctrine. The artillery generally seeks a technological solution to its problems. The problem of protecting the field artillery is to be solved by moving to dispersed formations using the capabilities of the AHIP system. The bottleneck in fire support created by TACFIRE will be solved as soon as AFATDS comes on line. (50) The question of integrating fire support with the scheme of maneuver can be handled using a fire support execution matrix.

While all of these of these improvements will be helpful will not resolve the dispute. The question of command and control of limited fire support resources remains. For its part, the maneuver community believes strongly that they should be the final authority as to how fire support assets should be employed. They claim that unless fire support is thoroughly responsive to the maneuver commander it cannot be doing its wartime mission. As General Saint has stated, "If you don't have fire support responsive to maneuver, the maneuver folks will run off and come up with something else. And that would be a great shame." (51)

The two sides seem to be at loggerheads. The field artillery believes that their doctrine which favors centralization of artillery assets is the most efficient way to use a limited resource. They admit to a need for the development of a fire support scheme of maneuver, but see

this device as a means of improving the execution of current field artillery doctrine. The maneuver community sees the situation as one where the field artillery refuses to acknowledge the requirements of the AirLand Battlefield for decentralized responsive fires totally supportive of and subservient to the scheme of maneuver.

Both sides are operating from a false premise. Both have developed an incorrect picture of the relationship among the elements of combat power. The error has its roots in language. Specifically, there is sloppy use of the word "maneuver". As evidenced throughout this study, maneuver can be used as numerous parts of speech. When we were referring to the elements of combat power we defined maneuver as a verb. To maneuver a force is to move it in relation to the enemy. Additionally, maneuver has been used as a noun with multiple meanings. It is referred to as the completed act of movement as described above and concurrently to describe certain branches of the Army. When asked to list "maneuver forces" Army officers have been conditioned through their military education and field experience to reply with "infantry, armor, cavalry, and (in a recent development) attack helicopters." This is not a problem until you ask a related question such as, "Do field artillery units 'maneuver'?" The answer must be yes. Field artillery must be moved to secure or retain a positional advantage vis-a-vis the enemy force in order to provide maximum effective fires. Yet, when we develop a scheme of

maneuver we do not include the field artillery. General Saint has said, "Right now the artillery can't keep up with the maneuver force. The Bradleys and M1s drive out of range, and that's a significant problem." (52) The Israeli's experienced the same problem in 1973.

A similar problem crops up when the terms "fire support" and "firepower" are mistakenly used interchangeably. FM 6-20 defines fire support as "the collective and coordinated use of target acquisition, indirect fire weapons, armed aircraft, and other lethal and nonlethal means in support of battle plans." (53)

Fire support assets to include the field artillery contribute a lion's share of the firepower element of combat power. However, they are not the only contributor to a force's firepower effect. The direct fire weapons of the "maneuver" force are also included. This is certainly no revelation, especially to the "maneuver" community. It is easy to see that "maneuver" units contribute to the firepower effect of a force. The mental hurdle that must be crossed is that other branches, non-"maneuver" branches also contribute to all of the elemental effects that make up combat power. The armor on an M1 tank contributes to the protection effect of the force. So does the firepower umbrella provided by a air defense battery.

The second source of error in sorting this out is that the maneuver and fire support communities have both forgotten that while "maneuver" forces may be considered

first among equals when compared with other combat, combat support, and combat service support branches this does not mean that maneuver (the relational positioning of the force) is more important than firepower. Clearly, if we go back to the definitions provided by our doctrine, we see that they are equal parts of the overall equation.

Protection is also an equal partner, while leadership is the preeminent factor that must synchronize the others to maximize combat power.

The Relative Combat Power Model, as outlined above, can also be devious in a subtle, yet important way. One side of the equation, (the friendly factor of combat power), was $L_f(F_f + M_f + P_f - D_e)$. The model considers the combined effect of friendly firepower, maneuver, and protection; degraded (minimally we hope) by enemy actions and multiplied by leadership as the factor in the equation to be maximized. Colonel Wass de Czege makes the point that the overall effect is what matters not the potential of that element. The equation as constructed assumes that the effects are additive, i.e., that combat power results from the addition of firepower to maneuver to protection. In the overall result, that is true. However, the equation hides the fact that in relation to each other; firepower, maneuver, and protection are not always positive.

