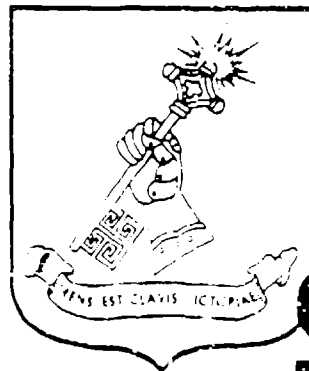


2

AD-A207 971

MEDIUM ANTI-TANK DEFENSE: THE CASE
FOR THE RETURN OF THE TANK DESTROYER

A Monograph
by
Major James A. Cope
Infantry



DTIC
ELECTE
MAY 17 1989
S E D

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

First Term AY 88-89

Approved for Public Release; Distribution is Unlimited

59-63131

89 5 16 141

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
1a. REPORT SECURITY CLASSIFICATION Unclassified			1b. RESTRICTIVE MARKINGS		
2a. SECURITY CLASSIFICATION AUTHORITY			3. DISTRIBUTION AVAILABILITY OF REPORT <i>Approved for public release, Distribution Unlimited</i>		
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE					
4. PERFORMING ORGANIZATION REPORT NUMBER(S)			5. MONITORING ORGANIZATION REPORT NUMBER(S)		
6a. NAME OF PERFORMING ORGANIZATION School of Advanced Military Studies		6b. OFFICE SYMBOL (if applicable) ATZL-SWV	7a. NAME OF MONITORING ORGANIZATION		
6c. ADDRESS (City, State, and ZIP Code) Fort Leavenworth Kansas 66027			7b. ADDRESS (City, State, and ZIP Code)		
8a. NAME OF FUNDING/SPONSORING ORGANIZATION		8b. OFFICE SYMBOL (if applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER		
8c. ADDRESS (City, State, and ZIP Code)			10. SOURCE OF FUNDING NUMBERS		
			PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.
			WORK UNIT ACCESSION NO.		
11. TITLE (Include Security Classification) Medium Anti-tank Defense: The Case for the Return of the Tank Destroyer					
12. PERSONAL AUTHOR(S) Cope, James A.					
13a. TYPE OF REPORT Final - MONOGRAPH		13b. TIME COVERED FROM _____ TO _____		14. DATE OF REPORT (Year, Month, Day) 88 12 06	
15. PAGE COUNT 44					
16. SUPPLEMENTARY NOTATION					
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB-GROUP			
			Tank Destroyer, Anti-tank Defense, Bradley Infantry Battalion, Hypervelocity Missile, and Dragon Missile		
19. ABSTRACT (Continue on reverse if necessary and identify by block number)					
<p>This monograph discusses the nature of the medium range anti-tank battle and the inappropriateness of the Dragon missile for that battle. An examination of the Bradley Infantry Battalion concludes that the Echo Company is unnecessary. The Light Infantry Division requirement for an anti-tank gun system is also considered. The need for a cannon for medium range anti-tank defense is explored.</p> <p>Medium range anti-tank defense is the anti-tank battle fought from 2,000 meters to close range. The nature of the Soviet tank threat and the speed of Soviet attacks are studied for their impact on missile-only defense. The historical use of the tank destroyer as a tank killer on the Eastern Front and the American misuse of the tank destroyer in the West are reviewed.</p> <p>Potential benefits from reintroducing tank destroyers are considered by examining the (over)</p>					
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT <input checked="" type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT <input type="checkbox"/> DTIC USERS			21. ABSTRACT SECURITY CLASSIFICATION unclassified/unlimited		
22a. NAME OF RESPONSIBLE INDIVIDUAL Major James A. Cope			22b. TELEPHONE (Include Area Code) 913-684-2138		22c. OFFICE SYMBOL ATZL-SWV

19. cont

German experience in World War II. The substitution of the tank destroyer for the M-1 tank in an anti-tank role is a suggested cost effective change. The tank destroyer is proposed as a potential launch medium for the hypervelocity missile. Additionally, cannons mounted on armored cars is proposed as the option which could provide the Light Infantry Division with a better medium range anti-tank defense.

This monograph concludes that the tank destroyer in both its wheeled and tracked versions is a feasible medium range anti-tank weapon. Financially and tactically the tank destroyer is currently the best available medium range anti-tank alternative to the M-1 tank.

Medium Anti-tank Defense: The Case for the Return of the
Tank Destroyer

by

Major James A. Cope
Infantry

School of Advanced Military Studies
U.S. Army Command and General Staff College
Fort Leavenworth, Kansas

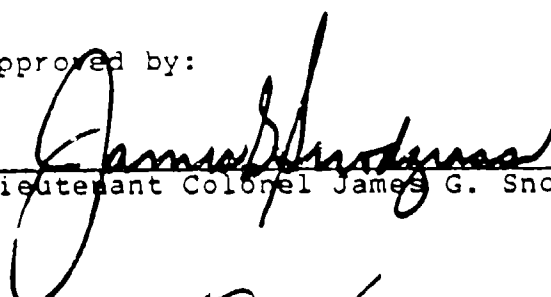
6 December 1988

Approved for public release; distribution is unlimited


School of Advanced Military Studies
Monograph Approval

Name of Student: Major James A. Cope
Title of Monograph: Medium Anti-Tank Defense: The Case
for the Return of the Tank Destroyer

Approved by:



Lieutenant Colonel James G. Snodgrass, M.A. Monograph Director



Colonel L. D. Holder, MA Director, School of
Advanced Military
Studies



Philip J. Brookes, Ph.D. Director, Graduate
Degree Programs

Accepted this 16th day of December 1988.



Accession For	
NTIS GRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By _____	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

ABSTRACT

MEDIUM ANTI-TANK DEFENSE: THE CASE FOR THE RETURN OF THE TANK DESTROYER by MAJ James A. Cope, USA, 44 pages.

This monograph discusses the nature of the medium range anti-tank battle and the inappropriateness of the Dragon missile for that battle. An examination of the Bradley Infantry Battalion concludes that the Echo company is unnecessary. The Light Infantry Division requirement for an anti-tank gun system is also considered. The need for a cannon for medium range anti-tank defense is explored.

Medium range anti-tank defense is the anti-tank battle fought from 2,000 meters to close range. The nature of the Soviet tank threat and the speed of Soviet attacks are studied for their impact on missile-only defense. The historical use of the tank destroyer as a tank killer on the Eastern Front and the American misuse of the tank destroyer in the West are reviewed.

Potential benefits from reintroducing tank destroyers are considered by examining the German experience in World War II. The substitution of the tank destroyer for the M-1 tank in an anti-tank role is a suggested cost effective change. The tank destroyer is proposed as a potential launch medium for the hypervelocity missile. Additionally, adoption of the technology of large caliber, high velocity cannons mounted on armored cars is proposed as the option which could provide the Light Infantry Division with a better medium range anti-tank defense.

This monograph concludes that the tank destroyer in both its wheeled and tracked versions is a feasible medium range anti-tank weapon. Financially and tactically the tank destroyer is currently the best available medium range anti-tank alternative to the M-1 tank.

INTRODUCTION

Today's too few defense dollars must be reserved for the most efficient weapons systems. It is common knowledge that there has been no real growth in the defense budget for the past three years. The future looks equally or more bleak for the growth of defense spending. Therefore, it is our responsibility as soldiers to determine the most cost effective solutions to military problems.

This monograph explores one of the most difficult and important tactical questions facing U.S. forces today: medium anti-tank defense, defined as the anti-tank battle waged from a distance of 1,000 to 2,000 meters. Anti-tank defense has long been one of the military's primary concerns. For the last thirteen years the problem of medium anti-tank defense has been insoluble. Long range (heavy) anti-tank defense, on the other hand, has been admirably solved with a succession of semi-automatic command to line of sight (SACLOS) missiles, the most prominent of which is the tube-launched, optically tracked, wire-guided missile (TOW).

