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STUDY PROJECT

THE FUTURE OF THE TANK!

BY

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USAWC CLASS OF 1991

U.S. ARMY WAR COLLEGE, CARLISLE BARRACKS, PA 17013-5050

Unclassified
SECURITY CLASSIFICATION OF THIS PAGE

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 Approved for public release. Distribution is unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION U.S. Army War College 6b. OFFICE SYMBOL *(If applicable)*	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS *(City, State, and ZIP Code)* Carlisle Barracks, PA 17013-5050	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)*
The Future of the Tank

12. PERSONAL AUTHOR(S)
Lieutenant Colonel David B. Kent

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT *(Year, Month, Day)*	15. PAGE COUNT
Individual Study	FROM _____ TO _____	91-4-5	24

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS *(Continue on reverse if necessary and identify by block number)*
FIELD	GROUP	SUB-GROUP	

19. ABSTRACT *(Continue on reverse if necessary and identify by block number)*

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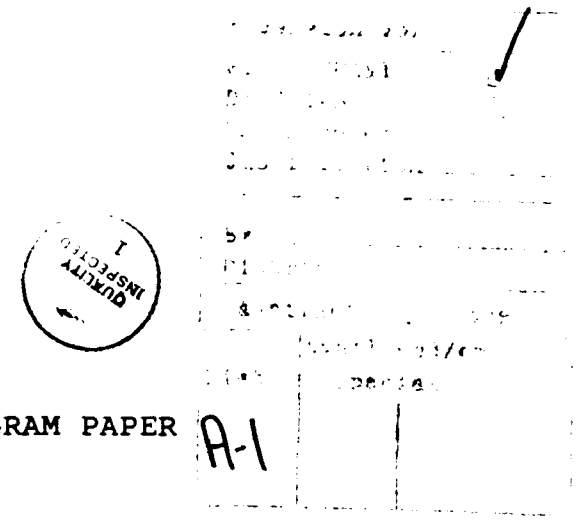
This exploration begins with a review of the history of the tank and its role on today's battlefield. Next, the author analyzes the role of the tank in both the near and far-term future. In both cases, it is determined that the tank will fill an essential role on the battlefield. This project finds that while its design and the technologies it utilizes may radically change, the military principals that it fulfills will remain the same. Therefore, the author concludes that the role of the tank will remain as important in the future as it has been for the past 75 years.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION	
☐ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS		
22a. NAME OF RESPONSIBLE INDIVIDUAL LTC Wayne A. Silkett	22b TELEPHONE *(Include Area Code)* 717-245-3032	22c. OFFICE SYMBOL AWCAC

DD Form 1473, JUN 86 *Previous editions are obsolete.* SECURITY CLASSIFICATION OF THIS PAGE



USAWC MILITARY STUDIES PROGRAM PAPER

THE FUTURE OF THE TANK!

AN INDIVIDUAL STUDY PROJECT

by

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ABSTRACT

AUTHOR: David B. Kent, Lt Col, AR

TITLE: The Future of the Tank!

FORMAT: Individual Study Project

DATE: 5 April 1991 Pages: 24 CLASSIFICATION: Unclassified

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INTRODUCTION

Since its introduction to the battlefield in World War I, the tank has been criticized for being too large, too slow, too vulnerable, under-powered, under-gunned, and overpriced. After World War I, prior to the Korean conflict, following Viet Nam, and again after the Yom Kippur War, the tank was even declared obsolete.

In 1958, a U.S. blue-ribbon panel of civilian experts concluded that "the tank killer of the future would be the long-range missile rather than the kinetic energy round fired by the tank gun."1 The lead article of the January-February 1972 issue of Armor magazine announced "The Death of the Tank." The author claimed that the tank "has evolved to the stage of imminent extinction because it has become increasingly inefficient in an age which demands more of machines than ever before."2

In spite of these predictions and assessments, the tank has emerged and remains the primary offensive weapon on the battlefield. The current Department of the Army Operations Manual, FM 100-5, declares that the tank's "firepower, protection from enemy fire, and speed create the shock effect necessary to disrupt the enemy's operations and to defeat him."3 This paper explores reasons for this dramatic turnaround. I will examine the history of the tank and its role on today's battlefield. Finally, I will analyze the role of the tank in the future.