Understanding this phenomena is critical to a leader's ability to maximize the combat power of his force.

In truth, the relationship among firepower, maneuver,

and protection is that they are not always positive in their effect on generating combat power. For example, when an M1 tank is in an overwatch position conducting direct fire against an enemy force, its firepower effect is a positive factor in the combat power equation. However, its impact on maneuver may or may not be positive. If the overwatch fires allow another tank to close with and gain a positional advantage vis-a-vis the enemy then maneuver has been enhanced. If not, then the loss of maneuver effect may be considered the price paid in firepower to protect the tank against the enemy force. When limiting the analysis to one branch of the Army, or one type of combat arm, or strictly combat versus combat support and combat service support the argument may seem like splitting hairs. The impact of this phenomena, when we consider combined arms warfare, is profound.

To protect themselves against enemy counterfire, field artillery units will have to move often. Projections range as high as 10-12 moves a day to protect a unit and keep it firing. (54) Failure to move will rapidly degrade the unit's capability to survive and fire. How does this factor into the combat power equation? Certainly the artillery unit's movement will be a positive effect in terms of protection, but what is its overall impact on the generation of combat power? Obviously such an action will have a negative impact on the force's firepower effect. Likewise, the maneuver effect of other units are degraded

as the artillery moves to protect itself and is unable to provide firepower to suppress or destroy enemy forces.

The lesson appears to be that the elements of the combat power equation have a symbiotic relationship. Symbiosis is a relationship among entities (usually between organisms) that may or may not be of benefit to each. At times the firepower of one part of the force can enhance the maneuver and protection of the others and thereby be a overall positive factor in generating combat power. The protection afforded by other units can enhance the maneuver effect by allowing freedom of movement. Maneuver to a relatively better position can likewise enhance the effect of the firepower to be brought to bear on the enemy while also increasing the protection effect of terrain and other friendly forces.

However, the relationship also has a negative side. Maneuver may at times suffer as firepower displaces to gain protection. Protection can ebb as units stand fast and deliver firepower to allow other units to maneuver. The overall firepower effect can decrease as firing units displace to keep up with the very units that were able to maneuver under the protection of their firepower. There are as many negative combinations as positive. That should not surprise us because it is the nature of combined arms.

From its earliest days the combat power equation has had validity. The first military leaders understood that to win on the battlefield you had to combine maneuver,

firepower, and protection. As time passed, specific types of forces developed to maximize each of the elements. Artillery weapons: large cannons and guns, were cast and dragged around the battlefield because they could deliver large volumes of firepower. It was understood that artillery was often slow and cumbersome to move but cavalry units had evolved and were capable of rapid movement in relation to the enemy to turn flanks or pursue. The infantry, quicker to move than the artillery and able to protect itself with massed musketry and squared formations against enemy cavalry, completed a triumvirate of force types that lasted for centuries.

It was no accident that these types of forces developed. If only indirectly, leaders understood that there were specific ways to maximize the firepower, maneuver, and protection that was needed to defeat their enemies. At the same time, they recognized that there was a price to pay for this capability. It is the same price we pay today in the conduct of combined arms operations. That price is the effort required of a leader to synchronize the types of forces under his command as he tries to maximize the resultant effects in terms of combat power.

Throughout the ages, and up to the latest NTC rotation, the synergistic effect of combined arms operations has not come free. The systems and forces which, on the one hand, give the commander the capability to mass overwhelming combat power at a decisive point, concurrently

demand that he balance the inherent negative influences those same systems can generate. At times the effect of firepower systems can be devastating; however, often the same systems demand that their firepower effect be paid for with decreased maneuver and protection. Current Army doctrine recognizes this truth and says that the greatest amount of combat power is generated when the different arms of the army complement and reinforce each other. (55) It is the function of leadership to see that this synchronization takes place.

Without the use of the different capabilities of combined arms to maximize combat power, disaster can result. That is the lesson of the Middle East experiences of the last two decades. In 1967, the IAF was able to destroy the Egyptian Air Force with a preemptive strike. In terms of the combat power equation, the Egyptian firepower and protection effect was decisively reduced by the Israeli action. Without air cover and close air support, the Egyptian ground forces were unable to generate enough combat power vis-a-vis the Israeli armed forces and were therefore defeated.