Fundamentally, the critical problem of the most dangerous, least likely conflict is conventional anti-tank defense. Recently the Army Times devoted three consecutive issues to future anti-armor concerns. In the generally accepted scenario for war in Europe, the most dangerous,

least likely conflict is a Warsaw Pact deployment of an awesome armor threat. In the mid-1980's, the Soviet Army alone had 53-55,000 front-line tanks deployed with a further 9,000 in war reserve stocks.(1) The United States cannot afford to match this force vehicle for vehicle.

Third World military activities also need to be watched carefully. The Third World, like the Developed World, has its share of armed forces with significant armored threats. India, for instance, builds its own tanks. Even in our hemisphere potential adversaries (both the Cubans and Nicaraguans) have tanks, Brazil is a major arms manufacturer (to include tank building), and several other nations have vintage U.S. tanks. Intervention in our own hemisphere requires consideration of the armored threat. Two Grenadian armored cars caused tremendous problems during the early phases of Urgent Fury.

Currently, U.S. forces are saddled with the Dragon, a slow missile with a weak warhead. Anyone who has served in an infantry platoon since the introduction of the Dragon is dissatisfied with this missile system. The Dragon is clumsy to fire, difficult to control in flight, and has a large back-blast. A Dragon gunner engaging an enemy tank at 1,000 meters (the maximum effective range) would have to fly the missile for ten seconds with no offset from the back-blast signature while within coaxial machine gun range of

attacking tanks. Engagements of this kind will be extremely difficult for the gunners.

A new anti-tank solution for the medium range battle is required to provide protection and staying power for the infantry. The U.S. Army currently has several types of infantry, all of which rely on the Dragon for medium anti-tank defense. For medium anti-tank engagements, the best means of engagement may well be a rapid-fire, high-velocity cannon. The high-velocity cannon achieves muzzle velocities that require a fraction of a second for a projectile to travel 2,000 meters, whereas the Dragon requires ten seconds to travel 1,000 meters.

"Certainly it is poor economy to use a \$35,000 medium tank to destroy another tank when the job can be done by a gun costing a fraction as much. Thus the friendly armored force is freed to attack a more proper target, the opposing force as a whole." General Leslie J. McNair 1942(1)

General McNair was correct in 1942 as far as he went. What he neglected to say was that the gun needed to be mounted on a proper platform. This monograph will argue that the proper platform is a tank chassis without a turret similar to vehicles the German and Soviet armies used in World War II that were known as assault guns. This modern day assault gun, which is hereafter referred to as a "tank destroyer," may well be the most cost effective and survivable anti-tank weapon. The tank destroyer must be as

immune to anti-tank fire as a tank is; it must be tough enough to slug it out with tanks toe to toe.

In order to evaluate the tank destroyer's ability to meet the challenge of the medium anti-tank battle, this monograph addresses the current threat and potential future anti-tank warfare requirements and then examines the historical record of anti-tank warfare.

THE THREAT

The tank is the quintessential offensive weapon of the post World War I world. In the stalemate of trench warfare on the Western Front, all traditional military methods failed. Mobility had disappeared from war. To break the stalemate, the British developed an all-metal-protected, tracked vehicle. The logical descendant of this early vehicle, the modern main battle tank, is a tracked vehicle that has a chassis mounted turret equipped with a high velocity cannon combined with a coaxial machine gun. The whole vehicle is protected with the best available armor. Historically, tanks have done tremendous damage both physically and psychologically as a part of offensive operations.

The Soviet Union and its surrogates have huge numbers of tanks. As stated earlier the Soviet Union alone had 53,000-55,000 front-line tanks in service by the mid-1980's. Marshal of Tank Forces, P.A. Rotmistrov, has said, "Only armour can assure the rapid and total destruction of the enemy. It alone can achieve swift and decisive victory under modern conditions. Armour is the basic maneuver element of the Soviet Army--it plays the decisive role in the attack."⁽³⁾ Soviets intend to achieve 20-40 tanks per kilometer of breakthrough front.⁽⁴⁾ This massing of armor used as part of a combined arms attack preceded by a fire

storm has the potential of overwhelming anti-tank defenses.(5) Large masses of tanks have traditionally been seen as lucrative tactical nuclear targets. It is not within the purview of this monograph to discuss the use of tactical nuclear weapons.

The preponderance of tanks in the Soviet Army combined with those of the Warsaw Pact provide the U.S. Army with more tank targets than the U.S. Army has anti-tank missiles. This is a somewhat disingenuous statement since the U.S. Army would not confront the Warsaw Pact singly and, more importantly, anti-tank defense would be a combined arms battle. The medium anti-tank challenge cannot be minimized and glibly left to anti-tank missiles as the nature of the threat would overwhelm a Dragon-based defense.

The 1984 version of Taktika still maintains that the high paced offense is the key to victory. The main effort in this attack is that of the armored force whose attack is carried out at 12 kilometers an hour allowing tanks to fire an aimed shot from brief halts.(6) The Soviets are striving to increase that tempo to 20 kilometers per hour,(7) the same tempo used by the OPFOR at the National Training Center. This pace of attack, between 200 to 350 meters per minute, produces a direct fire weapons engagement that may last as little as 12 to 20 minutes. (This is based on the maximum TOW range of 3750 meters.)

The Soviets realize that the anti-tank defense is based on anti-tank missiles. They intend to neutralize the anti-tank guided missiles with munitions and jamming. All open sources agree that a Soviet attack will be masked by massive use of smoke combined with intense indirect fire. The Soviets also intend to jam the guidance systems of anti-tank guided missiles.

Historically, most tank battles take place on broken ground at ranges less than 1,000 meters. This situation has resulted in the Western armies' belief that COL Swinton's 1916 dictum (which has become a modern mantra), "The best anti-tank weapon is another tank," is valid.(8) Thus NATO intends to defeat Warsaw Pact tanks with NATO tanks and anti-tank guided missiles (ATGMs).

The threat posed by the Soviets has another dimension. The Soviets intend to use their 2S1s (SP 122mm howitzers) as assault guns with a major anti-tank mission. Their 2S1 batteries, whose basic load contains a significant amount of high explosive anti-tank (Heat) rounds, will be accompanying the combined arms assault elements and be fired at less than 5,000 meters. Reports in Voenenny Vestnik of current Soviet training practices in these units stress the use of direct lay anti-tank engagements.(9)

As stated previously, the density of armored vehicles attacking the defense is such that these vehicles could well overwhelm a missile only based anti-tank defense. The

combination of the artillery fire storm, battlefield obscurants, and the rolling nature of terrain (nowhere is terrain absolutely flat) will provide those NATO missile system gunners that survive the initial fire storm all the targets they could wish for.

While the U.S. develops more and better missiles, the Soviets are developing better armor. Recent articles in the Army Times speculate on the next generation of Soviet armor and express expectations that some sort of exotic armor, either proactive or electromagnetic, is being developed. The danger of a breakthrough in armor technology is that it would make obsolete the current generation of ATGMs, thereby gutting NATO's anti-tank defense.(10)

Large caliber, high velocity cannons maintain an ability to defeat these future armor developments.(11) The dense long rod penetrator traveling at sufficient speed will maintain its edge over armor. It should also be noted that another solution to the anti-tank problem, the hyper-velocity missile, also has the potential to be launched/fired from tank cannons of a caliber equal to or greater than 120mm.(12)

There will be ample armor targets for everyone on a European battlefield. There is no drop-off in the nature of the threat in several potential Low Intensity Conflict scenarios. Soviet clients throughout the world have tanks; some have the capability to build their own tanks (e.g.