BACKGROUND

The development of armor and the concept of using a heavy offensive weapon on the battlefield has evolved over thousands of years. The current concept is basically the same as when hide shields and short thrusting swords were used to dominate the battlefield with soldiers well armed and protected from the enemy.

Three hundred years before Christ, Alexander the Great understood this concept and employed the infantry phalanx and heavy cavalry formations. These cavalry formations were the "innermost core" of his army. "They provided the battle-winning shock force of his army and he almost always took a station at their head."4 The mission of Alexander's early armor formations was to penetrate gaps in the enemy's lines and then to "exploit" these penetrations with thrusts deep into the enemy's rear. These heavy formations on an enemy's exposed flank or rear were often enough to panic front line soldiers. Once the enemy's nerve was shattered, the attack could result in annihilation of the enemy forces especially in the wake of a successful pursuit. Thus, the fundamentals for today's AirLand Battle Doctrine were formulated thousands of years ago.

Even before Alexander implemented the concept of "heavy", highly mobile formations, the predecessor of today's main battle tank was in use - the chariot. Indeed, "the problems faced by chariot designers were surprisingly similar to those that confront today's tank designers."5 These same issues: size of crew, horsepower, weight, amount of armor protection, type of

weapon systems employed, and logistical support requirements were all key areas of interest for chariot designers several hundred years B.C.. It can also be argued that discussions concerning cost effectiveness occurred during the chariot's era.

The dominant force that followed the era of the chariot, was the "armed and armored infantryman." We see a similar cycle that developed during the eighth to the tenth centuries A.D. First, the heavily armored knight dominated the battlefield and then the bowman armed with the longbow became the dominant force. Thus, we see a pattern of "every improvement in offense stimulates one in defence and the reciprocal process ..."6 taking place. Gunpowder transformed the battlefield during the sixteenth century. "It made the foot soldier the equal, if not the master, of the cavalryman ..."7 While we see "... it was precisely in reaction to the battlefield dominance of firepower that the tank (with its balanced portions of firepower, mobility and armor protection) first arose."8 Thus, it was the introduction of gunpowder that resulted in the British using the first "tanks" in the 15 September 1916 Battle of the Somme. Therefore, we once again see the cycle of improvements in the defense being met by improvements in the offense. This is a central theme that constantly repeats itself throughout history.

The constant struggle between offensive and defensive improvements is with us today and will continue. Ever since the tank's introduction in World War I, there have been a series of defensive weapons designed to defeat the tank and bring an end to armored warfare. During World War I, the Germans introduced the

K bullet and then the T rifle to serve as an antitank weapons. During World War II, fortified lines, anti-tank mines, the "panzerfaust" and the "bazooka" were designed to spell the doom of armored forces. In the Korean and Viet Nam conflicts, "terrain" was supposed to make the tank obsolete. Guided antitank missiles were the weapons during the Yom Kippur War that were to forever change the battlefield. However, we still see that "... the tank remains the epitome of modern large-scale land warfare."9

One of the key figures in this remarkable development of the tank and armor warfare was British Major General J.F.C. Fuller. He has been called "the most important military thinker of the century."10 His main contribution was "he was the first to see clearly how the mobility, firepower and armor protection of the tank would revolutionize warfare."11 Many of his ideas were adapted by the Germans and Soviets between World Wars and reappeared in the form of the German "blitzkrieg" in World War II and modern Soviet doctrine today.

One of the emerging world powers that quickly recognized the value and importance of the tank was the Soviet Union. One of the main driving forces behind this Soviet armor force development was Marshal Georgi Zhukov.