The Israeli experience in 1967 provided some false lessons which would haunt them in 1973. With little to fear from the Egyptian air forces, IDF tanks could exploit their maneuver effect. They literally ran circles around the Egyptian army by conducting mobile mechanized warfare without limitation. So successful was this armor/air force

combination that Israel built her entire armed forces around it. Artillery and infantry forces that could not keep pace with tanks and airplanes were relegated to secondary positions. In other words, Israel would rely almost exclusively on two arms to generate all of her combat power.

The Yom Kippur War of 1973 put the Israeli armor/airpower force structure to the crucial test. The results were nearly disastrous. Operating without the added protection and firepower that modern mechanized infantry and artillery can provide, the IDF tank forces were nearly decimated by the Egyptian infantry as they rushed to reinforce the Bar-Lev Line. The introduction of Sagger missiles gave the Egyptians a firepower edge that Israel could not counter.

The firepower of the IAF was thwarted by the Egyptian air defense system. The Soviet-provided network of surface-to-air missiles gave the Egyptian infantry the protection they needed to use their anti-tank firepower without fear of air attack.

Visualizing the Relative Combat Power Model in this case, we note that the Egyptians enhanced their firepower and protection effect and degraded the maneuver and firepower effect of their enemy. The impact of the Egyptian action was not entirely positive. By relying on the Sagger missiles, the Egyptians reduced their own ability to maneuver. The effect of the Egyptian anti-tank firepower

was achieved in part because the IDF maneuvered their tanks into the killing zones of the opposition. Likewise, while the SAM umbrella provided the Egyptians with protection, they refused to move out from under it. As many of the sites were fixed, the positive protection effect was countered by a negative maneuver effect.

Initially, both sides failed to integrate a complete combined arms solution to their combat power problem. Israel found the right answer. The neglected artillery branch was hastily recalled into action to contribute to the generation of combat power. Acting in concert with the armor forces, Israeli gunners massed indirect fires against the Egyptian anti-tank crews. The protection of a small profile in broken terrain was overcome by the firepower effect of IDF artillery. Indirect fires prevented the Egyptians from tracking their missiles to their targets. While the artillery protected them by suppressing the enemy, IDF armor was able to maneuver against the Egyptians and win the battle.

Israeli actions to rebuild their artillery forces into a greater contributor to the firepower effect of their combat power underscores the lesson they learned in 1973. When "Operation Peace for Galilee" was launched, new artillery units were available to support the armored forces.

In conducting the collateral operation into the Bekaa Valley, the Israelis kept their capability to generate

firepower in balance. Their artillery was again a member of a combined arms family; their operation to take out the Syrian SAM network would do the same for their air forces.

The bi-polar nature of firepower versus maneuver tilted toward maneuver as a result of the '67 war. Actions to reincorporate artillery had swung the pendulum the other way. Balancing these extremes with the protection, firepower, and mobility of airpower again moved the Israelis toward a central, balanced combined arms position.

A parallel situation has been experienced by the US Army. The 1976 version of doctrine, The Active Defense is generally regarded as a firepower/attrition oriented concept. AirLand Battle represents a movement toward a more balanced firepower-maneuver outlook. (56) A danger to be avoided is that this movement of doctrinal thought leads to an overreliance on maneuver. Combat power suffers regardless of which element is forgotten.

VII. CONCLUSIONS

The demands of AirLand Battle present a serious challenge to the standard methods employed by the field artillery in providing fire support. No longer is the battlefield linear. No longer can we focus our fire support strictly on the front line close battle. No longer do we have an abundance of field artillery systems. No longer can we ignore the enemy's counterfire capability.

Major armies have tended to integrate more and more arms and services in order to combine different

capabilities of mobility, protection, and firepower while posing more complicated threats to their enemy. (57)

Integration does not mean combining individual weapons of different arms together in a permanent organization.

Rather, it means that units come together under the concept of task organization to meet the varying demands of the current situation based on the principle of METT-T.

