

# **JAVELIN: THE NEW CHESS PIECE FOR THE BRADLEY INFANTRYMAN**

**A MONOGRAPH  
BY  
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Infantry**



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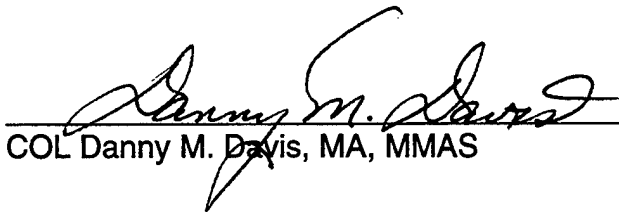
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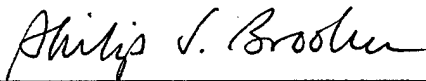
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## ABSTRACT

**Javelin: The New Chess Piece for the Bradley Infantryman** by Major Emmett M. Schail, USA, 45 pages.

The Army is currently replacing the outdated Dragon medium antiarmor missile with the much more capable Javelin manportable antiarmor missile. The new missile is a tremendous improvement over the old system, not merely a small step but a leap in capability for the dismounted infantry forces. The capabilities of this missile require that our Army examine how we intend to integrate it into our infantry forces and understand that the tactics of employing the Javelin are significantly different than those of the Dragon.

This monograph compares the currently deployed Dragon medium antitank missile to the soon to be fielded Javelin medium antitank missile. The monograph also examines whether the current tactics and doctrine for employment of the Dragon are sufficient for the new missile. The premise is that the current tactics for use of the Dragon must be reevaluated in light of the greatly enhanced capability of the Javelin missile system.

The monograph begins with a technical comparison and examination of the two systems through the use of six critical attributes of manportable, antiarmor systems. These attributes are lethality, rate of fire, range, gunner survivability and protection, portability, and ease of training. Next, the monograph examines the coevolution of armor and antiarmor systems in order to show the importance of organizational, tactical and doctrinal changes in maximizing the capabilities of any new weapon.

The monograph then analyzes the use of the Dragon in Bradley infantry units with the purpose of illustrating how the weapon limits commanders and soldiers due to its capabilities. Tactical employment of the mechanized company team and the dismounted infantry element are considered.

Finally, the monograph examines the Javelin and the leap in capability provided by this system. Retaining Dragon based tactics and thinking will prevent the realization of the full potential of the Javelin. This new weapon has the capability to significantly increase the company team's firepower and maneuver options. Only by updating our doctrine and procedures will we be able to take full advantage of the capabilities of the Javelin.

The monograph concludes that the current Dragon based tactics will not maximize the capabilities of the Javelin and that the Army, units, commanders and soldiers need to examine the best uses for the Javelin, not simply substituting it for the outdated Dragon.

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The new Javelin antitank missile currently being fielded to US Army light infantry units will enter service with Bradley units first in the 2 I.D. in 2001, then with 3 I.D. and other Bradley forces beginning in 2002.<sup>1</sup> Will the current Army tactical procedures and doctrine maximize the capabilities of this new system or must they change to exploit the advantages of the Javelin? Certainly this question needs to be asked.

The new system, the Javelin, provides an extensive improvement over the Dragon missile that it replaces. The Javelin is a fire and forget system providing first round hit probabilities exceeding 90% at ranges greater than 2500m.<sup>2</sup> The gunner can select top down attack mode for armored targets or direct attack against enemy fortified positions. The missile can destroy all currently deployed threat armored vehicles, uses a second generation thermal sight thus extending battery life and resolution, can be fired from within fortifications or buildings, and is fully man portable.<sup>3</sup>

The currently deployed Dragon is a wire guided missile requiring the gunner to track the target until missile impact. This prevents him from seeking cover immediately after launch. Missile range is limited to 1000m, with flight time of 11.2 seconds at max range<sup>4</sup>, creating a significant threat to the gunner as he is within enemy machine gun and main gun range. The Dragon uses first generation thermal sights, limiting battery life and resolution, and cannot be launched from within most fortifications. Due to the combined effects of a hard launch, tracking

time and missile capabilities, the Dragon system may at best have a 50% probability of hit. Test results, however, indicate that a conservative estimate for hit probability in tests is closer to 20%.<sup>5</sup>

This quick overview of each missile system shows the Javelin provides a leap in capability for our infantry forces, both light and mechanized. The current tactics, drills and doctrine for employment of Bradley dismounted infantrymen do not stress the use of man portable antiarmor systems due to the preponderance of other effective systems such as the TOW, 25mm, and M1 tank deployed in task forces and the perceived ineffectiveness of available man portable systems. Army FM 7-7J, Mechanized Infantry Platoon and Squad (Bradley) published in 1993, devotes a full 3 pages out of over 300 to the employment of the Dragon system.<sup>6</sup> The limited coverage to dismounted antiarmor tactics suggests that the Dragon is of limited value to the Bradley infantry squad and platoon. Should current doctrine change to reflect the new capabilities of the Javelin? If so, what changes are needed to take full advantage of this new system in our current force and how will the Javelin's increased capabilities interact with the other new enhanced systems being fielded such as the M2A3, MPIM, soldier systems and small arms improvements?<sup>7</sup>

This monograph will examine where our mechanized forces are in their doctrinal employment of their organic, dismounted infantry, centering on the antiarmor tactics based on the Dragon. It will briefly examine the historical roles and tactics of dismounted infantrymen to understand how they fight armor and progress to a recommendation of possible missions and tactics for dismounted

infantrymen in light of the Javelin system.

Why should we look at the effects of this new system on our combat forces? Is the Javelin not just another weapon that simply makes incremental improvements over the capabilities of its predecessor? On the surface the Javelin may seem to be an incremental improvement over the Dragon, but blind substitution of weapons without considering differences in capabilities may lead to less than optimal employment of the Javelin.

The battlefield is a complex system composed of a nearly infinite number of variables each acting on the other. Dorner in The Logic of Failure states “The more variables and the greater their interdependence, the greater the system’s complexity. Great complexity places high demands on a planner’s capacities to gather information, integrate findings, and design effective findings. The links between the variables ...make it impossible for us to undertake only one action in a complex system.”<sup>8</sup> Essentially, by changing one key variable we must look at the ramifications of that change to the system. Several historical examples follow showing the impact of introducing a new weapon and its corresponding impact on tactics and the battlefield.

The arquebus came into general use in Europe after 1550, largely replacing the archer in delivering missiles. Initially it was employed in the same manner as the bow with gunners deployed on line, firing, then remaining to reload. The reload time was so long, however, that the gunners were readily killed without the protection of pikemen. It took 50 years for tactics to evolve into several rows of infantrymen, alternately firing on the enemy.<sup>9</sup>



At the start of the American Civil War few repeating rifles were used by either army even though an effective weapon was demonstrated to President Lincoln as early as 1860. In 1863, at the battle of Chickamauga, part of Wilder's Brigade, armed with the Spencer repeating rifle which had been purchased with private funds, delayed a full Confederate division at a critical creek crossing for five hours. Wilder's force was mounted, able to move quickly and fought as infantry with their new rifles. This made them a potent yet unexpectedly lethal force in the battle and finally raised interest in the new weapon as well as the new mounted tactics.<sup>10</sup> The Army, in this case, reacted in just a few years but only did so after stumbling into success. These new weapons may have had a significant impact on tactics if they were properly introduced earlier in the war, even perhaps, shortening the bloody conflict.

Lastly, consider the Afrika Corps in 1941. The Germans deployed to the North African desert with 37mm antitank guns finding them not as capable as desired against British armor. This gun was controlled and fired by one man and was useful primarily in the defense due to short range and low penetration. As the Germans received their new 50mm PAK 38 with 1000m range and better penetration power they discovered through trial and error that their tactics could change. The new weapon was effective in supporting the movement of armor and infantry forward during attacks. The Germans began to leap-frog their AT guns with panzers so as to capitalize on the integrated effects of both. It took some time for the British to answer the new tactics.<sup>11</sup>

Each of these historical examples provide evidence that as new systems are

fielded it is incumbent upon an army to consider the systemic effects of that system. To not do so disregards the potential gains in effectiveness the system may provide with just minor tactical, doctrinal or organizational changes. Adoption of a new weapon causes uncertainty, hesitation, and inability to use it to its fullest capabilities until leaders and soldiers investigate and gain confidence in the weapon themselves. <sup>12</sup>An analysis of the Javelin and its optimum employment on the battlefield is necessary to understand its effect on our current tactics and doctrine.

## Chapter 2.

Understanding how the characteristics of each weapon influence its employment requires that we know the role of that weapon on the battlefield. In the case of the Javelin, what is the role of the man portable ATGM in the dismounted squad tactics of an M2 Bradley unit? Understanding the role of the ATGM requires an examination of the role of infantry on the battlefield.

According to Colonel John Weeks, author of Men Against Tanks, the infantry must:

- a. Hold ground against enemy armor and infantry attacks and provide a firm pivot for counterattacks or other maneuvers;
- b. Dominate and control the close country;
- c. Close with the enemy and clear him from his defensive positions; and,
- d. Carry out observation, reconnaissance, and provide early warning.<sup>13</sup>

General George Patton believed the purpose of the tanks in the infantry divisions was to get the infantry forward and the purpose of infantry in armored divisions was to protect the tanks until they could use their weapons on enemy

infantrymen.<sup>14</sup> On the mechanized battlefield dismounted infantrymen must be able to destroy armored vehicles to accomplish their mission.