Prior to World War II, he was actively involved in the Red Army's massive mechanization and motorization program. In fact, Stalin personally selected him to command one of the Red Army's first two experimental tank regiments. "A great deal was required of the commander of such a regiment. Zhukov swiftly

became, in the regiment, the center from which everything stemmed: initiative, leadership, and control; he saw everything himself and as a consequence knew everything."12 He commanded this regiment for almost seven years and, in May 1930, was selected to command the Second Cavalry Brigade.

In March 1933, he was assigned command of the Fourth Cavalry Division. "During this period Zhukov and Boris M. Shaposhnikov, chief of staff of the Red Army, sought to convince the army hierarchy that the tank could play an independent role on the modern battlefield - that this new and powerful weapon must not be spread out with slower-moving infantry units, thus dissipating its strength."13

Zhukov's development of his tank theories continued and in 1936 he was selected as a principal Soviet military observer for the Spanish Civil War. "Soviet intervention in Spain allowed Zhukov and his military comrades to test Red Army theories of armored warfa in combat and to put Russian tanks through their paces."14

This civil war taught Zhukov many valuable lessons. However, the major lesson was that the tank was tested during fast-moving combat operations and proved very successful. With this lesson in mind, he returned to the Soviet Union and took command of the Third Cavalry Corps and then the Sixth Kazakh Corps.

In 1939, he once again was to experience armed conflict. This time he commanded the 1st Army Group against the Japanese in the Far East. Here he succeeded in demonstrating that armor

could be a battle winning force. His use of a hastily assembled tank brigade, during the Battle of Kalchin-Gol, had such a devastating effect on Japanese armor that this combat force required 3-4 years to recover.

Several key lessons, with regard to armor forces, were demonstrated during this conflict. First, it was once again shown that tanks could play a key role during fast-moving combat operations. "Operating in conjunction with artillery and motorized infantry, they were capable of deep-thrust actions which could knock an enemy off balance and tear through his defences."15 It was here that much of current Soviet doctrine, with regard to the use of massed armor forces, was developed. Second, the Soviets decided that their tanks had several shortcomings and defects. Therefore, Soviet research and development turned to designing a new family of armored vehicles. The result of this effort was the development of the outstanding tank of World War II - the T-34.

The armor experience gained by Zhukov during this pre-war period served him very well during the Second World War. Stalin used him as his "troubleshooter" and he was sent from one crisis to the next. His personal involvement in all major land battles between the Red Army and Nazi Germany is well known.

Marshal Zhukov is an excellent example of a military leader who saw a technological advantage, developed a doctrine to take advantage of that advance, and then convinced his country's leaders that this new doctrine was correct for the entire army. His influence is reflected today in modern Soviet doctrine and in

armor doctrine world-wide.

ANALYSIS

It is clear that technological advances in themselves are not enough to revolutionize warfare. Forward thinking is required to fully integrate technological advances into military doctrine. This process requires time and effort. We see this evolution of armor doctrine occurring in the United States from World War I to the 1986 publication of FM 100-5, our latest "operations" manual. "Only when technological change has reached deep into the doctrinal and organizational level does it begin to exert its maximum influence on the strategic level."16 We have reached such a level only through years of development and study.

Current AirLand Battle doctrine was formulated during the 1970's and 1980's to counter Soviet doctrine. It was clear that we would have to fight outnumbered and would be successful only if we could "shape" the battlefield to our advantage. This would require us to move forces quickly and precisely. Thus, we would have to muster forces quickly to fight at a time and place of our choosing. This would provide us with the initiative and the opportunity to locally outnumber the enemy. "And the key to making all this work was the tank - the primary offensive weapon."17 Specifically, we now have the M1 Abrams Main Battle Tank as the "primary offensive weapon."

This tank, with its "special armour has challenged the once prevalent view that the antitank guided weapon had spelled the end of the tank's primacy."18 Therefore, "armored units equipped

with the Abrams, with its cross-country mobility and its heavy armor, would be able to respond with unprecedented speed to the commander's order and go where no other forces could survive."19 Recently, we saw this equipment and doctrine successfully applied in the Gulf War. In this theater, we saw large armor formations led by the M1 tank. This vehicle's firepower, protection, and speed provided the commander with the shock effect necessary to soundly defeat Iraqi ground forces.