India). The U.S. Army's Light Infantry Divisions suffer from a lack of organic anti-tank weapons (this a subject that will be revisited later.) The world-wide armor threat guarantees that if U.S. troops are committed in a contingency mission they will need an improved medium range anti-tank capability.

ECHO COMPANY AND THE TANK DESTROYER

As currently organized in the Bradley Mechanized Infantry Battalion, the antiarmor company (Echo Company) is both unnecessary and redundant. In the Bradley Battalion every Bradley Infantry Fighting Vehicle (BFV) is a TOW missile launcher. The Echo Company's claim to fame, the Improved Tow Vehicle (ITV), provides similar anti-tank missile support. However, the ITV, which is based on the M113, is neither as fast nor as tactically agile as the BFV. Therefore, the Echo Company currently gives the Bradley Battalion Commander no additional capability. Whereas the Echo Company's assets do strengthen the long range anti-tank capacity of the Bradley Battalion, there is a question as to whether the additional long range anti-tank capacity is necessary or justifiable.(13)

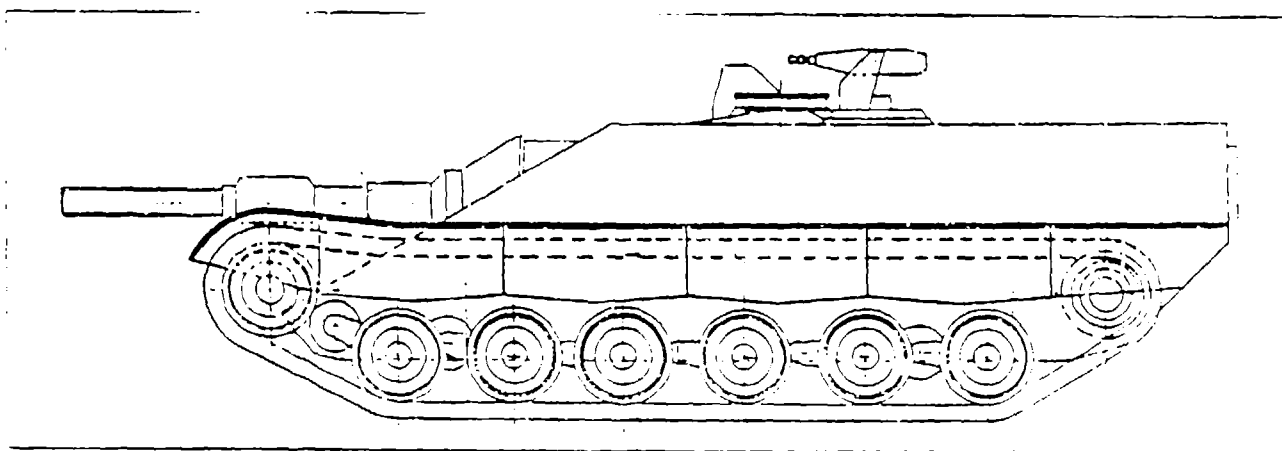
The ITV is singularly unsuited for its role in the modernized Mechanized Battalion. This system is too slow and not agile enough to keep up with the BFVs and tanks. The limited capabilities of the ITV do not justify its inclusion in the BFV equipped battalion. The ITV is capable of only two anti-tank engagements at 2,000 meters every minute. (This rate of fire is achieved only with everything going perfectly. The computation comes from ten seconds time of flight per missile, forty seconds to reload, and two missiles loaded in the hammerhead launcher prior to firing.)

This provides five minutes of combat with the ten missile basic load.(14) Whereas the twelve ITV systems in a Bradley battalion are redundant, they can be used as a structure around which a better alternative for medium-range anti-tank defense can be constructed. A new Echo Company could be built using a cannon based tank destroyer rather than the ITVs.

The tank is currently regarded as the best anti-tank weapon because of its high velocity, large caliber, rapid-fire cannon. The reason that most suggest that the tank is such a good anti-tank weapon is its rapid fire and forget capability. The tank is capable of more than two anti-tank engagements a minute; the basic load of most Western tanks is 3 to 4 times that of the number of missiles on an ITV.

The historical evidence of World War II suggests that the Soviets and Germans both fielded an effective anti-tank weapon that was as capable as a tank but was cheaper to build: the tank destroyer/assault gun. The Germans experienced such exceptional success with this weapon that by early 1944 this weapon was the mainstay of the German anti-tank defense and had accounted for 20,000 tank kills on all fronts.(15)

The tank destroyer is an anti-tank vehicle consisting of a tank chassis with no turret but equipped with a tank cannon. The design (pictured on the following page)



Proposed tank destroyer design.(16)

proposed by Paul-Warner Krapke (17) has a very low profile with a traverse of 15 degrees to either side and -10 to +15 degrees elevation. The vehicle is manned by a crew of only 3 with the driver doubling as the loader since the vehicle is not designed to fire while on the move.(18)

Survivability of the vehicle will be quite good and, as General Guderian has said, "The more efficient the protection, the better the crew's morale." (19) The frontal armor protection is 900mm and the top of the vehicle is bomblet proof.(20) This results in a vehicle 40 to 50 tons in weight that is proof against ATGM and most tank cannons.(21). Further technical design criteria from Krapke follow.

"Since a casemate design assures improved frontal protection by lowering the silhouette and allowing thicker frontal armor to be used, particular attention has been paid to these two aspects. The glacis armour plating is inclined at less than 30 degrees from the horizontal and has an under-layer of special armour. The glacis plate is "split" to accommodate the gun barrel. A low silhouette is all the more desirable as kill probability curves have demonstrated the importance of the vehicle's low height.

Above the level of the skirts the hull sides slope sharply inwards. The only opening in the roof is for the commander's hatch, and both roof and hatch are proof against bomblets. The engine air-intakes and exhausts are situated on the sides and at the rear. The rear mounted powerplant is mounted in such a way as to leave room for crew access and ammunition replenishment by a rear door. The vehicle is equipped with a NBC system working at slight overpressure. An explosion-suppression system is fitted in the battle station and engine compartment. Ammunition is stowed at the lowest point in the vehicle, most of it outside the battle station, below and to the side of the power-plant. There is stowage space for a greater number of rounds than in an MBT. Finally, a swivelling shovel is fitted at the front to enable the vehicle to dig itself in under cover." (22)

This vehicle would be compatible with current main battle tanks (MBTs) for both parts and ammunition thereby lessening the logistics strain. The Soviet and German approaches during World War II followed in general terms the design criteria expressed previously with the result that the tank destroyer/assault gun carried heavier armament and better protection than a tank of corresponding weight.(23) The World War II tank destroyer/assault gun had an additional benefit in that it was cheaper to produce than a tank.(24)

Modern light infantry, similar to its line infantry forebearers from World War II, needs anti-tank augmentation. The light infantry division, equipped only with the TOW and Dragon, has no cannon based anti-tank system. As a medium anti-tank weapon, the Dragon is lacking in range and durability. In "Infantry Magazine" MAJ McCreight has said "The Dragon is not the preferred MAW for light infantry since it lacks versatility for busting defense works, is least useful in cities, and requires prolonged gunner exposure and is too delicate."(25) There are wheeled alternatives available that have already been developed. The Belgians have a MECAR 90mm light weight gun system which their advertising states can be installed on any light armoured car. Advertisements claim:

- Armor piercing fin stabilized discarding sabot (APFSDS) defeats spaced armour.

- Muzzle velocity above 1500 meters per second, defeats the NATO medium target at 2000 meters.