One corollary is that all arms and services need the same mobility and almost the same degree of armor protection as the units they support. Not only infantry, engineers, field artillery, and air defense, but also logistics units need to be able to go where the tank units go in order to conduct sustained operations. (58)

In his discussion of collateral operations, General DePuy makes the same type of case. In his view, the complexity of modern war continues to grow. The types of units that a commander must incorporate into his concept and the capabilities they possess make the integration of combined arms and the efficient generation of combat power an increasingly difficult task. (59)

Units in which one arm dominates the other may be useful in some situations but they lack flexibility. (60) Doctrine which stresses one element of combat power over another runs the same risk. The adoption of such techniques as the Fire Support Execution Matrix will improve the capability of fire support to make their systems efficient. However, that will not guarantee that they will be

effective. That measure is derived from the overall concept for the operation springing from the mind of the commander.

Field artillery doctrine continues to try to march in step with the drumbeat of the maneuver community. This deference is rooted in a shallow interpretation of the true nature of the combat power equation. It is not important that fire support and the field artillery be supportive of the maneuver branches. What is critical to success on the next battlefield is how firepower, maneuver, and protection are integrated to produce the requisite amount of combat power. The experiences noted in the Mid East are therefore important. Failure to integrate capabilities into focused combined arms operations properly can lead to defeat.

In writing about sustainment of combat operations, the U.S. Army Chief of Staff stated that the purpose of planning was not to support the plan but to help form a supportable plan. (61) This logic applies as well to fire support and its doctrine. Without a clear view of the relation of firepower, maneuver, and protection, field artillery doctrine will miss the target.

Appendix A: Selected CALL Fire Support Lessons Learned

1. The DS battalion commander must be physically present when the brigade commander states his commander's intent.
2. The maneuver commander must state what he wants fire support to do in support of his plan.
3. The brigade commander or S3 should develop and use a brigade-level execution synchronization matrix to control brigade assets.
4. Maneuver commanders must understand and accept responsibility for execution of the fire plan within their area of operations.
5. The criticality of fire support to success on the battlefield mandates that FSOs are the best-qualified artillerymen available.
6. The fire support execution matrix is an essential tool to brief the fire plan and to help execute that plan.
7. FSOs must be able to explain field artillery combat power in terms that have meaning for the maneuver commander.
8. The Commander and FSO must develop a complete fire support plan and integrate it into the scheme of maneuver using the wargaming technique.

ENDNOTES

1. BG H.G. Taylor, NTC Brochure, (Public Affairs Office, Fort Irwin, California), p. 1.
2. Ibid.
3. GEN Crosbie E. Saint, Col. Tommy R Franks and Maj. Alan B. Moon, "Fire Support in Mobile Armored Warfare", Field Artillery Journal, (U.S. Army Field Artillery School, Fort Sill, Oklahoma, June 1988), p. 12.
4. LTC H.D. Heimgartner, "Indirect Fire Effects Study", (NTC Observation Division, 8 April 1987), para 2a.
5. Robert A. Doughty, The Seeds of Disaster, (Hamden, Connecticut, 1985), frontpiece.
6. U.S. Army, Field Manual 100-5, Operations, (Washington, D.C., May 1986), p. 9.
7. Ibid, p. 11.
8. Ibid, p. 12.
9. Ibid.
10. Ibid, p. 13.
11. Ibid.
12. Ibid.
13. Ibid.
14. Ibid, p. 12.
15. Col. Huba Wass De Czege, "Understanding and Developing Combat Power", Course 2 Readings, (SAMS, Fort Leavenworth, Kansas, 1988), p. 15.
16. Ibid, p. 14.
17. Heimgartner, para 2a.
18. The entire text of these lessons can be found in. "Indirect Fire Support Lessons Learned", (The Center For Army Lessons Learned, Fort Leavenworth, Kansas), p. 4, 6, 9, 11, 12, 14, 19, 23.
19. Lt.Col. David Eshel, IDF (ret.), The Lebanon War, (Hod Hasharon, Israel, 1982), p. 43.