Infantrymen have used man portable antitank weapons since the Mauser Tank rifles of WWI.<sup>15</sup> Experience demonstrates that the most important characteristics of a man portable antitank weapon are its accuracy, penetration or lethality, rate of fire, range, the protection or survivability afforded the crew or soldier, and weight or portability.<sup>16</sup> An additional factor, critical to today's Army, with its low fill rates in most M2 units,<sup>17</sup> and to any army in combat, is the ease of training of the weapon. Essentially, soldiers must be able to gain proficiency on the weapon quickly even in an environment with high turnover rates and little training time.<sup>18</sup>

A brief examination of these important characteristics of manportable weapons follows:

1. Probability of Hit and Lethality (Pk).

The infantryman is most interested in killing his target with the first shot, increasing his own chances of survival and allowing him to move on to other threats. Probability of hit (Ph) and lethality (Pl) can be combined with a missile reliability function (Pr) to form a first round probability of kill or Pk where;  $Pk = (Ph)(Pl)(Pr)$ .<sup>19</sup>

A higher Pk value is obviously critical to any battlefield but particularly today. The infantryman of today's mechanized infantry division is well armed and supported but few in number. He probably has few missiles to fire, perhaps only one, and not much time. His survival and that of his unit may depend on the

destruction of a few enemy vehicles at the right time and place.

## 2. Rate of Fire.

On a sterile battlefield the rate of fire determines the number of targets a gunner may engage in a period of time. The terrain, environment, target speed and other factors influence the true rate in a given situation, however, for this criterion a common threat speed of 20 kph is used. The rate of fire, simply, is the number of shots a gunner may potentially fire over the weapon's max effective range given reload times and target travel time.

Rate of fire gives planners an idea of the number of targets a gunner may engage in a given situation, offense or defense. It can assist in calculating the number of missiles required, the potential targets destroyed and the combat potential of a unit. It must be used with the other factors, of course, such as Pk, training, unit competence, and threat.<sup>20</sup>

## 3. Range.

Longer range is certainly a critical factor to any direct fire killing system but, for a man portable ATGM what does that added range do for the soldier and is the weapon equally effective throughout the range?

The dismounted infantryman is vulnerable to virtually all the weapons on a battlefield and seeks to reduce his vulnerability at every chance. ATGM's with ranges greater than the threat main gun range are ideal yet not always possible. Extending the range beyond effective enemy machine gun and small arms fire reduces vulnerability. Ideally, the weapon should remain consistently effective throughout its range otherwise the employment of the weapon is further

complicated.

The next advantage of longer range is the greater rate of fire, or more accurately, the more opportunities the gunner may have to engage a threat from a given position.<sup>21</sup>

#### 4. Gunner Survivability and Protection.

Protection is afforded an infantryman by many factors such as terrain, speed, fortifications, movement, camouflage, and armor. The capability of firing the ATGM from the gunners fighting position, how long he must remain exposed to fire and the signature of the weapon upon launch impact heavily whether the soldier lives or dies.<sup>22</sup> Every infantryman is critical to the success of the unit and a weapon which increases the chances of his survival is most valuable.

#### 5. Portability.

The essential distinguishing characteristic of these systems is that a man or small crew can carry and employ the weapon to destroy enemy armor and fortifications. The limitations are that the soldier must reach the launch position in time to be useful and physically capable of performing his tasks. Weight of the system as carried to include extra missiles must be part of the measure.<sup>23</sup>

#### 6. Ease of Training.

The weapon should be easily and quickly put into action by soldiers of less experience and training and perform at near full capability. This is a tall order for many systems but imperative in today's high turnover environment and emphasis on readiness. Time may not be available to train replacements in a theater, or upon deployment notification to get gunners ready for combat. A

weapon less dependent on the differences in gunner skill and training offers a distinct advantage over one requiring more training.<sup>24</sup>

#### The Dragon.

The M47 Dragon entered service with the US Army and USMC in 1973<sup>25</sup> as a fully man portable, semi-automatic command, line of sight (SACLOS), wire guided missile. In this guidance system the gunner must track the target from launch to impact while the missile automatically flies to the point of aim. Commands from tracker to missile are relayed via a wire played out of the missile in flight and requires collimation of the tracker to within .1 mil.

The Dragon is carried in three parts; the missile in a fiberglass disposable tube, day sight or tracker, and infra red night sight or tracker (which requires batteries and coolant bottles to operate). To fire, the gunner mates the missile to a sight, extends the bipod legs resting the forward end on the bipods and the rear on his shoulder. Once the target is acquired the gunner presses the trigger firing a small recoilless charge and expelling the missile several meters from the tube. Rocket motors then begin to fire sequentially based on missile attitude.<sup>26</sup>

Minimum range is 65m and maximum range is 1000m with a time of flight to 1000m of 11.2 seconds and nearly constant missile velocity after motor start.<sup>27</sup>

#### Comparison criteria.

##### 1. Pk.

In testing live missiles against stationary, exposed T72's, Dragon Pk mean from minimum to maximum range was 40%. At less than 250m but greater than

100m, Pk mean approached 75% while at 1000m Pk dropped to about 10%.<sup>28</sup> Army Missile Command (MICOM) historical data shows a lower mean Ph than that experienced in the above test sequence possibly due to different target sets and ranges. This negative shift in Ph would cause an even lower Pk due to the commutative properties of the function. The result is, perhaps, an optimistic conclusion of Dragon Pk. MICOM also asserts that 75% of misses are attributable to the launch as the gunner adjusts to a lighter tube and to gunner tracking error in the last seconds of flight.<sup>29</sup>

## 2. Rate of Fire.

Field Manual 23-24, Dragon Medium Antitank/Assault Weapon System M47, sets the standard at 30 seconds to put the weapon system into firing position. The task includes mating the missile and tracker, getting into firing position, acquiring the target, and firing. Missile track time can take up to 11 more seconds depending upon range so, conceivably the gunner may fire about every 40 seconds.<sup>30</sup> Field tests confirm that about 40 seconds are required depending on gunner skill.<sup>31</sup> A target array (or an enemy tank company) moving toward the gunner from 1000m at 20 kph (333m/min) requires 3 minutes to travel the distance. On ideal terrain a trained gunner could, at most, fire 4 missiles assuming he survived.

## 3. Range.

The Dragon engages armor from 65m to 1000m. Effectiveness given range is considered within the Pk parameter. The day and night sights offer some utility in observation but usefulness degrades significantly after 1000m.<sup>32</sup>

#### 4. Gunner Survivability and Protection.

ATGM gunner survivability is influenced by a number of factors on the battlefield. These include camouflage, weapon signature and effectiveness, unit leadership and training, terrain, and launch position.<sup>33</sup> The characteristics of the Dragon limit potential protective measures as it cannot be fired from small enclosures, must have a clear back blast area, creates a significant launch signature, and the gunner must remain in position to track the target to missile impact. Test data in defensive, force on force scenarios show a 66% survival rate and in offensive scenarios a rate of 79%.<sup>34</sup>

#### 5. Portability.

Weights: Missile = 28.9 lb.s, Day sight = 8.5 lb.s, Night sight = 36 lb.s.

Carry Weight total: day and night = 73.2 lb.s, day only = 37.5 lb.s.

The portability issue is not as simple as weights. The real question is how many systems must the squad or unit carry to accomplish its mission. Significant questions arise here due to the low Pk of the system. To ease this comparison and reflect the complex, interactive nature of the tactical equation only single system weight is used. Another pertinent question to the soldier is the worth of carrying the weapon. He may wonder why he carries a weapon that neither he, nor his leadership, have confidence in.

#### 6. Ease of Training.

Initial Dragon training per FM 23-24 is designed to take up to 10 consecutive days. This seems rarely possible in most units and, in fact, much of the training is cut to the detriment of the gunner's skill. The manual itself emphasizes the



importance of training for the gunner.<sup>35</sup> The Army does not have a separate MOS for a Dragon gunner, as does the USMC, but allows the position to rotate as needed and assigns an additional skill identifier to the soldier. In testing of live missiles, gunner skill and experience are heavily correlated with accuracy. Army gunners show distinctly lower performance when compared to Marine gunners due to MOS experience.<sup>36</sup>

#### The Javelin.

The Javelin is a man portable, fire and forget, antitank missile system with a Command Launch Unit or CLU and a self contained missile. The integrated sight is for day and night use with range out to 3000+ meters. The CLU is battery operated and can operate over 4 hours on one battery with no coolant bottles required. The missile operates either in top down attack mode for use against armor or in direct fire for use against enemy positions. Missile range is currently published at 2000 meters<sup>37</sup> but, according to the TRADOC System Manager at Ft Benning, Georgia, the unclassified planning range is 2500m. Test data support this fact.<sup>38</sup>

#### 1. Pk.

In testing of live missiles Pk mean was 91% throughout the missile's range against stationary T72's.

#### 2. Rate of Fire.

Live fire and force on force test data indicate about 40 seconds elapse between firings.<sup>39</sup> The Javelin ST 7-10-1 indicates a ready to fire time of 30

seconds (presumably from a short carry) with a reload time of 20 seconds.<sup>40</sup>

Using the test data as an approximate guideline and the same target parameters as for the Dragon, a Javelin gunner may, under ideal conditions, be able to fire 10 to 11 missiles in the 7.5 minutes a target requires to traverse 2.5 kms.

### 3. Range.

As stated earlier, planning range is 2500m. Effectiveness of the missile remains at 91% mean Pk with 95% level of confidence.

### 4. Gunner Survivability and Protection.

Once again, weapon characteristics are critical factors in this criterion. The Javelin may be fired from smaller, covered positions offering excellent camouflage and creates a smaller launch signature than either TOW or Dragon. Critical as well, the gunner may move or take cover immediately after missile launch.<sup>41</sup> Lastly, the Javelin range of 2500m is 400m greater than the maximum effective range of the 125mm T72 main gun, 500m greater than the maximum effective range of the 12.7mm turret gun and, 1500m greater than the maximum effective range of the 7.62mm coaxial MG.<sup>42</sup> This last fact significantly enhances gunner survival when he can engage the target at max range.

Test data show gunner survival in the defense to be 84% and 89% in the offense.<sup>43</sup> Detecting targets at 2500m range, especially dismounted infantrymen, is much more difficult than at 1000m. Additionally, at longer ranges the infantry is more dispersed in the field of view of oncoming targets thus less prone to detection or engagement.

### 5. Portability.

Weight of Command Launch Unit = 14.1 lb.

Weight of missile = 35.2 lb.

Total system = 49.3 lb.