- Extremely flat anti-tank trajectory with very low time of flight.(26)

Also, Rheinmetall has successfully mounted a NATO standard 105mm tank cannon on a MOWAG.(27) Both the U.S. Army and Marine Corps realize there is a need for a light assault gun. The two discussed above could be installed on the light armored vehicle (LAV) chassis.(28) The need to augment light units has been such a concern that in 1980 LTG Hollingsworth and MG Allen in an article in "Armed Forces Journal" called for a light armored corps as a strategic necessity.(29) Clearly, there is a need for the light infantry to acquire better medium range anti-tank weapons.

In the heavy divisions the reorganization of Echo Company into a tank destroyer company of four platoons of four guns each would provide the tactical commander with a more effective, credible medium anti-tank defense. This would provide the Bradley Battalion Commander with a rapid-fire gun system with which to thicken the defense of his Bradley Companies or use as a mobile tough anti-tank reserve. The tank destroyer, being as tough or tougher than a tank, as far as armor is concerned, allows for the tank destroyer to engage in closer combat than an ITV. In simple mathematics the tank destroyer will be able to engage in at least two engagements per minute with the advantage of being

able to fire and forget. Since the tank destroyer will have a basic load of at least 50 rounds, each tank destroyer will be in combat at least 25 minutes versus the 5 minutes of combat per ITV, providing a five fold increase in the anti-tank capability per vehicle.

The introduction of the tank destroyer into the heavy force will free tanks from defensive duties, thereby preserving a credible offensive capability. It is not in the best interest of the NATO allies to use expensive tanks which are best suited for offensive warfare in defensive roles. FM 100-5 states,

"In mounted warfare, the tank is the primary offensive weapon. Its firepower, protection from enemy fire, and speed create the shock effect necessary to disrupt the enemy's operations and to defeat him. Tanks can destroy enemy armored vehicles, infantry, and antitank guided missile units. Tanks can break through suppressed defenses, exploit the success of an attack by striking deep into the enemy's rear areas, and pursue defeated enemy forces. Armored units can also blunt enemy attacks and launch counterattacks as part of a defense."(30)

The superb M-1 tank would be attrited down to insignificant levels if it was committed to extensive medium range defensive battles. The M-1 procurement will result in only 7,000 M-1s and they would be consumed quickly fighting the Soviet armored threat. On the other hand, use of the tank destroyer would allow the Brigade and Division Commanders to husband tank units as reserves for offensive actions as FM 100-5 recommends.

The tank destroyer also has limited offensive potential. While it would not be designed to fire on the move it could be used as an overwatch/fixing force for the tank forces to use as a maneuver pivot. In World War II at the end of the war the Soviets were using a tank platoon made up of two T-34s and an SU-85. The SU-85 was a tank destroyer/assault gun used as a mobile base of fire from which the tanks could maneuver. Nothing so radical is suggested for the U.S. Army, but rather the use of a tank destroyer platoon that could be used as a medium range overwatch/fixing force is recommended.

A wheeled tank destroyer would be very useful in the light infantry division. As previously stated, virtually anywhere in the world the light infantry division might be committed there would be a significant armored threat. There is a need to increase the anti-armor capability to some form of fire and forget system. The wheeled tank destroyer is off-the-shelf technology. Another possibility is the towed anti-tank cannon. The Soviets still employ this type of anti-tank gun, the T-10.(32) The U.S. could develop a similar system that could be towed by the HUMMV and lifted by the Blackhawk. This system would meet stringent deployability criteria at the expense of tactical mobility. The turreted wheeled 90mm or 105mm tank destroyer appears to be the best option for the light infantry.

The best use of a tank destroyer unit in a light infantry division would be as an anti-tank company at the brigade level.(33) In this case the brigade commander would have the opportunity to reinforce the most dangerous avenue of approach or maintain a mobile anti-tank reserve. This would optimize use of this resource as the light infantry brigade will likely occupy a slightly greater frontage than a Bradley Battalion.

It is important to remember that the nature of ground is such that there are few perfect long range anti-tank engagement areas. Ground is not flat, even in the deserts as the descriptions of the Arab-Israeli Wars or the following passage from Hill 781 concerning anti-armor battle at the National Training Center indicates.

The T-72s and BMPs were appearing for only a few seconds at a time, rising over the small ridges running between the lines of wadis perpendicular to their front and disappearing as they descended into the next wadi. This negated the effects of the TOWs, which needed an unbroken line of sight on the enemy for the duration of the missile's flight, more than ten seconds at 2,500 meters. For the tanks it was another story. As soon as they had the target in their cross hairs they could kill in a split second. The same was true for the 25mm gun on the Bradley, although it could not hope to stop a tank. [LTC] Always recognized this and tried to direct the fires accordingly, tank against tank, Bradley against BMP.(34)

Quite clearly the tank destroyer would have success similar to that enjoyed by the tanks in the above passage, rather than the difficulty experienced by the TOW.

HISTORY AS A PARADIGM

In World War II, the U.S. had an operational tank destroyer doctrine which was used in the European Theater of Operations. Dr. Christopher R. Gabel of the Combat Studies Institute has made an exhaustive study of World War II tank destroyer doctrine. Briefly stated the tank destroyer doctrine was developed as a reaction to the German Blitzkrieg of 1940. The speed and shock of the German victory over the French and British was a tremendous catalyst for the U.S. military to develop new forms of warfare. It was decided that the solution to the anti-tank problem caused by the massed armor of the Blitzkrieg was to mass units of tank destroyers to contain the tank attack. LTG Leslie J. McNair decided that the critical asset of the tank destroyer would be speed. This caused the U.S. to develop a specific type of tank destroyer: fast, lightly armored, and equipped with a large cannon. The tank destroyers were organized in independent tank destroyer battalions that were army level assets (roughly equivalent to Corps level assets today). The tank destroyer battalions were massed to blunt tank penetrations and fix the enemy armor, allowing the counterattack of U.S. armor to destroy it. The doctrine was never tried. By the time the U.S. committed land forces to the war the Germans were no longer

capable of massed armored attacks on their Western Front.(35)

The tank destroyers used by the U.S. were poorly armored, very mobile, agile, and adequately armed. The entire family of tank destroyers used by the U.S. suffered from its inability to fight it out with German armor one on one. LTG McNair, a maverick who did not believe in the mantra, "The best anti-tank weapon is another tank," wanted the army mobile. He believed that the current tanks (early 1940's) were adequate since he did not believe tanks should fight tanks.(36) McNair preferred a tank destroyer whose gun was bigger than that on a tank. The gun was mounted on a tank chassis that had an open turret and the tank destroyer was stripped of heavy armor protection to save weight and improve mobility.(37) The final report of the First United States Army assessed them thusly:

The tank destroyer was created for the primary mission of destroying the hostile armor. Its initial superiority for this mission lay in its superior gun power. With the development of more adequate tank cannon and due to the offensive nature of operations the need for this special-mission type of unit has ceased. During operations tank destroyers were required to assume tank missions for which they were not equipped or trained adequately and to perform secondary missions as roving batteries, direct fire assault gun action and augmentation of the fire of armored units. The tank destroyer mission as originally conceived has been superseded by the requirements for a killer tank. Tank destroyers should be replaced by a tank which can equal or outgun enemy tanks and which has sufficient armor to protect itself and its crew from normal anti-tank and tank weapons.(38)

The lesson appears to be that the U.S. version of the tank destroyer was not tough enough. Had tank destroyers been more heavily armored the above assessment may well have been much more positive.(39)

The tank destroyer units were highly-motivated, well-trained units taught to consider themselves elite with all the attendant benefits of elite military units. . . an army asset tank destroyers were organized in independent battalions. Unfortunately, the tank destroyer units were seldom employed as battalions. Instead they were parcelled out in companies and platoons to augment infantry units. Any unit trained to operate as a unit within the construct of a certain doctrine and then not utilized according to that doctrine should not be expected to be successful. It is to the tank destroyer soldier's credit that the tank destroyers did as well as they did.