20. Ibid.
21. CPT Jonathan M House, Toward Combined Arms Warfare: A survey of 20th-Century Tactics, Doctrine and Organization, CGSC, Fort Leavenworth, Kansas), p. 177.
22. Ibid, p. 176.
23. Eshel, The Yom Kippur War, (Hod Hasharon, Israel, 1978), p. 57.
24. Ibid, p. 40.
25. House, p. 176.
26. Ibid, p. 178.
27. Ibid.
28. Eshel, Yom Kippur, p. 58.
29. Richard A. Gabriel, Operation Peace For Galilee, (New York, 1984), p. 19.
30. Eshel, Lebanon, p. 43.
31. Ibid, p. 12.
32. M. Thomas Davis, 40 KM into Lebanon, (Washington, D.C., 1987), p. 40.
33. Gabriel, p. 204.
34. U.S. Army, "Israel Observations", (U.S. Army Training and Doctrine Command, Fort Monroe, Virginia, 1976), p. VI-1.
35. Gabriel, p. 104.
36. Eshel, Lebanon, p. 34.
37. Ibid, p. 68.
38. Ibid, P. 34.
39. Gabriel, p. 20.
40. Philip J. Millis, "RPVs Over the Bekaa Valley", Army. (June 1983), p. 50.
41. Davis, p. 92.
42. Ibid.
43. Davis, p. 91.

44. U.S. Army, Field Manual 6-20, Fire Support in Combined Arms Operations, (Washington, D.C., December 1984), p. ii.
45. Maj. John J. Twohig, Should the Current Direct Support Artillery Battalions of the Heavy Division be Organic to the Maneuver Brigade?, (US Army Command and General Staff College, Fort Leavenworth, Kansas, Unpublished SAMS monograph, 2 December 1986), p. 31.
46. U.S. Army Field Artillery School, Field Manual 6-20-30, Fire Support at Corps and Division (Coordinating Draft), (Fort Sill, Oklahoma, 1 March 1988), p. 1-3.
47. Ibid.
48. Ibid, p. 1-1.
49. Ibid, p. 4-2.
50. U.S. Army Field Artillery School, "Command and Control", Field Artillery Journal, (December 1987), p. 64.
51. Saint, "The Key to Field Artillery - Focusing Combat Power", Field Artillery Journal, (October, 1988), p. 11.
52. Ibid.
53. FM 6-20, p. 1-4.
54. MG Raphael J. Hallada, "On the Move", Field Artillery Journal, (October, 1988), p. 1.
55. FM 100-5, p. 25.
56. John L. Romjue, From the Active Defense to AirLand Battle: The Development of Army Doctrine 1973-1982, (Fort Monroe, Virginia, 1984), p. 18.
57. House, p. 188.
58. Ibid.
59. GEN William E. DePuy (ret), "Concepts of operation: The Heart of Command, The Tool of Doctrine", Army, (August, 1988), p. 30.
60. House, p. 189.
61. GEN Carl E. Vuono, "Sustaining Combat Power", Army Logistician, (July-August, 1988), p. 3.

BIBLIOGRAPHY

Books

Allen, Peter. The Yom Kippur War. New York: Charles Scribner's Sons, 1982.

Asher, Jerry, with Eric Hammel. Duel for the Golan. New York: William Morrow and Company, Inc., 1987.

Badri, Hassan el, Taha el Magdoub and Mohammed Dia el Din Zohdy. The Ramadan War, 1973. Dunn Loring, Virginia: T.N. Dupuy Associates, Inc., 1978.

Bellamy, Chris. The Future of Land Warfare. New York: St. Martin's Press, 1987.

Doughty, Robert A. The Seeds of Disaster: The Development of French Army Doctrine 1919-1939. Hamden, CT: Archon Books, 1985.

English, John A. A Perspective on Infantry. New York: Preager Publishers, 1981.

Eshel, David. The Yom Kippur War. Hod Hasharon, Israel: Eshel-Dramit Ltd., 1978.

_____. The Lebanon War. Hod Hasharon, Israel: Eshel-Dramit Ltd., 1983.

Gabriel, Richard A. Operation Peace for Galilee. New York: Hill and Wang, 1984.

Herzog, Chaim. The Arab-Israeli Wars. New York: Vintage Books, 1984.

House, Jonathan M. Towards Combined arms Warfare: a Survey of 20th Century Tactics, Doctrine and Organization. Fort Leavenworth, Kansas: US Army Command and General Staff College, August, 1984.

el Shazly, Lt. General Saad, The Crossing of the Suez. San Francisco: American Mideast Research, 1980.

Sun Tzu, The Art of War. Translated and with an introduction by Samuel B. Griffith, London: Oxford University Press, 1963.

Periodicals

"Command and Control", Field Artillery Journal. (October, 1983) 64.

