Antiarmor
What You Don't Know Could Kill You

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Judging from my experience with the U.S. Army, many commissioned and noncommissioned officers today do not know enough about what their antiarmor weapons can do, or what they cannot do. (This should not be surprising because U.S. weapon performance and armor protection levels are not openly disclosed.) Check your own knowledge of antiarmor weapons by taking the simple test shown in the accompanying box, and remember that what you don't know could kill you. Then ask yourself what your subordinates know about these weapons.

In response to the need for more awareness of this subject, Training Circular 90-16, Antiarmor Operations on the Integrated Battlefield, was written to provide a single, classified source of information on the effects of recent advances in U.S. and Soviet weaponry and armor protection. While the TC is directed toward commanders and staffs at battalion level and higher, it is the company commanders and platoon leaders who must also understand their weapons' capabilities and supervise the training, deployment, and employment of their antiarmor systems.

A brief rundown of the characteristics of the various U.S. antiarmor weapons, along with their training and employment, may be helpful.

The Army's light antiarmor weapon (LAW) is the M72A2, a 66mm rocket weighing 5.5 pounds and measuring 25.7 inches in length. It has an effective range of 125 meters and can penetrate more than 300mm of armor. The M72A2 can be fired from some enclosures.

The AT4, which was procured to supplement the M72A2, is an 84mm rocket that weighs 14.6 pounds and is 40 inches long. It has an effective range of 300 meters and will penetrate more than 350mm of armor, but it cannot be safely fired from enclosures.

Antiarmor performance with the LAW was a problem during the U.S. Army's recent conflict in Grenada. Several lessons can be learned from its employment there. First, in some cases, soldiers began engaging targets beyond the LAW's maximum effective range. Second, of the LAWs that hit the targets, some failed to detonate because of the rocket's characteristic wobble as it decelerates during flight, an action that degrades the performance of the warhead initiation mechanism. And third, of the LAWs that did detonate on the vehicles, none produced catastrophic kills. For the soldiers who had seen Hollywood's version of the LAW's effects, this must have been disconcerting.

This highlights another problem: Most soldiers who carry LAWs or AT4s are lucky to have fired a single service round of antiarmor munition during an enlistment. Obviously, the correct employment of a light antiarmor weapon is to engage light armored vehicles with volley fire from the flank or rear at close range. Engaging targets simultaneously with multiple LAWs or AT4s, however, requires planning, and engagements must continue until the desired target effect has been attained—the vehicle begins to burn or the crew abandons it.

ANTIARMOR WEAPON QUIZ

1. Have you read TC 90-16, Antiarmor Operations on the Integrated Battlefield?
2. Do you know what enemy armored vehicles your antiarmor weapons can actually defeat?
3. How many types of TOW missiles are in the U.S. inventory?
4. Can you recognize the different TOW missile canister markings?
5. Do you know the different capabilities and limitations of the various TOW missiles?
6. Does the U.S. TOW have a longer range and a shorter time of flight than the Soviet AT-5?
7. Do you know what type of support U.S. tanks can provide to your unit?
8. How long does it take the field artillery to deliver a field of scatterable mines 400 meters by 400 meters?
9. Do you know what reactive armor is and how it affects antiarmor operations?
10. Do you know what threat armored forces your unit might be required to defeat? What type of tactics, organizations, and equipment do threat units have?
11. What is a Soviet missile firing tank? Why is it a threat to you?
12. Would your subordinates be able to answer these questions correctly?

Similar techniques are required when engaging tanks with the medium and heavy antiarmor missiles. Instead of volley fire, however, sequential fire is required in which a second and possibly a third gunner is ready to engage the same target if the first fails to destroy it.

The Army's present medium antiarmor weapon, the M47 Dragon, will continue in that role until the advanced Antiarmor Weapon System-Medium (AAWS-M) is fielded in the mid-1990s. It weighs 47 pounds (with its night sight) and has a maximum range of one kilometer. (Observations from the National Training Center (NTC) indicate that many of the Army's Dragon gunners continue to engage targets beyond the weapon's maximum range.)

Soldiers in infantry one-station unit training receive familiarization training with the Dragon, and there is a Dragon gunners course that selected individuals attend, but units are responsible for training their Dragon gunners.

It is interesting to note that the Marine Corps' Dragon gunnery scores are significantly better than the Army's, and I believe these differences can be attributed to differences in training. Marine Dragon gunners receive twice as much training on the Dragon in initial entry training as Army gunners. Additionally, the Marine Corps has dedicated gunners who fire more live rounds and are stabilized in their positions longer than Army gunners. Most important, Marine leaders receive periodic training on employing the Dragon.