Tactical use of the tank destroyers did not conform with their doctrine. The reality of war overcame the peacetime doctrine. Tank destroyers were used in roles they were unsuited to as described above in the First U.S. Army assessment. Tank destroyers were also combined with tanks in both offensive and defensive combat. Dr. Gabel concludes in Seek, Strike, and Destroy: U.S. Army Tank Destroyer Doctrine in World War II that the tank destroyer doctrine was flawed and would not work because of the reality of war. I contend that the doctrine was never tried even during the

opportunity at the Battle of the Bulge. The large anti-tank reserve of independent tank destroyer units that LTG McNair had envisioned had been parcelled out to the divisions. By the time of the Bulge commanders were unable to use tank destroyers according to their doctrine; they had been conditioned by tactical reality as they understood it to use them piecemeal in a variety of roles.

The Eastern Front of World War II was another story. The American concept of tank destroyers was never used by either side in the East. Both the Soviets and Germans developed similar tank destroyers and similar employment techniques. This monograph concentrates on the German experience as this experience has more relevance for the modern U.S. anti-tank problem. In 1935 Erich von Manstein proposed the idea of tank destroyers based on a tracked chassis with a turretless gun. The Panzer and Artillery branches slowed tank destroyer production with branch jealousy. After the start of the war production soared.(40) The Germans found the tank destroyers to be superb tank killers whose successes surpassed the expectations of senior German officers. Both the design and crew training contributed to these successes.

The startling numbers of 'kills' claimed by SP(tank destroyers) crews were met with a certain amount of scepticism until certain senior officers carried out personal inspections of battlefields and were convinced that the tallies had, indeed, been accurate. To quote the example of only one brigade: this, during a fifteen month

period in Russia, destroyed more than 1,000 Soviet machines. When it is considered that the average daily strength of the brigade was twenty 'runners' and that the unit must also have spent some time out of the line refitting and resting, the full measure of the fighting ability of the gun crews can be gauged. According to Alfred Mueller and Hugo Primozic, two of Germany's most able SP commanders, the secret of the German victories lay in the fact that they were better gunners than the Russians and in battle usually scored the first shot. A comparison between the assault artillery and the panzer arms also shows that, gun for gun, the SPs gained more 'kills' than did the tanks.(41)

By the end of the war German tank destroyers had accounted for more than 30,000 tank kills. The greatest number of these kills were on the Eastern Front against the superb T-34 and other Soviet tanks.(42) The tank destroyers were so successful that Soviet tanks were ordered to avoid vehicle to vehicle duels if at all possible.(43)

The Germans used their tank destroyers for both offensive and defensive operations. In the 1945 German publication "Leadership and Employment of Assault Artillery" the Army High Command set for the following:

Assault guns are armoured artillery whose task it is to serve in the front line and to give close support to the infantry attack by beating down the enemy's weapons or fire. The platform is mounted on tracks, capable of cross country performance and armed either with a gun or a howitzer. Through a combination of fire-power, mobility, armoured protection and instant combat readiness, whether leading an advance guard or forming the point unit during a pursuit battle, assault guns are the decisive means by which a commander can control the changing circumstances of an engagement; enabling a point of maximum effort to be formed quickly, to support a weak flank or to add power to a counter attack.

The basic organization is along the lines of field artillery and when used as front line artillery, SPs close the gap formerly existing by providing maximum support during those times of crisis which occur during an attack.

In cases where field artillery is unable to support front line troops SP guns can be called upon, as a temporary measure, to carry out that role. Assault guns have a decisive effect when formed into a compact group and put in at the point of main thrust. This effect is reduced or lost completely if the unit is split up.(44)

The Germans also had the good sense to make the tank destroyer commander the expert on how to employ his unit. German infantry commanders frequently sought out this expertise.(45)

The SP commander maintained the closest possible liaison with the unit he supported. The SP commander's most important liaison task was to ensure that the supported unit commander understood that at certain points in the battle the tank destroyers would have to withdraw to rearm and refuel. This coordination was critical; failure to do so could cause panic. (S.L.A. Marshall had said in Men Against Fire that once one person or vehicle moved to the rear without explanation the onus was off and a stampede to the rear could occur.) The SP commander had to ensure that his rearming and refueling was staggered so that at no time were all of his vehicles off the battlefield.(46)

In the autumn of 1942 a battle took place at the Soviet town of Rzhev. Rzhev is significant because any German attack on Moscow or Soviet attack toward Smolensk must go through Rzhev. A German panzer grenadier unit was attacked by a strong Soviet combined arms attack of T-34s, infantry, and artillery. On the first day the Germans had only 2 SPs

(assault guns with 75mm guns) to reinforce the defense with anti-tank weapons. The Soviets attacked with a fire storm and dismounted infantry followed by T-34s with infantry riding the tanks. Due to a failure of execution the dismounted Soviet infantry did not follow the fire storm closely and the German grenadiers were able to remain their defenses effectively and stop the dismounted attack. To blunt the T-34 assault the assault guns (SPs) were brought up. Early on in the fight one of the assault guns was disabled and yet the Soviet attack was halted by the remaining assault gun together with close air support by Stuka dive bombers which attacked to within 100 meters of the German line. The lone assault gun accounted for nine confirmed kills (German assault guns were only given credit for kills left on the battlefield).

The second day's battle with four assault guns on the German side was a repeat of the first day. The Soviet combined arms attack was beaten back with effective anti-tank fire from the assault guns and timely close air support from Stukas. Several times during the course of the battle the German infantry was prepared to withdraw but the timely arrival of an assault gun kept them in their trenches. Rzhev was a German defensive success based on combined arms. The air-ground coordination and the tactical agility of the assault guns were the keys to this success. The Stuka attacks stopped key Soviet armor attacks while the

assault guns stopped the rest. The use of the assault guns took in a wide variety of defensive missions, including use in static defense positions (primary, alternate, and supplementary positions); mobile defense; and limited counterattacks. Perhaps the assault guns' most important contribution was to stiffen the resolve of the grenadiers holding their positions.(47)

POTENTIAL BENEFITS TO THE ARMY FROM ADOPTING A MODERN TANK DESTROYER

The current generation of anti-tank missiles is losing whatever edge it may have enjoyed over armor technology. Modern Soviet tanks (T-80s) have 700mm of frontal armor plus add-on blazer armor.(48) The ability of current shaped charge warheads on the TOW and Dragon to penetrate a maximum 500mm of armor(49) means that these missiles cannot defeat a Soviet tank head-on. Modification to the TOW warhead to improve armor penetration will result in Soviet armor improvements. It has ever been so in the competition between armor and armor killer.

The historical evidence of the Eastern Front proves that the tank destroyer is an extraordinarily effective tank killer. The tank destroyer as designed and used on the Eastern Front was capable of all tactical missions. It was superb in the defense where it freed the panzers from the anti-tank battle and allowed them to be kept in reserve for the counter-blow, the key to successful defense. The defender must seize the initiative and establish a form of moral ascendancy by going over to the attack.(50) The tank destroyers also demonstrated limited offensive capability with the same shortcoming demonstrated by tanks: in close country the tank destroyers needed infantry protection, particularly when the close-in anti-tank weapons of the

infantry improved with the introduction of panzerfaust-type weapons.