## 6. Training.

The current ST 7-10-1 does not contain a detailed Javelin training program. Test data, however, shows that gunner performance was not related to his experience with the system. In support of the initial testing, Javelin gunners received training on the system then, upon deployment to the test site, received two more days of refresher training. The most important fact is that gunner error in tracking the target is entirely removed.<sup>44</sup>

The purpose of illustrating these criteria was not simply to show the Javelin to be superior to the Dragon, but also to present some data for further analysis. The Javelin is superior to the Dragon in all of the above criteria except weight of a single system. When considered in conjunction with required effectiveness and the greater number of Dragon missiles needed to compensate for its lack of capability, the Javelin is once again the clear choice. In testing, gunners preferred the Javelin due to its better performance performance.<sup>45</sup> Soldiers don't want to carry a heavy piece of equipment that does not work.

Below is a chart of the data just presented.

Criteria	Dragon	Javelin
1. Lethality	40%	91%
2. Rate of Fire	Every 40 sec.	Every 40 sec.
3. Range	1000m	2500m

4. Survival	Defense 66%	89%
	Offense 79%	84%
5. System Weight	73.2 lb.	49.3 lb.
6. Training	Difficult	Less difficult

This data now forms the basis to assess possible changes in antitank tactics and doctrine that the Javelin system warrants. In the following chapters this study will build on this analysis.

### Chapter 3.

Analysis of the Dragon and Javelin illustrate the continuing evolution of manportable, antiarmor systems. Since the appearance of the tank on the battlefield, infantrymen have required the means to destroy them. Infantry tactics and organization have evolved as improvements in antiarmor weapons have attempted to stay ahead of advances in armor. Understanding the coevolution of antiarmor weapons and armor systems provides insights into the potential impact of the Javelin on doctrine, tactics and organization.

Warfare and armed conflict have been part of human civilization throughout recorded history. The first stone age man to chip flint from a stone to form a sharper edge and discovering it a better killing weapon than his blunt club began the technical modernization trend of warfare. Such an act of technical innovation may soon have caused a change in hunting and battle tactics. The attacker and

the defender now were obliged to modify their techniques.<sup>46</sup>

Technical innovation often becomes the initiator of tactical, organizational, and doctrinal change in military organizations just as technical changes in all walks of life can bring about systemic changes in those organizations.<sup>47</sup> A single technical innovation or change in a capability within human based organizations or other complex, adaptive systems initiates a ripple of adaptation and effect throughout that system in uncountable ways.<sup>48</sup> On the battlefield, advances in weapons or other technologies will change not only one's own system, actions and mode of thought but the enemies' as well.

The stalemate and attrition warfare of the Western Front during World War I began in 1914 with the entrenchment of the opposing armies from the English Channel south, across France, to the neutral Swiss border. The interaction and combined effects of magazine fed rifles, belt fed machine guns, high explosives, barbed wire, rail, wire communications, and industrial might resulted in a long nightmare of death and attrition in the trenches. Concentrated firepower in the form of more and more artillery was first seen as the solution to the stalemate. Following a marginal success at the Third Battle of Artois-Loos and Second Champagne in which the Allies gained some 3000 yards using artillery as a roving barrage in front of the advancing infantry the tactic instilled the belief that here was the answer. More firepower would lead to victory. Subsequently, greater numbers of shells preceded each battle; 3.5 million shells prior to the Battle of Messines fired over 17 days and 4.3 million shells before Ypres over 19 days. During the shelling, the enemy either dug deeper or evacuated the forward

trenches surviving to fight on, the shelling and build up of ammunition prior to it acting to prevent surprise. These two examples resulted in over 500,000 casualties and gains measured in yards.<sup>49</sup>

Tanks appeared as the answer to this stalemate offering protection, firepower, and, albeit limited, mobility. Their first appearance was at the Battle of the Somme, September 15, 1916 but they met with limited success due to terrain, reliability problems and lack of experience in employing them. They did show, however, that armor could penetrate static defenses and have disastrous effects on enemy infantry armed only with small arms. The next major use of tanks was at Cambrai in November, 1917 in which 378 tanks attacked the German defenses penetrating up to 9 kilometers, an unheard of success since the first months of the war.<sup>50</sup> This concentration of tanks was perhaps the first proper example of their use, resulting in a great success for British armor and giving the German infantryman a swift, lasting education.<sup>51</sup> The initial success of the tank gave impetus to greater use and production of the machines by the British and French and quickly spurred development of antitank weapons.

The German infantryman at first had no true antitank weapons. His rifles and machine guns were ineffective so guns and mortars had to be used and it was primarily the terrain and mechanical break down of the first tanks that led to their containment and defeat. The first antitank weapons for the infantryman were specially produced 'K' bullets which had tungsten cores and could penetrate the thinly plated MK I and II tanks. In June, 1917, the British brought out the MK IV with thicker armor plate countering the 'K' bullet. The next step

for the infantry was the 13mm Tank-Gewehr rifle weighing 26 pounds.<sup>52</sup> Each improvement brought on further improvements to the other's weapons.

During the interwar years the former allied countries Britain, France and the US continued to view the tank largely in an auxiliary role to facilitate the infantry attack. Germany, however, perhaps due to her witness of the tanks effects and experience of the static trenches, saw armor as a rapidly moving powerful force, capable of searching out weak points and rupturing enemy defenses and developed the concept of Blitzkrieg. The Luftwaffe was to provide aerial artillery via dive bombers in order to continue fire support. The French view seems largely constrained by their defensive doctrine and history during WWI.<sup>53</sup> In the 1940 Battle of France it was this differing doctrinal use of armored formations that was responsible for the German victory. The attacking Germans were outnumbered in tanks 3600 to 2574 by the British and French. The superior employment and organization of the German armored forces proved the decisive factor for German victory.

Antitank weapons at the start of World War II consisted mainly of smaller caliber antitank guns of limited range such as 20mm, 37mm and 50mm<sup>54</sup> as well as some antitank rifles.<sup>55</sup> These smaller caliber guns and all of the rifles were rendered largely obsolete with the introduction of the T-34 and the later German tanks. Tactics in the use of these weapons both separately and together was to evolve with each new innovation as well. The Germans began to use their longer range antitank guns as stationary overwatch to support their movements in attack as well as defense. The Russians established tank mounted infantry who

habitually moved with their armor to provide protection from determined German infantryman.

Early in W.W.II it became clear that antitank guns were not always able to defeat enemy tanks and infantry and other units such as combat engineers needed a portable and lethal weapon with which they could destroy tanks. Too many good soldiers were dying attempting to use mines, charges or other means to destroy tanks.<sup>56</sup> The first such weapon to be used in battle was the German Faustpatrone or Panzerfaust appearing in the fall of 1942. This small, recoilless gun with about 30m of range (later 60m) was very effective against allied tanks. In one case a small group of determined German soldiers delayed an advancing squadron of British tanks for 4 hours. The tankers would not advance until assured that all the panzerfausts were destroyed.

The best known allied hand held antitank weapon of the war was the Bazooka, a 2.36" rocket launcher firing a shaped charge mounted on a rocket. Initially it met with excellent results but by 1945 could not penetrate the newer German tanks. The 2.36" version continued in use until the first months of the Korean War. Here due to ineffective ammunition, and inadequate training they could not defeat the Communist T-34's. The upgraded 3.5" version quickly entered service to fill the gap and remained in service for a number of years.<sup>57</sup>

Following W.W.II development of the antitank guided missile began. The first, deployed in the mid 1950's, was the French built SS10 based on a Nazi air to air design. The SS10 was slow, large and had a relatively short range yet laid the ground work for future ATGM's.<sup>58</sup>



The significant question here is what led to ATGM development in the first place? Why did armies not stay with some type of gun or longer range hand held rocket?

Tank armor and automotive technology at the end of W.W.II had progressed to a point where the smaller caliber antitank guns were no longer effective at long range. They could certainly not outrange the tanks they were designed to kill and resulted in too many dead gunners. Tanks were now heavily armored, very mobile and mounted larger, long range guns. These advances necessitated larger, heavier, more accurate and powerful antitank guns yet resulted in larger costs and less mobility. At the end of the war the average antitank gun weight had risen to 6 tons. The inherent advantage of a gun is that it can reload rapidly yet accuracy falls off drastically at greater range, and recoilless guns are even more vulnerable to this.<sup>59</sup> Armies realized that the infantryman needed a mobile, lethal, long range tank killer. The ATGM seemed to provide the solution. The US Army avoided early entry into development of ATGM's in the 1950's, perhaps preoccupied with its tactical nuclear capabilities, and continued using recoilless guns through the 1960's. Development of the TOW, tube launched, optically tracked, wire guided missile began in 1960 and was first deployed in 1972. It is an extremely effective, large missile providing high lethality and accuracy out to 3750 meters. Improvements have continued to keep the missile effective against threat armor. The TOW is, however, a large system requiring a vehicle or crew to transport and fire it.

The Dragon, of similar technology, was the Army's answer for the

infantryman on the ground and remains in use today.