But what of the future? Will the tank remain the "epitome" of large scale land warfare or will it, in fact, become obsolete? Of course, this is a very difficult question to answer. History indicates that the constant struggle between the offense and the defense will continue. With every advance in tank killing systems, there will be an advance in offensive capability. One author argues that the "greatest threat is likely to come from guided, primarily indirect fire, anti-armor weapons."20 He states that a "porcupine" type anti-missile missile system could be employed to protect large armor forces. Thus, we see a situation developing very similar to the situation in the Persian Gulf Crisis. There, the enemy employed the SCUD missile system, only to have it shot down by the "Patriot" anti-missile missile system. The same author argues that the kinetic energy projectile will remain the other major threat to tanks. He states that "if a lump of extremely dense metal were to hit a tank at over 3,000 miles per hour, no amount of ingenious armour would save it."21

American military planners appear to agree with both

conclusions. Support for this statement is seen in development of the new Line-of-Sight Antitank (LOSAT) weapon system. The heart of the LOSAT program is the Kinetic Energy Missile (KEM). This hypervelocity missile appears to be the first weapon of its type utilizing kinetic energy technology.22 Therefore, the U.S. appears to be set on the course of developing a "KEM" for use against armor.

Does this imply that missiles will replace our tanks as the greatest threat to enemy armor? It appears that the contrary will be true. "The tank remains the only vehicle able to fight and move under artilley fire and will remain a crucial component of major land warfare certainly for the next quarter century."23

U.S. military planners appear to agree that the tank will remain the crucial component of land warfare. The Army is currently implementing the Armored Systems Modernization (ASM) Program which calls for development of six heavy armored vehicles. At the heart of this Program is the Army's new Main Battle Tank (MBT) the Block 3 tank.24 This new Block 3 tank will have several new components including an advanced fire control system, a new-generation targeting system, and a machine that rapidly loads ammunition into a more powerful 140mm cannon. The critical component of the Block 3 is the Advanced Tank Cannon System (ATACS). The ATACS includes the XM291 140mm gun, the XM91 Auto-loading System, a highly sophisticated fire control system and the multi-sensor Target Acquisition System. This system will double the muzzle velocity of the current M1A1 120mm cannon while reducing the current four man crew to three.25 On-going with

development of this "heavy" tank will be several "light" tanks. These vehicles will be members of the Armored Gun System (AGS). The AGS is to have three different armor configurations. They will vary in weight from 17 1/2 to 21 tons, will be tracked or wheeled and armed with a 105mm cannon. These vehicles will be developed to offset the airlift problems associated with the heavy tank.26

The development of these tanks has been done by the U.S. planners while "making 3 tacit assumptions:

that a main battle tank in the generally understood sense of the term has been and still is the primary surface-to-surface weapon system in non-nuclear mechanized warfare:

that such a tank, mounting a high performance gun of rather large caliber, excels both as an instrument of shock effect and as a means of defense against hostile tanks;

that there is a rather high correlation between the operational requirements stated for a tank and its leading design characteristics."27

These assumptions are the same that have been used for the last 2-3 generations of tanks. However, there is once again a body of critics claiming these assumptions are no longer valid. There is a group of "experts" who claim that the armed helicopter will soon dominate the battlefield. Another group claims that "a

tank is now only as good as the air situation in which it operates and the air defense system which supports it."28 A third group states that modern munitions require a new radical or extreme tank design.

The majority of the world's military powers concur "that we are entering a period, probably of 15 to 20 years, in which the sole fully effective antitank weapon system will be the tank gun delivering kinetic energy."29 Thus, we see the reasoning responsible for the United States' current family of armored vehicle development. A similar concept of vehicle development is being utilized throughout the world. It is therefore obvious there is basic agreement for the near-term future. However, there is little agreement to what the far-term future holds.