The World War II experience on the Eastern Front also proved the tank destroyer to be an economical alternative to tanks. The German practice of using obsolete tank chassis as the basis for many of their assault guns reduced the casting costs. The omission of turrets for the assault gun approach resulted in a significant cost savings. In modern terms the savings from incorporating tank destroyers into the combat units are still obtainable. The Leopard II tank designer Paul-Warner Krapke has said,

....the procurement costs of a tank destroyer can be as much as 30% below those of an assault tank. The principal reason for this is that it is a far less complex weapon system as it does not need to possess the ability to fire accurately on the move -- one of the main requirements of the MBT. This means that it can dispense with the traditional tank turret with all its associated equipment: sophisticated turret drive and electric or hydraulic slip-ring, gyrostabilized main armament and sighting system, complicated computer, and built-in test equipment, and furthermore it can make do without the station for the fourth crew member, the driver doubling as gunner. This not only reduces procurement costs but life-cycle costs, which over a normal span of 20 years amount to about ten times the procurement costs.(51)

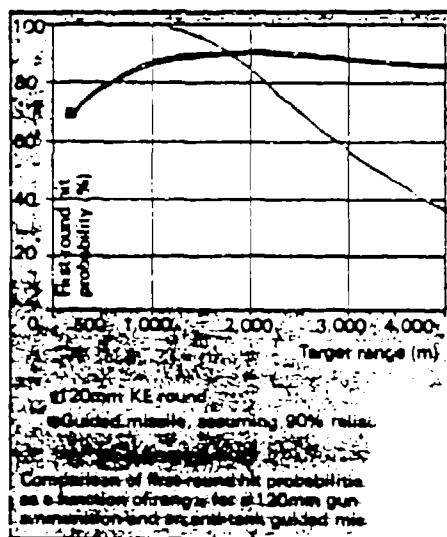
Spare parts for the automobiles and the gun system should not cause any undue problems. Because they are based on MBT chassis, tank destroyers are automotively compatible for repair parts. The cannon of a tank destroyer of the Eastern Front type and the type that Paul-Warner Krapke proposes uses the same gun as the MBT. As far as spare

parts for the gun are concerned the fire control system of the tank destroyer is simpler than those of the MBT. It is simpler and cheaper to upgun a tank destroyer than an MBT.

There is potential for morale benefits from the tank destroyer. In German experience on the Eastern Front the Infantry stayed in its holes and fought when the tank destroyers were with them. The tank destroyers calmed what was known as 'panzer fever,' the fear of tanks. The U.S. Army's light Infantry units could be a candidate for 'panzer fever' as they have only Dragons for medium range anti-tank defense. Reinforcing/augmenting the light Infantry with tank destroyers could have decisive effects on the light Infantry's staying power. The technology for air-transportable, wheeled tank destroyers is available right now and would not require any research and development costs.

Tank cannons on tank destroyers are a cost effective alternative to missiles. Walter Stone in a recent International Defense Review said "....the time is ripe for the reintroduction of the anti-tank gun. There is also a good economic argument, in that ammunition for guns is much cheaper than any missile and many rockets." (52) As examples the Hellfire missile costs \$26,000 and the FOG-M (fiber-optic guided missile) will cost about \$30,000. (53) At some point the cost of these missiles becomes so prohibitive it will not be cost effective to build up a

stock pile. Tank cannon rounds, on the other hand, cost in the hundreds of dollars, can be produced relatively quickly and cheaply, and would be much easier to mass produce. On a cost basis only tank cannons are superb tank killers. It is important to remember that close to 2,000 meters, the limit of medium range engagements, the tank cannon is equal to or better than an ATGM.



(54)

Development of the hyper-velocity missile and other exotic technologies make the tank destroyer a viable platform. The hyper-velocity missile will be fired from two systems: a wheeled carrier with a launcher system or from the MBT cannon.(55) The hyper-velocity missile is exciting because of the tremendous energy caused by its speed and weight.

The basic tank killer missile is rocket propelled and can achieve speeds of 1,524 meters (5,000 feet) per second. At a gross weight of 77 kilograms (170 pounds), the rocket will strike the target with a force of 117,348 kilograms per

meter per second (258,703 pounds per foot per second). There aren't a great many things short of the Rocky Mountains that can shrug off that kind of impact.

At Mach 5, flight time is about 2.5 seconds over a range of three kilometers (1.9 miles). Even if a tank commander could see the missile at the moment it was fired, there wouldn't be time to maneuver out of its way. When the hardened warhead (tungsten or depleted uranium) strikes the target, not only will the bullet penetrate but in so doing it will shower the interior with semimolten and spalled fragments of metal knocked away from the armor plate and wall construction. The sudden release of the missile's energy may literally burst the tank apart. (56)

The expected devastating performance from the hypervelocity missile on the battlefield plus its suitability to tank destroyer adaptation combined with the relatively low cost of \$8-10,000 make this missile a feasible option for medium anti-tank defense.

CONCLUSION

The United States has habitually looked at war through a telephoto lens with too much emphasis on the overview of war and too little emphasis on the lower levels of war. The long range engagement gets the most attention. Those weapons procured to fight the long range fight are only shown in their best light (perfect testing conditions that will not apply in war). The medium and close anti-tank fight have been largely ignored for the last decade. Perhaps the most critical time in a fight on the Central Front will be the Soviet transition to attack formations at medium to close range.(57)

The tank destroyer is a time proven, effective, medium range anti-tank weapon that has added potential tactical benefit. The presence of tank destroyers may influence the moral domain of battle and keep the infantry fighting when their senses tell them to run. The tank destroyer has proved itself as part of the combined arms team as the Battle of Rzhev has shown. Tactically, the tank destroyer can also be used to attack point targets other than tanks; carry canister rounds to use on troops in the open; be a launch medium for hyper-velocity missiles; and aid in attacks, as well as defense.

With military budgets becoming more and more an issue, the tank destroyer is a relatively inexpensive, virtually

off-the-shelf option for anti-tank warfare. Everything needed to build one has already been developed; the chassis, gun, and fire control system are in place. The only research and development costs necessary would be those required to construct prototypes. For the wheeled tank destroyer options, the turrets and prototypes have already been built by MECAR and Rheinmetall. The tracked tank destroyer can take advantage of the superiority of the high velocity cannon and of the potential of the hyper-velocity missile versus the ineffectiveness of present ATGMs against increasingly exotic armors. The case for cannon ammunition being more cost effective than missiles has already been made above. The tank destroyer also preserves the tanks (one of the Army's most expensive systems) for the offensive operations (as delineated in FM 100-5) armor was designed to perform.

The tank destroyer in either a towed form or wheeled form would provide the light infantry division with desperately needed anti-tank defense. Either of these options would be air deployable and would not slow the deploying division. Providing an anti-tank unit at the brigade headquarters would allow brigade commanders to stiffen anti-tank defense on the most likely armor avenue of approach. Wheeled tank destroyers have a great deal of tactical mobility and agility and could be moved quickly around the battlefield to critical locations.

The wheeled tank destroyer might also have utility for the Military Police in their rear battle responsibilities. The current anti-tank capability of the Military Police is laughable. If they should have to deal with an armored threat in the rear area, wheeled tank destroyers would greatly enhance their chances to defeat or at least contain the threat.

In this age of intermediate nuclear force reduction treaties and potential conventional reductions, the tank destroyer can be easily construed as a defensive weapon. It is designed to perform a defensive mission first and offensive operations only as needed. If the Soviets are using conventional reductions to improve their offensive posture, as a noted Soviet affairs expert recently opined, then the tank destroyer becomes even more potentially beneficial. It would offset the Soviet preponderance of tanks for fewer dollars and be acceptable to public opinion as a defensive weapon.

The U.S. Army should reconsider this historically proven anti-tank option as a legitimate answer to both the medium anti-tank problem and the problem of continual improvements in armor. The tank destroyer could fire both the best anti-tank rounds available for cannons and serve as a launch medium for the hyper-velocity missile when the missile is developed. It is time for the Army and Marine

Corps to seriously consider tank destroyer options for both the light and heavy forces.