In W.W.II the most effective antitank weapon was thought to be another tank or at least a big gun. Today this may not be the case.<sup>60</sup> The Egyptian destruction of the Israeli 190th armored brigade in the 1973 Yom Kippur War was largely accomplished by small groups of infantrymen with hand held missile or rocket launchers. The all armor daylight attacks of the Israeli armor were not tactically sound in light of the threat. Well armed and determined Egyptian infantryman were able to fight successfully both day and night against an armored force with little or no infantry to protect it.<sup>61</sup>

What is the battlefield situation today? Battlefield trends demonstrate that for every action there is a counter action; each improvement in armor protection whether in thickness or slope, vehicle speed, or counter measure is answered by a new killing weapon. Current tank designs provide extensive frontal protection as well as numerous reactive armor technologies negating the effects of smaller direct attack, high explosive projectiles. The advent and proliferation of compound armor and possible dynamic armor will further degrade direct attack lethality. The weak point of tanks continues to be the sides, rear, and top until designers extend the armor coverage, develop countermeasures, and overcome the other engineering problems of power and increased weight. To remain effective against tanks and armored vehicles the logical points of attack are the remaining vulnerable areas, the top, rear and, to a lesser extent, the sides.<sup>62</sup>

Weapons technology, tactics and doctrine evolve together through time based on a plethora of known and unknown variables. Where will this evolving process

lead the US Army in the near future? The Force XXI initiative seeks to provide insight and develop forces to capitalize on America's comparative advantages in technology and to test new capabilities in training and simulation. The fight on a future battlefield is one in which precision weapons will be essential while information dominance and speed of decision are critical. These technologies will allow US forces to disperse for protection and survivability while concentrating effects to accomplish objectives. Within Force XXI's compliment of capabilities a number of new technologies will reach the infantryman. Near term weapon deployments include the M2A3; an improved Bradley; a number of small arms improvements; MPIM, a short range antitank weapon; improved night vision equipment; squad radios; improved GPS; as well as the Javelin.<sup>63</sup>

These new technologies will set a new tempo and tone to any battlefield they enter while carrying their own advantages as well as vulnerabilities. That full set of variables requires study to determine how each performs as part of the whole in order to maximize capabilities. That process encompasses not only technical parameters but also study of current tactics and doctrine and how these need to change to utilize the new systems. These must also be considered in light of the most likely threats such as Iraq or North Korea as well as perhaps less likely threats in the near or far term. It may now be helpful to look at the current Dragon based antitank tactics and doctrine of our dismounted infantry and the changing environment that exists today.

Chapter 4, The Dragon in M2 Units.

In order to understand and visualize more fully the battlefield capabilities of the Dragon we need to know the organization of the M2 dismounted element, the weapons of the platoon, the effects of training on the unit, and the current methods of employment in battlefield tasks.

The platoon is currently organized with four M2 Bradley Fighting vehicles each armed with 25mm chain gun, TOW missile launcher, and 7.62mm coaxial machine gun. The gun fires armor piercing ammunition to a maximum effective range of over 2000m capable of penetrating lightly armored vehicles and high explosive ammunition for use against infantry and lightly armored vehicles with effective range of 3000m. The TOW is an anti-armor, wire guided missile with 3750m range and can defeat main battle tanks. The 7.62mm coaxial machine gun is used for close, unarmored targets and personnel with 900m maximum effective range.<sup>64</sup>

The dismounted element is currently composed of 2 squads of 9 men each, armed with 6 M249 squad automatic weapons, 6 M203 grenade launchers, M16 rifles and 3 Dragons.<sup>65</sup> A larger organization, the 2x9+5 was recently tested as part of the Army Warfighting Experiment. This TOE provides a machine gun team of five infantrymen for each platoon. This TOE has not yet been instituted or manned in units.<sup>66</sup>

The Dragon is employed with the dismounted section as its primary and longest range portable antiarmor killing system. It is used in conjunction with AT-4's and other available light antitank systems to destroy enemy armor and

bunkers or point targets.

Dragon gunners in Army infantry units are designated to be antiarmor specialists and receive extra training on the Dragon missile systems. This arrangement, coupled with the difficulties of Dragon training, contribute to an actual ineffectiveness of the weapon and, probably, a perception of ineffectiveness throughout the force regarding the weapon. As noted in chapter 2 of this monograph, the USMC has designated an MOS for antiarmor specialists which alleviates some of the training related performance problems of Dragon gunners.<sup>67</sup>

Beyond gunner training, consider the leader. He must lead the squad or element and plan the most effective use of his weapons. This requires an understanding of the characteristics and capabilities of each weapon and an awareness of how each weapon must work with the others to achieve mutual support. In the case of the Dragon the leader's knowledge and skills are particularly critical for mission accomplishment and soldier survival because of the limitations of the Dragon in range and effectiveness.

When employing the Dragon or any antiarmor weapon on a battlefield the leader must consider a number of factors. First, the range. The Dragon as noted in chapter 2 has a 1000m effective range. This range is short relative to the range of enemy armored systems. The gunner is within machine gun and main gun range of most tanks before he can engage. The gunner must also remain exposed from acquisition to missile impact which at 1000m can average over 40 seconds. A long, dangerous and nervous time for a gunner where any flinching or jostling

caused by direct or indirect fires could cause a miss of the target.

The leader and soldier must attempt to avoid head on shots and seek out flank positions to hit enemy vehicles from the sides or rear. This increases the chances of killing the enemy vehicle and the gunners chances of survival as he is not in the enemies' line of sight.

Restricted terrain must be used whenever available to increase the infantryman's survivability. Restricted terrain limits the maneuverability of the enemy in both direction and speed presenting the Dragon gunner a slower target and, possibly, a side or rear shot. Restricted terrain also offers the opportunity to integrate the shorter range Dragon with other longer range armor killing systems by protecting the Dragon gunners from direct enemy assault and placing them in supporting range of other infantry.<sup>68</sup>

Planning to use Dragons in restricted terrain can present significant challenges to the unit leadership, however, as there may be little natural, restricted terrain in the battle area and engineering assets may not be available to create it. The Dragon may therefore offer little use when range to the engagement area is long and protective obstacles between friendly and enemy forces are few.

Employment of the Dragon is further hindered by the low Pk and the number of missiles that can be carried by the soldier and within the fighting vehicle itself. The soldier's load depends upon weight, bulk, and distance. The dismounted element with three launchers and all of their other equipment can be expected to carry a load of six missiles, that's three shots and three reloads.

The Bradley is constrained in bulk capacity also. The vehicle can carry two TOW missiles in the launcher with a total of 5 missiles stowed in the rear of either Dragon or TOW. The TOW, being a much more effective weapon of longer range, would take precedence in load planning unless it could not be used. The platoon is probably limited to six to eight Dragon missiles unless they cache for a defense.<sup>69</sup>

The leader also determines what method he will use to control his element's AT fires. The two common methods are either centralized under platoon leader control or decentralized under squad leader control. The distinction becomes important in controlling volume and timing of AT fires. The unit leader should also designate priorities of fire by system and rules of engagement in order to maximize the platoons available antiarmor fires.

Several other general employment considerations must be addressed as well. First, the short range and low Pk require that the Dragon be employed when it has the mutual support of other antiarmor systems or other Dragons. If not, its survivability and effectiveness are decreased.

The weapon requires a wide field of fire free of obstacles such as power lines or poles and lakes so that its wire link will continue to function. The gunner must also fire from the open, not an enclosed position. Additionally, the act of firing creates a significant blast signature that can be seen from well over 1000m.<sup>70</sup>

Keeping the above general characteristics in mind, now consider the Dragon in an attack as part of an M2 based force. What tasks will the Dragon gunner be expected to perform and what does the unit need him to do?

The initial question to the platoon leader is whether he needs the Dragon in the fight at all. The antiarmor specialist may be used more effectively as a rifleman in many situations. If the attack is mounted and the infantry will be required only to clear enemy infantry on the objective then the Dragon will be useful only during consolidation. In this case the weapon reinforces fires on enemy avenues of approach or may be sent forward of the objective area as part of a security or ambush element. The main antiarmor capability will remain the M2 and any tanks attached to the unit. The infantry are primarily concerned with enemy infantry.

In the case where an attack requires the dismounted element to operate either separate from the vehicles or from positions not supported by them the Dragon may be useful. Here the platoon leader may designate a support element which includes Dragons and other weapons to support the assault element. The Dragon provides the dismounted element pinpoint destruction capability of armored vehicles and fighting positions in this case. It may have difficulty, however, engaging enemy vehicles in hull down positions as it is strictly a direct fire weapon with no top down attack capability and the gunner has no stand off range relative to enemy fires. The signature of the firing will also compromise his location and expose him to enemy fires.

In this example the dismount element may have to walk some distance to arrive at their positions and are thus constrained in the number of missiles they can carry.

The Dragon night sight offers the dismount element the advantage of



providing 1500m of detection range as well as assistance in reconnaissance, surveillance, and, of course, targeting.

In the attack the leader must evaluate whether the mission requires the Dragon or not and what added utility it will provide beyond the other AT weapons. If the Dragon can be used, where is the best place to use it given its limitations?<sup>71</sup>

In the defense the Dragon is more useful as it augments the antiarmor fires of the units' Bradleys and tanks. The basic guidelines for the positioning of Dragons in the defense are:

1. Engage enemy vehicles from the flanks and from positions with cover to the sides of his sector.
2. Employ Dragons from positions that allow interlocking fires with other AT weapons.
3. Provide infantry for security.
4. Provide overhead cover if the backblast area can be cleared.
5. Use terrain and obstacles to slow and restrict enemy movement.
6. Prestock ammunition.
7. Plan primary and alternate positions with covered routes between them.

With these considerations in mind what firepower does the weapon add to a Mech/Tank company team?<sup>72</sup>

The infantry heavy company team will have 10 M2's armed with TOW, 25mm and machine gun and 4 tanks with 120mm main gun, 7.62 coaxial MG and M2 HB .50 caliber MG. In terms of tank killing capability the team has 20 TOW

missiles uploaded with 5 missiles stowed in each M2 for a total of 70. Assume 12 of these are Dragon missiles and the team has  $70-12=58$  TOW missiles. The M1's carry a load of 40 rounds per tank or 160 rounds total. The team has 2 platoons of infantry with three Dragon launchers each for a total load of 12 Dragon missiles per company team.<sup>73</sup>

Assume the TOW and tanks have at least a 90% Pk providing potentially,  $(.9)(160+58)=196$  kills. The Dragon Pk of 40% adds  $(.4)(12)=4.8$  or 5, at best, extra kills of enemy vehicles. In this case does the weapon offer much to the unit in the way of effectiveness? The potential could be increased by caching more rounds but the 40% Pk is difficult to surmount. This ideal for number of rounds and potential is for comparison only. In the fight the initial minutes will probably be most important as forces attempt to gain fire superiority and the initiative.