DePuy, GEN William E. (ret), "Concepts of Operation: The Heart of Command." Army. (August, 1983): 26-40.

Hallada, MG Raphael J., "On the Move." Field Artillery Journal. (October, 1988): 1.

Millis, Philip J., "RPVs Over the Bekaa Valley." Army. (June, 1983): 49-51.

Saint, GEN Crosbie E., COL Tommy R. Franks and MAJ Alan B. Moon, "Fire Support in Mobile Armored Warfare." Field Artillery Journal. (June 1988): 12-14.

_____, "The Key to Field Artillery - Focusing Combat Power." Field Artillery Journal. (October 1988): 10-12.

Vuono, GEN Carl E., "Sustaining Combat Power." Army Logistician (July-August 1988): 2-6.

Field Manuals and Circulars

Field Circular 6-20-40 (Coordinating Draft), Fire Support in Brigade Operations (Heavy). Fort Sill, OK: US Army Field Artillery School, 1987.

Field Manual 6-20, Fire Support in Combined Arms Operations. Washington, D.C.: HQ Department of the Army, 1984.

Field Manual 6-20-30 (Coordinating Draft), Fire Support at Corps and Division. Fort Sill, OK: US Army Field Artillery School, March 1988.

Field Manual 71-2 (Approved Final Draft), The Tank and Mechanized Infantry Battalion Task Force. Washington, D.C.: HQ Department of the Army, January 1988.

Field Manual 71-3 (Draft), The Armor and Mechanized Brigade. Fort Knox, Kentucky: United States Army Armor Center, May 1988.

Field Manual 100-5, Operations. Washington, D.C.: HQ Department of the Army, 1986.

Theses and Monographs

Davis, M. Thomas. "40 Km Into Lebanon: Israel's 1982 Invasion." Washington, D.C.: National Defense University. National Security Affairs Monograph. 1987.

Doughty, Robert A. "The Evolution of U.S. Army Tactical Doctrine, 1946-1979." The Leavenworth Papers, No. 1. Fort Leavenworth, KS: Combat Studies Institute, US Army Command and General Staff College, 1979.

Idiart, Philip L. "Time-On-Target: Tactical Organization and the Massing of Divisional Field Artillery Fires on the Airland

Battlefield." Fort Leavenworth, KS: School of Advanced Military Studies. MMAS Monograph. 1986.

Redlinger, Mark J. "AirLand Battle and the Division Artillery Counterfire Dilemma." Fort Leavenworth, KS: School of Advanced Military Studies. MMAS Monograph. 1987.

Romjue, John L. "From Active Defense to AirLand Battle: The Development of Army Doctrine 1973-1982." TRADOC Historical Monograph Series. Fort Monroe, VA: Historical Office, US Army Training and Doctrine Command, 1984.

Sweeney, Patrick C. "Enhanced Abilities or Lost Chances? An Examination of the Howitzer Improvement Program's (HIP) Evolving Organization and Doctrine." Fort Leavenworth, KS: School of Advanced Military Studies. MMAS Monograph. 1988.

Turner, Albert F. Jr. "The Direct Support Field Artillery Battalion: Counterfire or Close Support?" Fort Leavenworth, KS: School of Advanced Military Studies. MMAS Monograph. 1987.

Twohig, John J. "Should the Current Direct Support Artillery Battalions of the Heavy Division be Organic to the Maneuver Brigade?" Fort Leavenworth, KS: School of Advanced Military Studies. MMAS Monograph. 1986.

Wass de Czege, Huba. "Understanding and Developing Combat Power." Fort Leavenworth, KS: School of Advanced Military Studies. 1984.

Other Sources

Heimgartner, LTC H.D., (Unpublished Study), "Indirect Fire Effects Study." NTC Observation Division: 8 April 1987.

"Indirect Fire Support Lessons Learned", (Unpublished Study), Fort Leavenworth, KS: The Center For Army Lessons Learned: Lessons Analysis Division-Combat Training Center.

"Israel Observations." Trip Report of Visit to Israel; 26 July to 6 August 1976. Fort Monroe, VA: U.S. Army Training and Doctrine Command. 1976.

Taylor, BG H.G., NTC Brochure. Fort Irwin, CA: NTC Public Affairs Office.