ENDNOTES

1. Isby, David C. Weapons and Tactics of the Soviet Army. New York: Jane's Publishing Company, 1988. p 107.

2. Gabel, Dr. Christopher R. Seek, Strike and Destroy: U.S. Army Tank Destroyer Doctrine in World War II. Leavenworth Paper #12 Fort Leavenworth, Kansas, 1985.

3. Isby. op. cit. p. 107.

4. Ibid. p. 119.

5. Reznichenko, V.G. Taktika. Moscow, 1984. Translated by CIS Multilingual Section Translation Bureau, Secretary of State Department Ottawa, Canada. Published under the auspices of the United States Air Force.

6. FM 100-2-1 The Soviet Army. Washington D.C. 16 July 1984. p. 5-27.

7. Ibid. p. 5-27.

8. Ogorkiewicz, Richard M. Armoured Forces: A History of Armoured Forces and Their Vehicles. New York: ARCO Publishing Co. Inc. 1978, p. 374.

9. These observations are the results of several conversations with MAJ James F. Gebhardt of the Soviet Army Studies Office. The more recent editions of Voenenny Vestnik (Military Herald) are as yet untranslated. The inclusive period of the untranslated editions are from late 1986 to the present. Thankfully MAJ Gebhardt was willing to read the appropriate articles and explain them to me.

10. Donnelly, Tom. "Soviets Plan Exotic Tank for the 90's." Army Times. 10 Oct 1988. pp. 31-32.

11. Ibid.

12. "Hyper-velocity Missiles for Tank Guns." International Defense Review. February 1987. p. 244.

13. Conversation with LTC Carl E. Linke a Bradley Battalion Commander with the 24 ID (M).

14. CGSC Student Text 101-1 Organizational and Tactical Reference Data for the Army in the Field. Fort Leavenworth, Kansas. June 1988. pp. A-4 and A-5.

15. Kershaw, Lieutenant Colonel R.J. "Lessons to be Derived from the Wehrmacht's Experience in the East 1943-45." Journal of the Royal United Services Institute for Defense Studies. September 1987. p. 63.
16. Krapke, Paul-Werner. "Design Concept for a Heavy Tank-Destroyer." International Defense Review. March 1983. p. 341.
17. Paul-Werner Krapke was the Chief of the Leopard II Design Team.
18. Krapke, Paul-Werner. "Time Perhaps to Rethink Anti-Tank Warfare Concepts." Armada International. April/May 1988. p. 22.
19. Ibid. p. 23.
20. Ibid. p. 22.
21. Isby. op. cit. p. 119.
22. Krapke. op. cit. pp 23-24.
23. Ogorkiewicz. op. cit. p. 381.
24. Ibid.
25. McCreight, MAJ Richard D. "Killing Armor in the Middle Ground." Infantry. March-April 1988. p. 34.
26. Stone, Walter. "Recent Developments in Infantry Weapons." Armada International. November/December 1987. and an MECAR advertisement in the December 1987 Military Technology page 34.
27. Ibid. The MOWAG is a variant of the same vehicle the U.S. calls the LAV.
28. Bolte, Phillip L. "A Case of Foot Dragging, the Mobile Protected Gun System." Armed Forces Journal. July 1983.
29. Hollingsworth, LTG James F. and Wood, MG Allan T. "The Light Armored Corps - A Strategic Necessity." Armed Forces Journal. January 1980. pp. 57-59.
30. FM 100-5 Operations Washington, D.C. 1986. p. 42.
31. Ogorkiewicz. op. cit. p. 282.

32. Biryukov G. and Melnikov G. Antitank Warfare. Moscow: Progress Publishers, 1973. and Imby both discuss the use towed anti-tank guns. The towed guns are used in the depth of the defense or along the flanks of penetrations as hasty defenses.

33. Conversation with Dr. Christopher R. Gabel CSI.

34. McDonough, James R. The Defense of Hill 781: An Allegory of Modern Mechanized Combat. Novato, Ca.: Presidio Press, 1988. p. 81.

35. This paragraph owes its content to Dr. Gabel's Leavenworth Paper.

36. Welgley, Russell F. Eisenhower's Lieutenants: The Campaign of France and Germany 1944-1945. Bloomington, Indiana: Indiana University Press, 1981. pp. 14-15.

37. Ibid. p. 15.

38. Ibid.

39. To get an idea of what U.S. tank destroyers looked like and what they were capable of see the Osprey-Vanguard Series Number 10 Allied Tank Destroyers or Peter Chamberlain and Chris Ellis's British and American Tanks of World War II: The Complete Illustrated History of British, American and Commonwealth Tanks 1939-1945 published by ARCO Publishing Company, 1969.

40. Lucas, James. War on the Eastern Front 1941-1945: The German Soldier in Russia. New York: Bonanza Books, 1979. p. 119.

41. Ibid. p. 122.

42. Ibid. pp. 121-122.

43. Ibid. p. 122

44. Ibid. pp. 122-123.

45. Ibid. p. 123.

46. Ibid. p. 126.

47. Ibid. pp. 140-144. My account of the Battle for Rzhev is a condensation from these pages.

48. Powell, M. Phillip. "Supersonic Tank Terminator." International Combat Arms, May 1988. p. 17.
49. Isby. op. cit. p. 119.
50. Clausewitz, Carl von. On War. Edited and Translated by Michael Howard and Peter Paret. Princeton, N.J.: Princeton University Press, 1976. Book Six.
51. Krapke. op. cit. p. 20.
52. Stone, Walter. "Recent Developments in Infantry Weapons." Armada International. November/December 1987. p. 59.
53. Powell. op. cit. p. 16.
54. Krapke. "Design Concept for a Heavy Tank-Destroyer." p.344.
55. The tank cannon is mentioned in the February 1987 International Defense Review's Research and Technology Section.
56. Powell. op. cit. p. 18.
57. This paragraph originated with ideas encountered from the following: Lynch, Eugene M. "The Chink in our Antitank Armor." Armed Forces Journal. November 1983. pp. 52-58.

BIBLIOGRAPHY

BOOKS

- Adan, Avraham. On the Banks of the Suez. California: Presidio Press, 1980.
- Biryukov, G. and Melnikov, G. Antitank Warfare. Moscow: Progress Publishers, 1972.
- Clausewitz, Carl von. On War. Princeton, N.J.: Princeton University Press, 1976.
- Delighton, Len. Blitzkrieg. New York: Ballantine Books, 1979.
- Ellis, John. The Sharp End: The Fighting Man in World War II. New York: Charles Scribner's Sons, 1980.
- English, John A., ed. The Mechanized Battlefield. Washington, D.C.: Pergamon-Brassey's, 1985.
- Foss, Christopher F. Jane's World Armoured Fighting Vehicles. New York: St. Martin's Press, 1976.
- Gabel, Christopher R. Seek, Strike, and Destroy: U.S. Army Tank Destroyer Doctrine in World War II. Leavenworth Paper no. 12. Fort Leavenworth, Kansas: Combat Studies Institute, U.S. Army Command and General Staff College, 1985.
- Herzog, Chaim. The War of Atonement. New York: Little, Brown and Co., 1973.
- Isby, David C. Weapons and Tactics of the Soviet Army. New York: Jane's Publishing Co., 1988.
- Kahalani, Avigdor. The Heights of Courage: A Tank Leader's War on the Golan. Westport, Ct.: Greenwood Press, 1984.
- Lucas, James S. War on the Eastern Front 1941-1945: The German Soldier in Russia. New York: Bonanza Books, 1979.
- MacDonald, Charles B. A Time for Trumpets: The Untold Story of the Battle of the Bulge. New York: Bantam Books, 1984.
- McDonough, James R. The Defense of Hill 781: An Allegory of Modern Mechanized Combat. Novato, Ca.: Presidio Press, 1988.