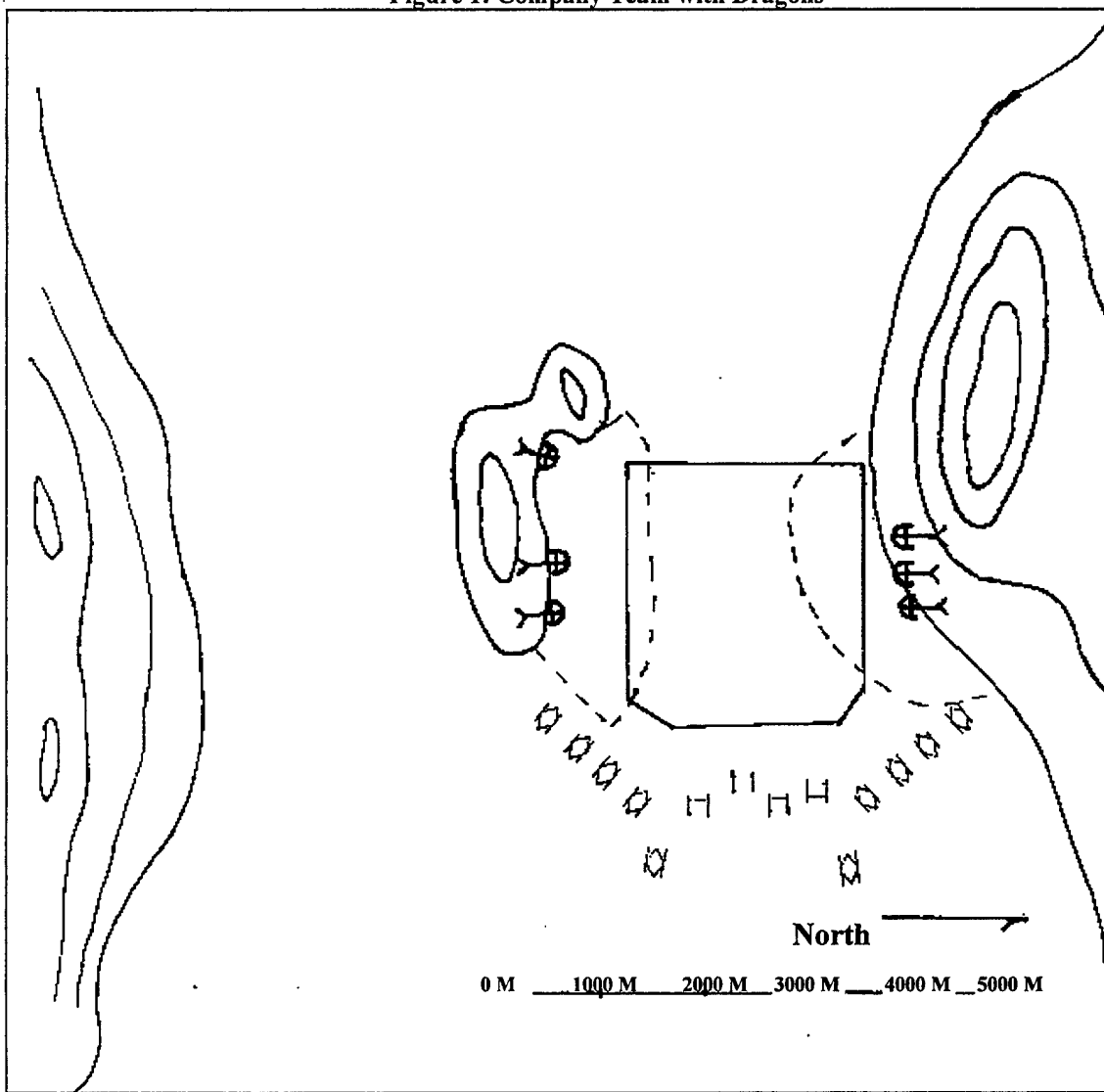
From just this basic math the reader may conclude that the Dragon offers little to the team. Consider the added difficulty of getting the weapon into a position in which it could enter the fight in light of its range and other characteristics. The tactics for this weapon are not well developed because there aren't many uses for it on a mechanized battlefield with numerous TOWs, 25mm guns, and tanks. Why should the commander or leader have much confidence or put much effort in this weapon for minimal return and potentially the loss of TOW missile carrying space?

Consider the next example in figure 1 (next page) in which a company team with 10 BFVs and 4 tanks, defends a corridor with Dragons positioned three to the north and three to the south of the engagement area. The Dragons are

emplaced to increase their chances of making flank or rear shots and to avoid frontal enemy fires. Here the Dragon can reach only partially into the engagement area providing limited mutual support to the vehicles positioned to the east. The Dragon gunners and dismounted infantry can contribute to the fight only by limiting the enemies' ability to maneuver on the flanks of the engagement area. The Dragons and infantry can also be easily overwhelmed and destroyed piecemeal if the enemy concentrates either north or south.

Another consideration is the possibility of an enemy attack in the southern, or left side, corridor. The Dragons in the middle could reposition to engage the enemy force but once again contribute only a small part. The mechanized force would be forced to reposition if other forces were not already defending the area.

Figure 1: Company Team with Dragons



The six Dragons deployed here with three missiles for each launcher total 18 missiles. Assuming, in the best case, that the enemy force came within range of each weapon, the Dragons, at 40% Pk, could destroy  $(18)(.4) = 7$  enemy vehicles. That is, if they all survived long enough.

The Dragon in the defense can be used to reinforce the units defense and provides added capability in the offense when the dismounted element is

separated from their vehicles. The basic characteristics and limitations of the system present significant challenges, however, to leaders and soldiers in safely and effectively employing the Dragon. Its drawbacks limit its utility thus its use and, in the end, the inclination of commanders to trust in its contribution to the mission.

## Chapter 5. Javelin, the New Chess Piece.

The addition of the Javelin to US Army Bradley infantry units will add a significant capability to their dismounted infantry. The current medium antiarmor weapon, the Dragon, offers only minimal capability and limited range to the unit in its requirement to defend against or attack enemy armor. According to Pfc Joshua Larsen, A Co., 1-5 IN from Force XXI rotation at the National Training Center “The tanks (OPFOR) are scared of the Javelin”. Subsequently, his platoon killed 4 enemy tanks from their defensive position with no losses.<sup>74</sup>

The Javelin’s advantages become apparent by looking at the five general areas of firepower, maneuver, protection, leadership, and command and control. After analyzing these aspects in relation to the Javelin’s capabilities one should understand the platoon organization, the weapons use in several battlefield missions, followed by examples of how the weapon’s increased capability changes the face of the battlefield for mechanized units.

From the chapter two comparison the increased lethality of the weapon over the Dragon (91% v 40%) coupled with its 2500m range offer extensive

improvement in firepower for the infantry. The dual attack modes and tandem warheads allow destruction of all known armor and engagement of enemy fortified positions beyond effective machine gun range. Fire and forget launch increases gunner survivability by allowing immediate reload from a covered or alternate position.

The Javelin enhances the maneuver capability of the soldier, his unit and the options available to his commander in a number of ways. First, the weapon weight carried by the soldier is less than the combined weight of the Dragon with both day and night sight. Additionally, by virtue of the increased lethality, the unit needs to carry fewer missiles to get equal effect. That is assuming a range limitation on the Javelin to the same 1000m as the Dragon.

Finally, the Javelin can be fired from inside buildings and fortifications and has a lower launch signature. The weapon also has equal effect against armor whether fired from flank or frontally. The flank shot is still preferred but not essential. These factors coupled with the range and lethality greatly enhance the options available for effective use and employment of the Javelin and its contribution to mission success.

Javelin offers greater protection to the soldier and his unit as well. The basic fact that the weapon can destroy enemy armor at 2500m then be reloaded and fired within 40 seconds with over 90% Pk is significant protection in itself. The soldier can move immediately upon firing, and fire from cover with low signature, again increasing his protection. The Javelin sight allows soldiers to passively detect targets night or day at up to 3000m further adding to unit

security.

The unit commander and other leaders will find the flexibility and lethality of the Javelin both a vast improvement over the Dragon and a challenge for making full use of the weapon's capabilities. The commander is no longer restricted to 1000m of range with a system that has 40% Pk and he has little faith in. He can, with less risk to his soldiers and mission, attack the enemy from numerous locations where he could not before and need not depend solely on the TOW or tank for reliable, long range, antiarmor fires. His dismounted infantry forces are now a potent, and potentially decisive force on the mechanized battlefield. The leaders are challenged with fully integrating this new weapon by expanding current tactics, techniques, and procedures and developing new ones.

A further challenge arises from the command and control difficulties of a dispersed battlefield. The Javelin allows dispersed squads or teams to integrate and focus fires to support the plans. Units may not have sufficient communications equipment to support such distributed operations and must rely on clear mission oriented orders, well trained small unit leaders and soldiers, well understood engagement criteria and rehearsal. This challenge, if met, may be the key to fully capitalizing on the leap provided our infantry forces by the Javelin.<sup>75</sup>

The Javelin will be fielded to Bradley infantry battalions at two per platoon or six per company. The M2 still is limited to two TOW missiles loaded with a combination of five missiles carried in the vehicle, either TOW or Javelin. The other weapons available to the unit remain essentially the same in the short run.

New weapons and equipment planned within the next ten years will change the equation even further, however, for the Bradley infantry unit and soldier. These programs include the M2A3, Land Warrior project, a new crew served weapon and new individual weapon.

The new M2A3 Bradley, with proposed fielding starting in 2000, provides enhanced night vision with upgraded FLIR, imbedded GPS, laser range finder to increase accuracy, squad leader display, and a combat identification system. The land warrior soldier system provides the soldier with thermal sights, laser range finder, multipurpose computer and squad radio. Proposed fielding begins in late 2000. The new crew served and individual weapons will double the range of the weapons they replace and allow engagement of enemy personnel in covered positions and in defilade. Fielding begins in 2005.<sup>76</sup>

The effects of these advances coupled with the Javelin will significantly change the battlefield for Bradley infantrymen. Infantrymen will be able to engage enemy forces long before they are within effective range of return fire. Commanders will find it a challenge to fully integrate the capabilities of the weapons based on the current tactics and must train and depend upon small unit leaders to exercise initiative in this task. The process of understanding the complexities of this process are not germane to this monograph but are important in acknowledging the need to change our current tactics and doctrine.