As for the Army's heavy antiarmor weapon, there are five different TOW missiles in the U.S. inventory and one in development. The only way to distinguish between them is by the markings on the box or the canister. (Comparison data are shown in Table 1.)

The basic TOW and the extended-range basic TOW warhead were developed to defeat the Soviet T-55 and T-62 tanks. The improved TOW (ITOW), which has an improved five-inch warhead and an extendable probe for stand-off detonation, was designed to defeat the T-64 or T-72 tanks without reactive armor. The six-inch TOW2 warhead was designed to defeat the later model tanks. It has not only an extendable probe for increased stand-off detonation, but also an improved guidance system that permits it to operate through dust, smoke, and limited countermeasures.

Not all TOW launchers have been modified to take advantage of the additional capabilities of the TOW 2. The launchers on the basic M2 and M3 Bradley fighting vehicles can fire the TOW 2 but may lose the missiles in obscurants. The systems that have been modified to fire the TOW 2 must have operational thermal night sights.

The TOW 2A has an explosive tip charge on the extendable probe that is designed to detonate reactive armor before initiating the warhead's main charge.

The TOW 2B missile (BGM71F), currently in development and to be fielded in 1991, uses a fly-over shoot-down technology. But indiscriminately overflying friendly vehicle positions can result in fratricide.

While the TOW is one of the finest antiarmor weapons in the world, recent live fire exercises at the NTC have shown that we may not be adequately training our TOW gunners to conduct prefire checks. The results of one test indicate that the TOW gunners hit only one-third of the targets they engaged.

Those who believe the U.S. TOW can outperform the Soviet AT-5 Spandrel missile are wrong. While the various TOW missiles have maximum ranges of either 3,000 or 3,750 meters, depending on the model, the AT-5 has a maximum range of 4,000 meters. The TOW's average velocity is 186 meters per second, while the AT-5's average velocity is 250 meters per second. Thus, the AT-5 has both a greater maximum range and a shorter time of flight.

In addition to knowing their own antiarmor weapons, infantrymen also need to recognize and make the most of the systems used by other members of the combined arms team. Observations from a recent light-heavy force rotation at the Joint Readiness Training Center (JRTC) revealed that the light infantry soldiers did not know as much as they should about our armor systems.

First, infantrymen working in front of tanks were unaware of the injuries that could be caused by the discarding petals of the armor piercing discarding sabot (APDS) rounds. (The danger area when firing ADPS ammunition extends out 1,000 meters to the front and 70 meters on either side of a round's trajectory. As a rule, tanks should not be directed to fire over the heads of exposed friendly personnel.) And second, some infantrymen were unfamiliar with the types of ammunition the armored vehicles used.

The basic load of ammunition carried on U.S. tanks (M60A3, M1, and M1A1) consists of two types of main-gun rounds—kinetic energy APDS/APFSDS (armor piercing discarding sabot/armor piercing fin-stabilized discarding sabot) and chemical energy HEAT/HEAT-MP (high explosive antitank/high explosive antitank multipurpose).

The APDS round uses a kinetic energy defeat mechanism while the HEAT uses a chemical energy defeat mechanism.

TOW MISSILE COMPARISON

NOMENCLATURE	MARKING	RANGE (m)	FIELDED	NUMBER
Basic TOW	BGM71A	3,000	1970	-
Extended Range Basic TOW	BGM71A1	3,750		-
Total Basic TOW				311,000
Improved TOW (ITOW)	BGM71C	3,750	1981	49,000
TOW 2	BGM71D	3,750	1983	50,000
TOW 2A	BGM71E	3,750	1987	45,000
Soviet AT-5		4,000	1974-75	

Table 1

Kinetic rounds use speed and mass to penetrate armor, while HEAT shaped-charge warheads essentially "burn" through the armor.

Additionally, it is possible that war stocks of limited issue (rounds for 105mm tanks that are no longer manufactured) may be made available. These rounds are the high explosive plastic used against bunkers, the flechette used against personnel, and the white phosphorous for marking or obscuring targets.

The number of main gun rounds declines from the M60A3's basic load of 63 rounds to the M1's 55 rounds and to the M1A1's 40 120mm rounds. The M1A1 120mm has two APFSDS-T rounds (the M829 and M829A1) and one HEAT-MP round (the M830). The M551A1 Sheridan carries 21 152mm conventional rounds and 8 Shillelagh missiles. The M551's conventional rounds are HEAT-MP effective out to 1,600 meters; the high explosive and canister (flechette) rounds are effective out to 400 meters. The Shillelagh missile has a maximum effective range of three kilometers.