Marshall, Samuel Lyman Atwood. Men Against Fire: The Problem of Battle Command in Future War. Gloucester, Massachusetts: Peter Smith, 1978.

O'Ballance, Edgar. No Victor No Vanquished: The Yom Kippur War. San Rafael, Ca.: Presidio Press, 1978.

Ogorkiewicz, Richard M. Armoured Forces: A History of Armoured Forces and their Vehicles. New York: ARCO Publishing, Company, Inc. 1970.

Design and Development of Fighting Vehicles. Garden City, N.Y.: Doubleday and Company Inc., 1968.

Perrett, Bryan. Sturmartillerie and Panzerjaeger. London: Osprey Publishing, 1979.

Piekalkiewicz, Janusz. Translated by Jan van Heurck. Tank War 1939-1945. Poole, Dorset: Blandford Press, 1986.

Reznichenko, V.G. ed. Tactics. Moscow, 1984. Translated by the CIS Multilingual Section, Translation Bureau, Secretary of State Department, Ottawa, Canada. Published under the auspices of the United States Air Force.

Simpkin, Richard E. Antitank: An Airmechanized Response to Armored Threats in the 90s. New York: Brassey's Publishers Limited, 1982.

Human Factors in Mechanized Warfare. New York: Brassey's Publishers Limited, 1983.

Mechanized Infantry. New York: Brassey's Publishers Limited, 1980.

Race to the Swift: Thoughts on Twenty-First Century Warfare. New York: Brassey's Defense Publishers, 1985.

Red Armor: An Examination of the Soviet Mobile Force Concept. New York: Brassey's Defense Publishers, 1984.

Tank Warfare. New York: Brassey's Defense Publishers, 1979.

Vigor, P. H. Soviet Blitzkrieg Theory. New York: St. Martin's Press, 1983.

Weeks, John. Men Against Tanks: A History of Anti-tank Warfare. New York: Mason/Charter Publishers, Inc., 1975.

The Yom Kippur War. Garden City, N.Y.: Doubleday and Co., 1974.

ARTICLES

"Armor Anti-Armor an Army Times Forum" Army Times 17 October 1988 pp. 14-18.

Biryukov, G. "Antitank Artillery" Soviet Military Review January 1983 pp. 24-26.

Bolte, Phillip L. "A Case of Foot Dragging the Mobile Protected Gun System" Armed Forces Journal July 1983 pp. 74-76.

Bonsignore, Ezio. "Infantry Anti-Tank Weapons: Where to Go?" Military Technology December 1987 pp. 35- 49.

Dean, Scott D. "Marines Grapple with Requirements for LAV Assault Gun" Armed Forces Journal International October 1988 pp. 26-27.

Donnelly, C.N. "Soviet Tactics for Overcoming NATO Defenses: Part 1" Infantry September-October 1980 pp. 20-26.

"Soviet Tactics for Overcoming NATO Defenses: Part 2" Infantry November-December 1975 pp. 16-23.

Donnelly, Tom. "Soviet Plan Exotic Tank for the 90's" Army Times 10 October 1988 pp. 31-32.

Doughty, CPT R.A. and Holder, Cpt L.D. "Anti-tank Doctrine" Infantry March-April 1976 pp. 16-20.

English, LTC John A. "A Historical Perspective on Anti-Armor" Marine Corps Gazette December 1985 pp 30-37.

Finlayson, LTC Andrew R. "The Need for an Assault Gun" Marine Corps Gazette September 1987 pp. 56-60.

Goodman, Glenn W. Jr. "Joint Hypervelocity Missile Tests Near: Potential Low-Cost Tank-Killer of the 1990's" Armed Forces Journal International September 1987 pp. 22-24.

Hollingsworth, LTG James F. and Wood, MG Allan T. "The Light Armored Corps - A Strategic Necessity" Armed Forces Journal January 1980 pp. 20-24.

"Hypervelocity Missiles for Tank Guns" International Defense Review February 1987 p. 244.

Jones, Phillip Dwight "US Antitank Doctrine in World War II" Military Review March 1980 pp. 57-67.

Kershaw, Lieutenant Colonel R.J. "Lessons to be Derived from the Wehrmacht's Experience in the East 1943-1945" Journal of the Royal United Services Institute for Defense Studies September, 1987 pp 61-68.

Knyazkov, V. "100-mm Antitank Gun MT-12" Soviet Military Review October 1983. pp. 26-28.

Koerner, Craig and O'Conner Michael "The Heavily-Armored Gun-Armed Main Battle Tank is not Optimized for Mechanized Warfare" Armor May-June 1986 pp. 9-16.

Krapke, Paul-Werner "A Design Concept for a Heavy Tank-Destroyer" International Defense Review March 1983 p. 341-344.

"Time Perhaps to Rethink Anti-Tank Warfare Concepts" Armada International April/May 1988 p. 19-24.

Livingston, JPT Noys B. "Blitzkrieg in Europe: Is it still Possible?" Military Review June 1986 pp. 26-38.

Loginov, M. "Tanks on the Offensive" Soviet Military Review April 1983 pp. 18-20

Lopez, Ramon L. "US Army Anti-Tank Update" International Defense Review October 1987 pp. 1371-1372.

Lynch, Eugene M. "The Chink in Our Antitank Armor" Armed Forces Journal November 1983 pp. 52-58.

McCreight, MAJ Richard D. "Killing Armor in the Middle Ground" Infantry March-April 1988 pp. 14-16.

O'Neill, CPT Timothy R. "Needed Now: An Anti-Armor Doctrine" Armor January/February 1976 pp. 18-24.

Powell, M. Phillip "Supersonic Tank Terminator" International Combat Arms May 1988 pp. 16-19.

Schemmer, Benjamin "Army Decides to Push for Light Tank Reviving Canceled Armored Gun System" Armed Forces Journal International August 1987 pp. 24-26.

Stone, Walter "Recent Developments in Infantry Weapons" Armada International November/December 1987 pp. 59-68.

Thompson, Robert A. "Lessons Learned from ARMVAL" Marine Corps Gazette July 1983 pp. 36-44.

DOCUMENTS

Dunham, Emory A. "Tank Destroyer History" Army Ground Forces Study no. 29. N.p.: Historical Section, Army Ground Forces, 1946.

Field Manual 18-5, Tank Destroyer Field Manual Washington D.C.: War Department, 16 June 1942.

Field Manual 18-5, Tank Destroyer Field Manual Washington D.C.: War, 18 July 1944.

Field Manual 18-20, Tactical Employment of Tank Destroyer Platoon Self-Propelled Washington D.C.: War Department, 9 May 1944.

Field Manual 18-22 Tank Destroyer Reconnaissance Platoon Washington D.C.: War Department, November 1944.

Field Manual 100-2-1 The Soviet Army Operations and Tactics Washington D.C.: Headquarters Department of the Army, 16 July 1984.

Field Manual 100-5 Operations Washington D.C.: Headquarters Department of the Army, 5 May 1985.

Huntoon, MAJ David H. Jr. "Tank Destroyers -- A New Look at Old Doctrine" Fort Leavenworth, Kansas: U.S. Army Command and General Staff College, 14 December 1987.

CONVERSATIONS

Gabel, Dr. Christopher R. concerning unit organizations for modern tank destroyers.

Gebhardt, MAJ James F Several concerning Soviet anti-tank tactics.

Linke, LTC Carl E. 17 September 1988 re: Echo Company