Today's military equipment designers seek solutions to many of the same questions chariot designers faced. However, the basic question remains: "How to protect the soldier while arming him with a heavy weapon system that will dominate the battlefield?"

The solution to this question remains the best method of using technological advances to balance the requirements for mobility, survivability and firepower. At this crossroads there are many different opinions. The U.S. position has clearly focused on crew survivability. From this position emerged the concept of a "crew pod". This concept "... led to the notion of cocooning the crew in a pod which would give them the highest feasible levels and optimum balance of ballistic and nuclear protection."30 The other subsystems of the tank would be added

to the frame which houses this pod. This concept calls for a very small crew area and subsystems which could be added on. Thus the notions with regard to 2 or 3 man crews, auto-loading cannons and turretless vehicles were born.

Several present day vehicles heralding tanks of the future are the U.S. M1A1, the Israeli' "Merkava" and the Swedish S tank. The M1A1 demonstrates the emphasis on crew survivability by separating the crew from the vehicle's ammunition supply. This allows the crew to survive destruction of the tank's main gun rounds. With this concept, ammunition is stored in a special compartment separated from the "crew pod" by steel ballistic doors. To obtain a round, these heavy steel doors are briefly opened, then quickly closed automatically. Also, the top of this compartment is covered with blowout panels. Thus, energy released by the destruction of ammunition would be directed up and away from the protected "crew pod." "The crew is also protected from nuclear, biological, and chemical (NBC) weapons by a system that purifies outside air before it enters the turret."31 Additionally, the M1A1 has thicker and much improved armor. This improved Chobham armor uses depleted uranium.

This use of technology to further enhance crew survivability, creates a different problem for the designers of tank killing systems. A very small crew pod would be very difficult to hit. In fact, were the crew reduced to only two members, the pod would be smaller than the probability of hit area for modern tanks at extended ranges. It is also possible to make the pod extremely "hard" while keeping it relatively light.

Finally, crew survivability could be maximized in all aspects, including NBC protection.

The Israeli "Merkava" also provides an example of the future tank. When the Israelis designed the "Merkava", they were determined to create an entirely new vehicle. They, too, made crew survivability their number one priority. They produced a tank with a front mounted engine, a rear crew compartment, a slanted front slope and a small, well-shaped turret. Thus, "the "Merkava" represents perhaps a limited and traditional response to problems of tank design and to very specific lessons."32

Finally, the Swedish S tank may provide us with the best current example of the tank of the future. "The S tank concept has great design advantages, most of them stemming from a dramatic reduction in armored volume compared with the turreted tank."33 The S tank is swimmable and turretless. It has a heavily sloped frontal area and incorporates a "crew pod" system. The crew consists of three, with the potential for reducing that to two. The turretless concept allows for the main gun to be mounted either inside the vehicle hull or externally.

This design offers several firepower, mobility and protection advantages. First, an externally mounted gun could be of a very large size, and caliber, but attached with few disadvantages. Next, reduced weight, due to the lack of a turret, increases mobility. Finally, reduced silhouette and additional hull protection for the crew could also significantly improve crew protection.34

These modern day tanks are examples of the near-term future

for the armor force. However, what will the next several generations of tanks look like?

The "crew pod" concept appears to be the start point. This statement is especially true from the U.S. Army's perspective. The U.S.'s priority on crew survivability indicates that development of the pod will be given top priority and be the core for all future tank design. It also seems that the tank hull will be the location for this "pod" to further protect a reduced crew. The future vehicle will be turretless and probably have a powerful gun mounted externally on the hull. A complex automatic loading system will be included and the powerful cannon could be of a new revolutionary design. The focus will remain on high velocity projectiles but they will likely be propelled by a liquid propellant or be rocket assisted. The enhanced armor protection system may include an electronic shield. This shield could either serve to destroy incoming projectiles or serve as an early warning system for the anti-missile missile system used to protect the armor force of the future.