Infantrymen directing the fire of these armored vehicles need to know that both the M60 tank and the M551 Sheridan have an external telephone box on the rear fender; unfortunately, the M1 and M1A1 do not. All armored vehicles have a radio capability and can accept a WD-1 telephone line.

Finally, infantrymen should remember that there are visual blind spaces and weapon dead zones around each tank that can either help or harm them.

When used together, engineer antitank mines and infantry antiarmor weapons are a winning combination. FM 20-32, Mine/Countermine Operations, discusses the use of antitank mines. The M15 and M19 are manually emplaced pressure activated antitank mines. They weigh 30 and 28 pounds, respectively, and are designed to provide a mobility kill. The M21 antitank mine is a manually emplaced full-width killer mine. It weighs 17 pounds and contains a shaped charge with 11 pounds of explosives. It is activated as an enemy tank drives over the tilt rod and is effective against all known tanks.

ANTIARMOR MUNITIONS

MUNITION	PLATFORM	PENETRATION	RANGE	AVERAGE VELOCITY
U.S.				
TOW 2A	BFV/ITV	1,000mm	3750 m	186 m/s
TOW 2	BFV/ITV	900mm	3750 m	186 m/s
I-TOW	BFV/ITV	800mm	3750 m	186 m/s
Dragon	Manportable	500mm	1000 m	90 m/s
120mm M829	M1A1	525mm	2000 m	1,660 muzzle vel
120mm M829E1	M1A1	650mm	2000 m	1,660 muzzle vel
105mm M833	M1/M60	420mm	2000 m	1,500 muzzle vel
SOVIET				
AT-3 Sagger	BMP-1/BRDM	400+mm	3000 m	120 m/s
AT-4 Spigot	Crew Served	500-600mm	2000 m	181 m/s
AT-5 Spandrel	BMP-2/BRDM	500-600mm	4000 m	250 m/s
AT-6 Spiral	HIND-E	600-700mm	5000 m	450 m/s
AT-8 Songster	T-64B/T-80	700-800mm	4000 m	Not Available
125mm APFSDS	T-64/72/80	450mm	2000 m	1,750 muzzle vel
115mm APFSDS	T-62	350mm	2000 m	1,600 muzzle vel
100mm APFSDS	T-54/55	300mm	2000 m	1,500 muzzle vel
125mm HEAT-FS	T-64/72/80	500+mm	2400 m	Not Available
115mm HEAT-FS	T-62	450mm	1600 m	Not Available
100mm HEAT	T-54/55	390mm	1500 m	Not Available

ARMOR PROTECTION

Tank	Protection Level Frontal 60 Degrees Arc (mm)	
U.S.	**vs HEAT Munitions**	**vs KE Munitions at 2 KM**
M60A1	325	325
M1	750	350
M1A1	1000	400
M1A1 (DU)	1300	600
SOVIET		
FST 1 w/RA	1200	550
T-80 w/RA	1050	500
T-72 w/RA	900	450
T-64B w/RA	900	450
T-80	500	500
T-72	400	400
T-64	400	400
T-62	300	300
T-55	200	200

NOTES:
1. **RA stands for explosive reactive armor.**
2. **DU stands for depleted uranium.**
3. **To insure a kill, the number for penetration must be larger than protection level.**
4. **Sides, rear, top and bottom of tanks are less protected.**
5. **Chart data from Soviet Gains in Armor/Antiarmor, FM 100-2-3, Soviet Military Power 1987, and Ten Million Bayonets.**

Table 2

TC 6-20-5, Field Artillery Delivered Scatterable Mines, discusses the employment techniques for field artillery delivered scatterable mines. The manual states that a 155mm battery requires 15 minutes to fire a planned and approved minefield that measures 400 x 400 meters.

A maneuver commander must consider several factors before employing artillery delivered scatterable mines:

- The corps commander holds authority for the emplacement of all scatterable minefields in the corps area of operations. He may delegate this authority down to battalion level for a short duration minefield (less than 24 hours) and

to brigade level for a long duration minefield.