#### Javelin in the Attack.

The Javelin provides the commander a significant capability in the attack



over the Dragon. The mech team normally has 10 BFV's with 4 tanks and two infantry platoons. At current planned fielding of two Javelin command launch units or CLU's per platoon that provides the dismounted infantry 4 launchers and 8 missiles if required. With the greater than 90% Pk the two platoons can plan on destroying 8 enemy vehicles or positions and more if missiles are available.

In the attack the dismounted infantry can place accurate fire on the objective from 2500m, and destroying vehicles or critical positions, isolating the objective area from reinforcement by the enemy and providing all round security for the unit. These missions all reliably accomplished without the required support of the units tanks and BFV's. Such a capability can be a significant combat multiplier when terrain does not support vehicle movement to the objective or when the defended position cannot be approached mounted without risk.

The Javelin also increases the dismounted element's rationale to infiltrate the enemy defense. Consider an enemy position that cannot be approached via BFV or tank without high losses or a critical point that is defended by armor or fortifications. The units dismounted infantry now have a consistently reliable weapon with which to reduce a strongpoint and allow armored forces to reach the objective with support.<sup>77</sup>

Another possible use is to use Javelin armed dismounted infantry to penetrate an enemy counter-reconnaissance force. Insertion early should allow the infantry to provide significant information to friendly forces while remaining protected from enemy armor. Additionally, this penetration force can reduce the effectiveness of the enemy force and allow friendly heavy forces to approach the

enemy defense undetected.

The attack now involves more planning for the units leaders. They must now study terrain to determine where best to place Javelins to integrate them in support of the units attack or movement. Infantry squads can now secure and support movement or infiltrations without fully integrated tank/mech support expanding the capabilities of the force, providing greater security and necessitating development of tactics and training to support such operations.

#### Javelin in the Defense.

The Javelin provides the mech team significant improvement over the Dragon in the defense allowing the commander and other leaders greater flexibility, lethality and confidence. Using the same example as with the Dragon in the previous chapter a review of the teams available weapons is helpful.

The infantry heavy team normally consists of 10 BFV's and 4 M1A1 tanks. The unit will also have 2 dismount elements with a total of 4 Javelin launchers. Assuming the same ammunition load as for the Dragon example the company has 12 Javelin missiles, 58 TOW missiles, 160 120mm tank rounds and 25mm and small arms ammunition. Assuming a 90% Pk for tanks and TOWs alone, disregarding the 25mm and small arms, the unit generates 196 potential kills. Add in the 12 Javelin missiles at 90% Pk and the unit gains another 10 to 11 kills equivalent to another enemy company. The enemy force is, at once, presented with 18 armor killing systems distributed over a large area. The enemy must disperse his forces to survive while our force can concentrate its effects.

The improvement in firepower is not as simple as this math indicates. The increased capability rests in the flexibility of the Javelin to be placed in critical locations through the depth of the defense and to engage enemy armor simultaneously at long range with the other weapons. It also allows the infantry forces significant capability in establishing a strongpoint that can provide mutual support for Bradleys or tanks.

Commanders may also consider increasing their load of Javelins relative to TOW missiles. To fire the TOW, the Bradley must remain exposed to enemy fire until impact. The Javelin is a fire and forget weapon that can destroy tanks at nearly the range of the TOW. This tactic allows the unit to have the 25mm destroy enemy armored vehicles other than tanks. The combined effect is to increase fires on enemy formations throughout the engagement area.

The unit leadership must create a defense that integrates all of these weapons to accomplish the defensive mission. What critical tasks must the unit perform to optimize its defense and how does the Javelin contribute?

First the commander wants to mass the effects of his units' fires on the enemy while using terrain and obstacles to disrupt or canalize the formation. This also allows the enemy to be engaged piecemeal. The defense should allow destruction of the most dangerous targets first while controlling fires to avoid overkill. The plan must consider limited visibility conditions, contingencies for enemy actions or diminished capabilities and emphasize minimal friendly exposure to enemy fires.<sup>78</sup>

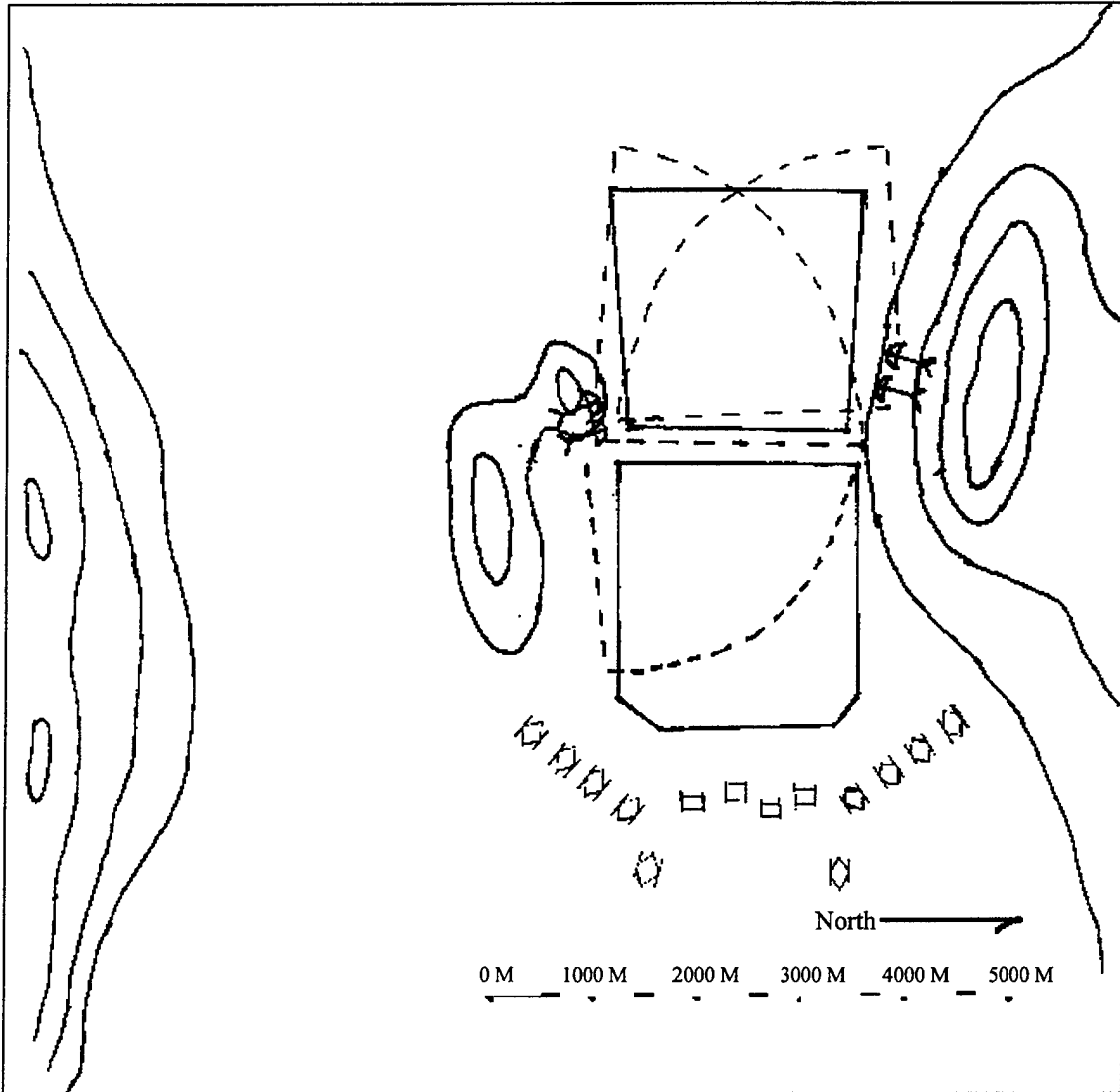
The antiarmor defense must have both static and mobile elements in order to

be most successful. The static element must be able to stop enemy forces through destruction, providing obstacles and disruption. The mobile or maneuver element provides the greatest advantage by locating in some protected location and moving, when needed, to a position to fire or maneuver, or both, on enemy armored forces completing their destruction. The Javelin reinforces significantly the infantry's ability to perform the static mission.<sup>79</sup>

The Javelin enhances the commander's ability to do each of these tasks with its range, launch characteristics and lethality. In the initial moments of an attack a defending unit now has 4 extra tank killers, possibly the critical difference. Consider the following scenarios.

A Bradley company, equipped with Javelins, defends the same corridor presented in the previous chapter (redrawn in figure 2, next page). The commander decides to defend with two Javelins to the north and two to the south of the engagement area and with his BFV's to the east. Due to the range of the Javelin, and their low signature, the unit can plan for two engagement areas. In this case, an intervisibility line exists between the two areas so that the approaching enemy force can not see the vehicles to the east. The western area is covered by Javelins with the mission to destroy high pay off targets such as ADA or command and control vehicles.

Figure 2: Company Team with Javelin



If three missiles are prepositioned with each Javelin gunner, these 12 missiles, at 90% Pk, allow for the destruction of 11 vehicles or a company. If more missiles are cached at alternate and supplementary positions even more enemy vehicles could be destroyed further enhancing the defense. The western engagement area also helps break the momentum of the enemy attack and allows other arms to be used such as artillery or aircraft.

Additionally, if the enemy decides to use the southern corridor the two

Javelins on the middle terrain feature can reposition and range across the entire southern corridor. This capability allows the commander greater flexibility in the positioning of his BFV's and in the options for the design of his defense.

Javelins can also greatly enhance the capabilities of security and screen missions by placing more potential threats to the enemy throughout the screen. In the defense the commander must deny the enemy knowledge of his unit's dispositions. To do this one must deny enemy reconnaissance, destroying them before they get into the defended area. Prior to the Javelin, the Dragon could play only a small role in such missions due to range and lethality limitations.<sup>80</sup> The Javelin can strongly reinforce a security mission as in this example.