It also appears that the tanks of the future will be smaller rather than larger. "One factor is that tanks have to get over or under bridges, and to be carried on rail flats. Continental railways are designed around wagons up to 4.4 metres high and 3.55 wide, and tanks have to fit those dimensions."35 This fact is already a problem for today's armor force. Since the M1 already exceeds the width of most European rail cars, rail movement of our main battle tanks is of serious concern. This problem is compounded by the fact that this vehicle is

approaching 70 tons in weight. This causes many transportation problems. It severely stresses the bridge and road systems, especially in Europe, and it seriously limits air transportation possibilities. Therefore, it logically appears that the tank of the future will be smaller rather than larger. However, the most logical solution seems to be a "light" tank for our contingency or quick reaction forces and a "heavy" tank for our heavy divisions. The requirement for both types of armor vehicles was demonstrated during the recent Gulf War.

Finally, the tank of the future will be very mobile. Does this mean that there will be a new design for the vehicle's main power pack?

It will require several enhancements of the current main power packs to be satisfactory in the future. Foreign tank designers all favor a diesel power pack. U.S. designers, strongly encouraged by Congress, concluded that the multi-fuel gas turbine was the best choice. Of course, this is the type of engine utilized by the current M1 fleet. Disadvantages of the turbine system are the high fuel consumption rate and the intense thermal signature produced. However, current advantages far outweigh the disadvantages.

First, the power pack produces 1500 horsepower giving the M1 a superior power to weight ratio. Also, the turbine engine produces a much quicker response than the diesel giving the Abrams superior battlefield agility. A diesel engine also weighs more than a turbine and therefore the use of a diesel would increase the weight of any future tank. Finally, there are

several solutions to the turbine's current fuel consumption problems.

One idea is to put an auxiliary power unit (APU) on-board the tank. This APU would provide the required power to run the vehicle's thermal sights, crew lights, heater, radio, etc., while the main engine would remain off. This idea would also greatly assist with the thermal signature issue, especially at night.

In addition, "the TACOM developed Advanced Integrated Propulsion System (AIPS) turbine engine will also reduce fuel use by over 40 percent for a battlefield day and will be very competitive in fuel use with the most modern technology diesel system."36

Therefore, it appears that the multi-fuel turbine engine could remain in demand to provide the lightweight power required for the future. However, a completely new main power pack design cannot be totally ruled out.

What remains certain is that the future vehicle will combine "the three interacting qualities of firepower, mobility, and protection in almost perfect equilibrium ..."37

Will the far-term vehicle that accomplishes this perfect equilibrium be a tank? Could it be a helicopter or some other highly mobile "craft"? Some believe that the battlefield of the future will be dominated by aircraft, either fixed or rotary wing.

One school of thought believes that fixed wing aircraft will become so technically superior that campaigns could be won without the ground phase. On the surface, our experience in the

Gulf War supports this concept to a certain degree. However, it must be remembered that it will not always be possible to achieve unopposed "air supremacy", as well as, totally destroy the enemy's air defense systems. In fact, the future battlefield may become more, not less, dangerous for very expensive fixed wing aircraft. Also, history, to include the Gulf War, clearly shows "that you may fly over a land forever; you may bomb it, atomize it, pulverize it, and wipe it clean of life - but if you desire to defend it, protect it, and keep it for civilization, you must do this on the ground, the way the Roman legions did, by putting your young men into the mud." 38

Rotary wing aircraft could be the new dimension on the future battlefield. These aircraft could operate in the zone between fixed wing and ground systems. They are able to operate over extended distances, carry large amounts of ordnance, and are highly mobile. All these qualities appear to be essential for any future battle.

However, they have neither the anti-armor firepower nor the protection of the tank. Therefore, it appears that their rightful role should be in addition to rather than as a replacement for the tank.