- A firing battery has, as part of its basic load, enough rounds to emplace only one short duration minefield 400 x 400 meters, and those rounds may not be positioned with the howitzers. Additional time may be required to ensure that enough rounds are available to support multiple minefields.
- As many as half of the mines may land outside the desired minefield area, which necessitates a safety area up to 1,500 x 1,500 meters around the 400 x 400 meter minefield.
- Since artillery delivered scatterable antitank mines are round, they may roll off a paved road upon impact, and in deep snow they may not be positioned correctly. Unfortunately, there is no solution to this problem.
- Finally, for survivability, it is standing operating procedure for artillery units to displace after firing a scatterable mine mission; consequently, during the time it takes to displace, move, and emplace a battery again, it will not be available to fire other missions.

Artillery delivered scatterable minefields need to be linked to the commander's decision points identified by the intelligence preparation of the battlefield (IPB) process and to such target areas as choke points. The engineer and the S-3 or G-3 plan and coordinate the minefield, and the artillery fires the mission.

REACTIVE ARMOR

A new challenge to antiarmor operations in recent years is reactive armor on vehicles, which consists of explosive boxes designed to defeat shaped-charge/HEAT munitions. It was first fielded in 1982 by the Israelis, and the Soviets began fielding reactive armor on their T-64B and T-80 tanks in 1984.

The Israeli's reactive armor called "Blazer" protected their vehicles against handheld HEAT weapons such as the RPG-7, the LAW, and the AT-3 Sagger ATGM (antitank guided missile). Most important for today's infantryman is to know that reactive armor will defeat the shaped-charge munitions available to him and that it is insensitive to kinetic energy munitions.

The number of threat armored vehicles continues to grow, and it is important for leaders to be familiar with these vehicles. Some other characteristics of these vehicles are shown in Table 2.

The Soviets have fielded missile firing tanks that are similar to the U.S. Sheridan in that an ATGM is fired through the tank's main gun. The T-64B and T-80 tanks are known to fire the AT-8 Songster missile, which has a 4,000-meter maximum range. The missile-firing tank's primary role is believed to be destroying antiarmor systems such as the Bradley Fighting Vehicle (BFV), the Improved TOW Vehicle (ITV), and attack helicopters.

Soviet tanks carry three types of main gun rounds—APFSDS, HEAT, and HE-FRAG (high explosive fragmentation). For the infantryman, the HE-FRAG round presents the greatest threat, followed by the 12.7mm and 7.62mm machineguns. More than half of a Soviet tank's 40-round basic load is HE-FRAG ammunition, which is used to suppress enemy fighting positions and against ATGM sites.

An article entitled "Soviet Gains in Armor/Antiarmor Shape US Army Master Plan," published in *Armed Forces Journal International*, February 1989, presents a comparison of the armor protection and munition penetration levels of both U.S. and Soviet systems. Some of these comparisons are shown in Table 2. TC 90-16 is a more precise source of data for planning training exercises against armored vehicles.

Leaders must also recognize and guard against the negative lessons that some training devices, gunnery standards, and training ammunition constraints may instill in their soldiers.

For example, SIMNET, a command and control trainer, uses an unrealistic "cardboard" threat target that burns when it is hit. And Bradley Fighting Vehicle gunnery standards require gunners to hit the target with three out of five rounds—not because a BMP can be killed with three or even five rounds, but because of the high cost of ammunition. The expectation is that soldiers who can hit a target with three out of five rounds can continue to hit a target until it is destroyed.

Likewise, during LAW/AT4 gunnery, leaders have their soldiers fire one round individually instead of having the squads practice volley fire. A prevailing attitude during most gunnery training is that one shot equals one hit, and that one hit equals one kill. While this idea may be suitable for gunnery training, it does not match the reality of the battlefield where at least two rounds are required for a kill. In addition, leaders must keep in mind that there are differences between the targets used for gunnery and the actual enemy armored vehicles.

The way you and your unit fight the first battle of the next war will set the tempo for the way it fights the remainder of the war. In the worst case scenario, if threat vehicles move into your engagement area, and you engage them with little or no success, two things will happen. First, the enemy will gain confidence in his equipment and his ability to defeat you. Second, your confidence in your weapon systems, and your ability to defeat the threat, will decrease.

If, on the other hand, the threat vehicles move into your engagement area and your soldiers engage them with devastating success, the threat's second echelon, observing the destruction, will lose confidence in their equipment and their leaders.

As Sun Tzu wrote in *The Art of War:* "If you know the enemy and know yourself, you need not fear the result of a hundred battles. If you know yourself, but not the enemy, for every victory gained you will also suffer a defeat. If you know neither the enemy nor yourself, you will succumb in every battle."

The art of killing armored vehicles is rapidly approaching a science. It is therefore vital that you know your weapons' exact capabilities, and those of your potential enemy as well. What you don't know could kill you—and your men.

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