A mech heavy task force occupies a defense and assigns the task force scouts and one BFV company a counter-reconnaissance mission. The force consists of 6 scout HMMWV's, 14 BFV's and 6 Javelin teams along with other infantry elements armed with small arms and small antitank weapons. Assume the Javelins can cover 2000m left and right of their positions or 4000m total frontage and have three missiles each. These teams alone, using the conservative range of 2000m can cover a frontage of 24,000m linearly or, more likely, 8000m to 10,000m deployed in depth. These teams deployed on the difficult terrain with the vehicles deployed on terrain suitable to BFV's or HMMWV's can cover an extensive area and in sufficient depth to significantly increase the chances of eliminating enemy reconnaissance. Certainly, at least, of reducing its chances of success.

This enhanced ability to destroy enemy reconnaissance increases the options

available to the task force commander in the type of defense he can build, where he can concentrate forces and the knowledge that the enemy may know little of his disposition.

The Javelin has added a new dimension to the mechanized force commander. He is no longer constrained to the use of tanks or BFV's as his only effective means of destroying tanks. The Javelin increases the flexibility, firepower, and maneuver options available to the unit while increasing the force protection potential. The weapon challenges the leadership and soldiers to use it to its full capabilities while alleviating the consternation and difficulties of finding a mission for the Dragon. The Javelin will also challenge the leaders to provide proper guidance and mission orders to subordinates in order to use the weapons effectively.

Similar challenges are dealt with in using Dragons, however, the Javelin provides a leap forward over the capabilities of the Dragon. Commanders must realize this and train themselves and their soldiers to capitalize on the capabilities of this new weapon.

#### Conclusion.

The Army is currently fielding the Javelin missile to the light infantry forces and will begin with the heavy divisions in 2000. This new missile provides the dismounted infantry soldier a tremendous and previously unavailable capability,

that of destroying enemy armor at better than 90% reliability outside of machine gun range and at the edge of tank main gun range.

Commanders will now be able to capitalize on the weapons greater range, flexibility, lethality, and the protection it affords his soldiers to accomplish missions his unit could not do before. He can also plan with the confidence that the weapon is effective and it will increase the moves available to him on the battlefield chess board. The Javelin alleviates the need to keep the dismounted infantry so close to their vehicles for them to survive. They can now provide effective mutual support for the vehicles, operate autonomously under special conditions, and destroy armor effectively. Hence, they are an important capability in the commander's arsenal.

The Army and particularly the mechanized forces must acknowledge the need to update current tactics in the employment of this new weapon. Simply substituting Javelin for Dragon without changing the doctrine will not maximize the contributions of the new weapon.

History has shown that as new technologies enter the battlefield, Armies can be slow to adapt their tactics or organizations to capitalize on them fully. A couple of the many examples of this phenomenon, such as the introduction of the arquebus and the 50mm antitank gun to the Afrika Corps, were illustrated in the introduction. Each change in the complex system of the battlefield illicit a host of unforeseen consequences which the prudent soldier will examine thoroughly.

It may be some time before we realize the full ramifications of the introduction of the Javelin to our mechanized forces. Additionally, the



introduction of land warrior, M2A3, and the other new weapon systems soon to be fielded demand that the mechanized force tactical level manuals receive study and revision. Simple quick fixes to the current manuals will not fully integrate the capabilities of the Javelin into the force.

Commanders, leaders and soldiers will be challenged to train themselves and their units to use this weapon to its capacity in conjunction with other systems. The Javelin is a new chess piece for the commander and the rules have yet to be discovered on how it will play on the board. Greater study by the Army of its effects and integration will enable future infantrymen to capitalize on this leap in technology.

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## ENDNOTES

- <sup>1</sup> 1997 Infantry Conference Notebook, "Equipping the Force". Section R, 10-12 June, 97.
- <sup>2</sup> TRADOC System Manager, Antitank Missiles. Javelin Weapon System Slides, June 2, 1997.
- <sup>3</sup> Jane's Infantry Weapons 1996-97. "Javelin Antitank Missile System." p347.
- <sup>4</sup> Ibid. P345.
- <sup>5</sup> Christensen, Major Dee C. "Dragon Training." Infantry (Jan-Feb 1990) p37.
- <sup>6</sup> FM 7-7J, Mechanized Infantry Platoon and Squad (Bradley), 1993. The pages I found with descriptive text on use of the Dragon were 2-60, 2-119 and 2-152. Admittedly, this may not be fully inclusive, however, such a dearth of information on a weapon system at platoon level in a platoon manual may indicate problems. More pages were, in fact, devoted to dismounted machine gun employment and positioning.  
FM 23-24 Dragon Medium Antitank/Assault Weapon System M47, 1990, provides extensive information on the Dragon yet addresses primarily individual skills not integrated employment in the platoon or higher echelon.
- <sup>7</sup> 1997 Infantry Conference Notebook, Section R.
- <sup>8</sup> Dorner, Dietrich. The Logic of Failure. New York, NY: Metropolitan Books, 1996 p38.
- <sup>9</sup> Dupuy, Trevor N. The Evolution of Weapons and Warfare. Fairfax, Va.: Hero Books, 1984 p303.
- <sup>10</sup> Tucker, Glenn. Chickamauga. Dayton, Ohio: Morningside House, 1992 p113-116.
- <sup>11</sup> Weeks, John. Men Against Tanks. New York: Mason/Charter, 1975 p58.
- <sup>12</sup> Dupuy, Trevor N. p304-5.
- <sup>13</sup> English, LTC J.A., Addicott, Maj. J., and Kramers, Maj. P.J., ed. The Mechanized Battlefield A Tactical Analysis. Washington: Pergamon-Brassey's International Defense Publishers, 1985. p3.
- <sup>14</sup> Ibid. P3.

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- <sup>15</sup> Weeks, John. Men Against Tanks. New York: Mason/Charter, 1975. p23.
- <sup>16</sup> Biryukov, G. And Melnikov, G. Antitank Warfare. Moscow: Progress Publishers, 1973. p94.
- <sup>17</sup> 1997 Infantry Conference Notebook, Section Q, "Enlisted Personnel Update", 10-12 June, 1997.
- <sup>18</sup> Lee, Col. R.G., Garland-Collins, T.K., Johnson, D.E., Archer, E., Sparkes, C., Moss, G.M., Mowat, A. W. Guided Weapons. New York: Brassey's Defense Publishers, 1988. p179.
- <sup>19</sup> Ibid. p192.
- <sup>20</sup> Biryukov and Melnikov, p96.
- <sup>21</sup> Ibid, p97.
- <sup>22</sup> English, p2.
- <sup>23</sup> Weeks, p162.
- <sup>24</sup> Lee et al, p179.
- <sup>25</sup> Jane's, p345.
- <sup>26</sup> Weeks, p165-167.
- <sup>27</sup> Jane's, p345.
- <sup>28</sup> Army Operational Test and Evaluation Command, "Javelin Operational Test and Evaluation", April 1994, p3-48.
- <sup>29</sup> Christensen, Maj. Dee C. "Dragon Training". Infantry (Jan-Feb 1990) p37.
- <sup>30</sup> FM 23-24, Dragon Medium Antitank/Assault Weapon System M47. April, 1990. P8-10.
- <sup>31</sup> Javelin Operational Test, 1994. p3-15.
- <sup>32</sup> FM 23-24, p1-2.
- <sup>33</sup> Biryukov and Melnikov, p95-97.
- <sup>34</sup> Javelin Operational Test, 1994. pES-8.

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<sup>35</sup> FM 23-24, p5-6.

<sup>36</sup> Javelin Operational Test, pES-12.

<sup>37</sup> ST 7-10-1, Tactical Employment of the Javelin Antiarmor System. 15 April 97, p2-3.

<sup>38</sup> Javelin Operational Test, 1994, p3-56.

<sup>39</sup> Ibid, p3-17.

<sup>40</sup> ST 7-10-1, p2.

<sup>41</sup> Javelin Operational Test, pES-7.

<sup>42</sup> ST 100-7, OPFOR Battle Book. Ft Leavenworth, Kansas:US Army Command and General Staff College, August, 1996. p7-3.

<sup>43</sup> Javelin Operational Test, pES-8.

<sup>44</sup> Ibid, pES-12.

<sup>45</sup> Ibid, pES-10.

<sup>46</sup> Dupuy, Trevor N., p1.

<sup>47</sup> Senge, Peter M., The Fifth Discipline. New York: Currency Doubleday, 1990, p3-6.

<sup>48</sup> Waldrop, M. Mitchell., Complexity. New York: Touchstone, 1992, p45-46.

<sup>49</sup> Fuller, J.F.C., The Conduct of War 1789-1961. New York: Da Capo Press; 1961, p169-171.

<sup>50</sup> Ibid, 175-6.

<sup>51</sup> Guderian, Major General Heinz, Achtung-Panzer. Trans. Christopher Duffy. London: Arms and Armor Press, 1995. P 85.

<sup>52</sup> Weeks, p 22-23.

<sup>53</sup> Dupuy, p 233-234.

<sup>54</sup> Guderian, p 156.

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- <sup>55</sup> Weeks, p 30-35.
- <sup>56</sup> Ibid, p 64.
- <sup>57</sup> Ibid, p 103-104.
- <sup>58</sup> Weeks, p 156.
- <sup>59</sup> Lee, et al. P 178.
- <sup>60</sup> Weeks, p 183.
- <sup>61</sup> English, p 188.
- <sup>62</sup> Simpkin, Richard E. Antitank. New York: Pergamon Press. 1982, p73-74.
- <sup>63</sup> 1997 Infantry Conference Notebook, Section R.
- <sup>64</sup> FM 23-1, Bradley Gunnery. Washington D.C.: Department of the Army. March, 1996, p 1-3.
- <sup>65</sup> FM 71-1 Tank and Mechanized Infantry Company Team. Washington D.C.: Department of the Army. November, 1988, p1-8.
- <sup>66</sup> 1997 Infantry Conference Notebook, Section Q.
- <sup>67</sup> Javelin Operational Test, p ES-12.
- <sup>68</sup> FM 23-24, p3-5 - 3-28.
- <sup>69</sup> Zaloga, Steven J. The M2 Bradley Infantry Fighting Vehicle. London: Osprey Publishing Ltd. 1986, p41.
- <sup>70</sup> FM 7-7J, Mechanized Infantry Platoon and Squad (Bradley), Washington, D.C.: Department of the Army. 1993, p 2-118 - 2-120.
- <sup>71</sup> Batchelor, Captain David C. "Dismounted Mechanized Infantry in the Deliberate Attack" Infantry. (Jul-Aug 96) p34-35.
- <sup>72</sup> FM 23-24, p3-8 - 3-9.
- <sup>73</sup> Zaloga, p41.
- <sup>74</sup> Griggs, SPC Jacqueline, "Javelin Produces High Level of Fire Power, Confidence". 28th PAD, 4th I.D., Force XXI internet site <http://www.hood->

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pao.army.mil/FORT\_HOOD/4thID/STORIES/JAVELIN.HTM

<sup>75</sup> ST 7-10-1, p2-5.