Working with armor forces, the helicopter could provide an additional means of destroying enemy armor, protecting the flanks of friendly formations, and extending the FLOT. The range of the helicopter allows it to strike the enemy deep in front of and behind the FLOT. It can function as a troop carrier and as an attack element. Therefore, it can and will effect the "deep" and

"rear" battlefields like no other system. The enemy will have to be concerned about large helicopter formations far in his rear and/or on his flanks. These formations could be very effective after a penetration and in the development of a pursuit. They could also be effectively used to stop an enemy penetration and be the quick reaction force for the rear battle. They would also have the capability to destroy enemy helicopter forces. Thus, the future may have air, land, sea, and helicopter battles all being conducted at the same time. The U.S.'s development of the LHX (Light Helicopter Experimental) supports the belief in the role of the helicopter in the future. However, their role will remain as a "complement to tanks and not as a substitute for them." 39

The concept of combining the tank and the helicopter has also been expressed. It was publicly discussed by German General Dr. Ferdinand von Senger und Etterlin, "beginning with a lecture at the RUSI in February 1983 which centered on the Main Battle Air Vehicle (MBAV) concept." 40 This concept calls for an attack helicopter, like the AH-64 Apache, to function like a light tank and a helicopter that can carry troops, like the Mi-24 Hind, to function as an IFV. This MBAV would be designed to replace lift helicopters, attack helicopters, light tanks, and ground anti-helicopter systems. It appears that this concept has real potential for the far term future. This is especially true with regard to trafficability and water obstacle crossing. A "flying tank" would be able to transverse terrain that is currently "no go" for armor vehicles. However, it must not be forgotten that

helicopters are still extremely vulnerable, complicated, expensive, and to a large degree, dependent upon favorable weather conditions.

CONCLUSION

The tank has frequently been called obsolete since its introduction during World War I. However, according to our Army Chief of Staff, GEN Vuono, today's armor force is still "at the heart of the Army." Currently tanks hold a key and essential role on the modern battlefield. Their mobility, firepower, and survivability combine to create the primary offensive weapon. The current M1A1 is the epitome of a weapon system required for fast-moving combat operations. The result of our doctrine and this equipment was demonstrated during the recent Gulf War. In this theater, large armor formations, led by the M1 tank, were able to out-flank the enemy while attacking over 100 miles per day. The direct result of their actions was the destruction of over 40 Iraqi combat divisions.

It is basically agreed upon that the tank will remain the critical component of major land warfare for the next quarter of a century. The U.S. Army certainly supports this belief and is currently planning to implement the Armored Systems Modernization Program. This program will include both a "light" tank family and the successor to the M1A1, the Block 3 tank.

The far-term future holds many more questions for the tank. However, "as long as contemporary custodians of the armor tradition continue to search out new technologies that improve

the capabilities of their machines, and create new organizational and doctrinal forms to govern their use, the tradition of Fuller, Liddell Hart, and Guderian will live on -- even if the machines themselves bear little resemblance to those of earlier eras." 41

These new technologies will certainly include electronics and new "hard" materials. The priority for future tank design will remain on crew survivability. Thus, the "crew pod" concept will likely be the cornerstone of future design. These future tanks will be smaller, highly mobile, and carry a very powerful weapon system. In fact, these "tanks" may be able to fly!

In summary, a combination of air and ground systems could well characterize warfare of the future. But as long as over 30 countries have more than 1000 tanks and over 15 of these have over 2000, armor will remain the dominant battlefield factor.

Fixed and rotary wing aircraft, and kinetic energy missiles will be developed to destroy these armor vehicles. However, as history has shown, these defensive improvements will be equalled or exceeded by offensive armor capabilities. Technologies may radically change but the basic principles of warfare will remain the same. Therefore, the important of applying massed strength against enemy weaknesses will remain valid. We will continue to place our men into the mud to achieve our military objectives and to destroy enemy forces to obtain the operational center-of-gravity.

Thus, the role of the tank and armor formations will remain as important in the future as they are currently and as they have been for the past 75 years. We must "stay the course" because

"military history has shown that mistakes in assessing the effectiveness of the tank or in its use can be fatal." 42

ENDNOTES

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