<sup>76</sup> 1997 Infantry Conference Notebook, “Equipping the Force”, Section R.

<sup>77</sup> ST 7-10-1, p44-48.

<sup>78</sup> Ibid,p32-36.

<sup>79</sup> Fuller, MG J.F.C., “Armor and Counter-Armor, Part 3”. Infantry. (May 1944), p40.

<sup>80</sup> ST 7-10-1, p43-44.

## BIBLIOGRAPHY

### BOOKS

- Bellamy, Chris. The Future of Land Warfare. New York: St Martin's Press, 1987.
- Bellamy, Christopher. The Evolution of Modern Land Warfare, Theory and Practice. New York: Routledge, 1990.
- Biryukov, G and Melnikov, G. Antitank Warfare. Moscow: Progress Publishers, 1973.
- Cooper, Matthew. The German Army, 1933-1945. Chelsea, MI.: Scarborough House Publishers, 1978.
- Dorner, Dietrich. The Logic of Failure. New York: Metropolitan Books, 1996.
- Dupuy, Trevor N. The Evolution of Weapons and Warfare. Fairfax, Va.: Hero Books, 1984.
- English, John A. On Infantry. New York: Praeger Publishers, 1984.
- English, LTC J.A., Addicot, Maj. J. And Kramers, Maj. P.J., ed. The Mechanized Battlefield, A Tactical Analysis. Washington: Pergamon-Brassey's International Defense Publishers, 1985.
- Fuller, MG J.F.C. Armored Warfare. Westport, Conn.: Greenwood Press, 1983.
- Fuller, MG J.F.C. The Conduct of War 1789-1961. New York: Da Capo Press, 1992.
- Glantz, David M. The Soviet Conduct of Tactical Maneuver. Portland, Oregon: Frank Cass Press, 1991.
- Guderian, MG Heinz. Achtung-Panzer. Trans. Christopher Duffy. London: Arms and Armor Press, 1995.
- Lee, Col. R.G., Garland-Collins, T.K., Johnson, D.E., Archer, E., Sparkes, C., Moss, G.M., Mowat, A.W. Guided Weapons. New York: Brassey's Defense Publishers, 1988.
- Senge, Peter M. The Fifth Discipline. New York: Currency Doubleday, 1990.

- Simpkin, Richard E. Antitank. New York: Brassey's Publishers Limited, 1982.
- Simpkin, Richard E. Human Factors in Mechanized Warfare. New York: Brassey's Publishers Limited, 1983.
- Simpkin, Richard E. Mechanized Infantry. New York: Brassey's Publishers Limited, 1980.
- Simpkin, Richard E. Race to the Swift. Washington: Brassey's Defense Publishers, 1985.
- Simpkin, Richard. Red Armour. Washington: Brassey's Defense Publishers, 1984.
- Toppe, MG Alfred. Desert Warfare: German Experience in WWII. Ft Leavenworth, KS.: Army Command and General Staff College, 1991.
- Tucker, Glenn. Chickamauga. Dayton, Ohio: Morningside House, 1992.
- Waldrop, M. Mitchell. Complexity. New York: Touchstone, 1992.
- Weeks, John. Men Against Tanks. New York: Mason/Charter, 1975.
- Zaloga, Steven J. The M2 Bradley Infantry Fighting Vehicle. London: Osprey Publishing, Ltd.1986.

### ARTICLES

- Batchelor, Captain David C. "Dismounted Mechanized Infantry in the Deliberate Attack". Infantry. (Jul-Aug 96): 34-35.
- Christensen, Major Dee C. "Dragon Training". Infantry (Jan-Feb 1990): 8-10.
- Copson, SFC Daniel. "Javelin: Reach Out and Touch Someone." Engineer. (April 1994) 30-33.
- Davis, Captain John T.. "Javelin: A Leap Forward." Infantry. (Jan-Feb 1992) 14-15.
- Ernst, MG Carl. "Javelin- The Knockout Punch." Infantry (Sep-Oct 96) 1-2.
- Fuller, MG J.F.C. "Armor and Counter-Armor" Infantry. (March, April, May 1944).
- Griggs, Spc Jacqueline, "Javelin Produces High Level of Firepower, Confidence". 28th PAD, 4th ID, Force XXI internet site [http://www.hood-pao.army.mil/FORT\\_HOOD/4thID/STORIES/JAVELIN.HTM](http://www.hood-pao.army.mil/FORT_HOOD/4thID/STORIES/JAVELIN.HTM)



Grimes, Vincent P. "Precision Munitions Give Soldier Enhanced Punch." National Defense. (Jul-Aug 1996) 60.

Jane's Infantry Weapons 1996-97. "Dragon Medium Anti-Armor System" p344.

Jane's Infantry Weapons 1996-97. "TOW Heavy Anti-tank Weapon System" p345.

Jane's Infantry Weapons 1996-97. "Javelin Advanced Anti-tank Weapon System-Medium." 347.

Lockhart, Captain Christopher E. "Modern Dragoons: Bradley Mechanized Infantry." Infantry. (Nov-Dec 92) 33-35.

Wendt, Major Todd R. "Bradley M2A3/M3A3, The Army Fighting Vehicle for the 21st Century." Infantry. (Jan-Feb 1997) 23-27.

#### GOVERNMENT PUBLICATIONS

US Army. FM 7-7J Mechanized Infantry Platoon and Squad (Bradley). Washington, 1993.

US Army. FM 71-1 Tank and Mechanized Infantry Company Team. Ft. Knox, Ky., 1988.

US Army. FM 71-2 The Tank and Mechanized Infantry Battalion Task Force. Ft. Benning, Ga., 1987.

US Army. FM 23-1 Bradley Gunnery. Ft. Benning, Ga., 1994.

US Army. FM 23-24 Dragon Medium Antitank/Assault Weapon System M47. Ft. Benning, Ga. 1990.

US Army. ST 7-10-1 Tactical Employment of the Javelin Antiarmor Section. Ft. Benning, Ga. 1997.

US Army. ST 100-7 OPFOR Battle Book. Ft. Leavenworth, KS: Command and General Staff College, 1996.

US Army. DA PAM 20-269 Small Unit Actions During the German Campaign in Russia. 1953.

US Army. 1997 Infantry Conference Notebook. Ft. Benning, Ga., Conference 10-12 June 97.

Gabel, Dr. Christopher R. Leavenworth Paper No. 12; Seek, Strike, and Destroy: U.S. Army Tank Destroyer Doctrine in World War II. Ft. Leavenworth, KS: Combat Studies Institute, 1985.

Gawrych, Dr. George W. Leavenworth Paper No. 7; Key to the Sinai: The Battles for Abu Ageila in the 1956 and 1967 Arab-Israeli Wars. Ft. Leavenworth, KS: Combat Studies Institute, 1990. Ft. Leavenworth, KS.: School of Advanced

Gawrych, Dr. George W. Leavenworth Paper No. 21; The 1973 Arab-Israeli War: The Albatross of Decisive Victory. Ft. Leavenworth, KS: Combat Studies Institute, 1996.

Wray, Major Timothy A. Leavenworth Paper No. 5; Standing Fast: German Defensive Doctrine on the Russian Front During World War II, Prewar to 1943. Ft. Leavenworth, KS: Combat Studies Institute, 1986.

### THESIS, MONOGRAPHS, AND REPORTS

Carmichael, John M. "Devising Doctrine for the Bradley Fighting Vehicle Platoon Dismount Element--Finding the Right Starting Point." Ft. Leavenworth, KS.: School of Advanced Military Studies, 1987.

Cope, James A. "Medium Anti-tank Defense: The Case for the Return of the Tank Destroyer." Ft. Leavenworth, KS.: School of Advanced Military Studies, 1988.

Freakley, Benjamin C. "The Interrelationship of Weapons and Doctrine: the Case of the Bradley Infantry Fighting Vehicle." Ft. Leavenworth, KS.: School of Advanced Military Studies, 1987.

Gibbons, Edward G. "Why Johnny Can't Dismount: The Decline of America's Mechanized Infantry Force." Ft. Leavenworth, KS.: School of Advanced Military Studies, 1985.

US Army Tradoc Systems Manager, Antitank Missiles, "Javelin Weapon System Slides" Ft. Benning, Ga., June, 1997.

US Army Operational Test and Evaluation Command, "Javelin Operational Test and Evaluation." Alexandria, Va.: April, 1994.

Cannella, D.A. "Heavy Force Analysis of the Javelin." Monterey, CA.: Naval Post Graduate School, September, 1994.

Cornelius, K.L. "Methodology Employed to Calculate Javelin Effectiveness." Redstone Arsenal, Al.: Army Missile Command Systems Simulation and Development, Aug 94.

US Government Accounting Office. "Army Acquisition: Status and Performance of the Javelin Antitank Weapon." Report to the US House of Representatives, Armed Services Committee: Gaithersburg, MD, 1994.

US Government Accounting Office. "Javelin Antitank Weapon: Quantity and Identification Capability Need to Be Reassessed." Report to the Vice-Chairman, House Armed Services Committee, Sep, 1992.