Army Rifle Marksmanship Against Moving Targets

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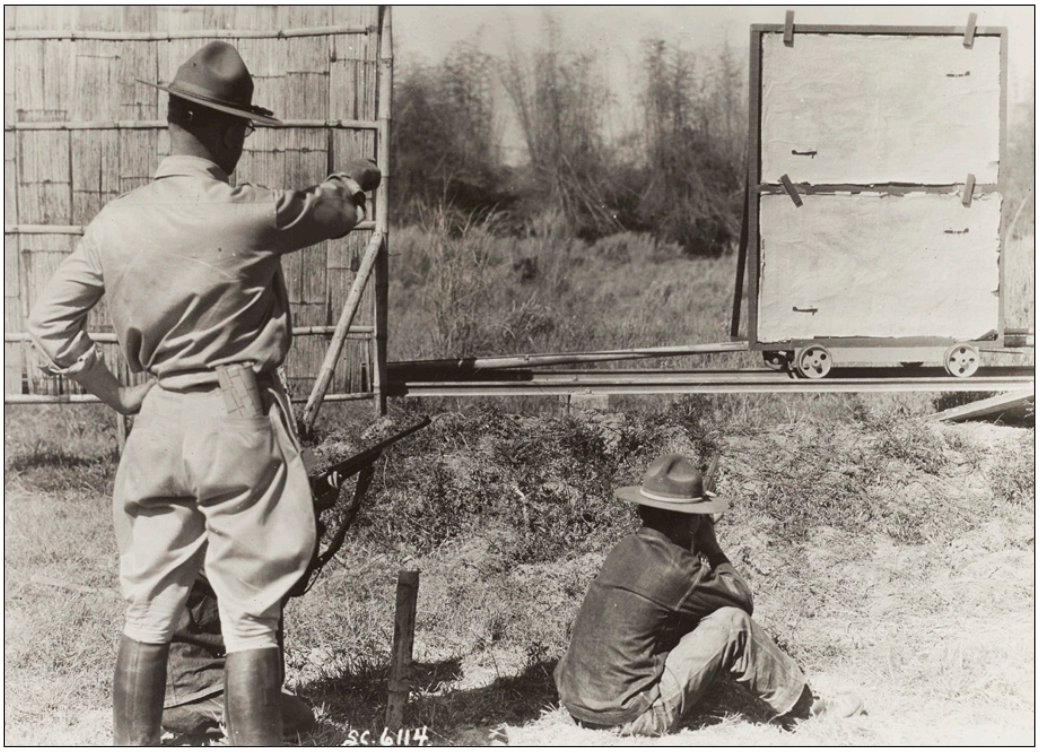
For almost as long as Soldiers have been launching projectiles at each other, the issue of moving targets has been a regular point of discussion. After reading the latest moving target doctrine in Training Circular (TC) 3-22.9, *Rifle and Carbine*, I wanted to submit a constructive critique to stimulate discussion of the subject.

Before getting to the subject hand, it may be useful to share what I call the four characteristics of a personnel target.[1] This proves beneficial if we define our target first and then work backwards to design our training. Therefore, we should start this discussion knowing that a target can be: dynamic, non-cooperative, robust, and restricted. Looking at each of these characteristics in more detail, we can see how they impact on our ability to actually hit a real-world target.

Dynamic: This simply means that the target can change… as in change their orientation, change their threat level (by shouldering a rifle or even surrendering), or change their position (standing to kneeling to sitting, etc.). Paper targets are two-dimensional and people are three dimensional. Real people can change their shape. For example, if making a chest shot against someone in full-on stance, this may be about 19 inches across the shoulders. By facing to the left, a target can become 9-inches wide. This change may also come without warning and be performed quickly.



Service members conduct marksmanship training on a moving target at Fort William McKinley in the Philippines on 24 April 1933. (National Archives photo)

Non-cooperative: This can be an attempt to place cover or concealment between you and them if they know or think they know where your position is; they can move if standing still and stop suddenly if moving. They can also run, crawl, or dive to the ground. In a nutshell, they're not cooperating with your efforts to shoot them. Last and certainly not least, they can shoot at you as well.

Robust: This addresses the uncertainty of wound ballistics. Despite assurances of all kinds of wounding theories, we can't overlook the fact that people have been wounded with .50 caliber bullets and killed with .22 rimfires. And I know that shot placement is the "go to" response right now, but especially in a discussion of moving targets, it becomes problematic as we'll see later in this article. Also, the need for a rapid follow-up shot is always a possibility.

Restricted: This addresses the realities of rules of engagement, which are basically unknown until the conflict begins. Consider World War II, where an enemy soldier was fair game just by the uniform he was wearing, to more recent situations, where armed men were off limits unless they pointed a weapon in your general direction.

A Brief History of the Moving Target Dilemma

Although moving targets across the years have included advancing and retreating troops, I will limit this discussion mostly to engaging moving targets (or "movers") that cross laterally across our front.

Please note that this is in no way meant to be an exhaustive history but rather a "highlight reel" of how different generations of American Soldiers have recognized and addressed this problem. Consider it a "flashbulb" look at the advances (and retreats) in the evolution of moving target training for Infantry Soldiers. At this point, it may be useful to quote military historian Timothy Harrison Place, who said, "It is, or should be, a tenet of military history that one cannot assume that what the manual said was what the soldiers did."[2]

Rather than going down the usual rabbit hole of beginning with cavemen throwing rocks, English bowmen at Agincourt, or the Minutemen with their smooth-bore muskets, I will start with the 19th century.

Late 19th Century

Manual for Rifle Practice* by General George Wingate, 1874, *Army and Navy Journal

> *89. In firing, at an object in motion, the instructor should explain that the best way is to aim in the usual way, and then, without dwelling an instant on the aim, move the rifle laterally in the direction and to the extent required, by simply turning on the hips, the arms and eye being kept perfectly steady. If the object be approaching, the aim should be low; if receding, high. This must be decided by the distance and the speed of the object, fired at, and is a matter of judgment as to the distance it will have passed over during the flight of the bullet.*

Note: Rather than sharing any rules, the author leaves how far to lead a lateral target up to a Soldier's judgment. This is also an example of a discussion about engaging moving targets that consisted of large formations of men moving toward or away from the firer.

***Instructions in Rifle and Carbine Firing for the United States Army* by CPT Stanhope E. Blunt, 1885, prepared by Command of Brigadier-General S. V. Benét, Chief of Ordnance, U.S. Army**

> *Chapter III - Practice at Disappearing and Moving Targets*
>
> *362. Practice at some form of moving target should be frequently conducted, as firing at fixed targets has a tendency to make men too deliberate for field firing.*
>
> *Either a disappearing target, or a running target may be employed.*
>
> *367. For running targets the Cushing rolling target (paragraph 420) should be employed. The track*

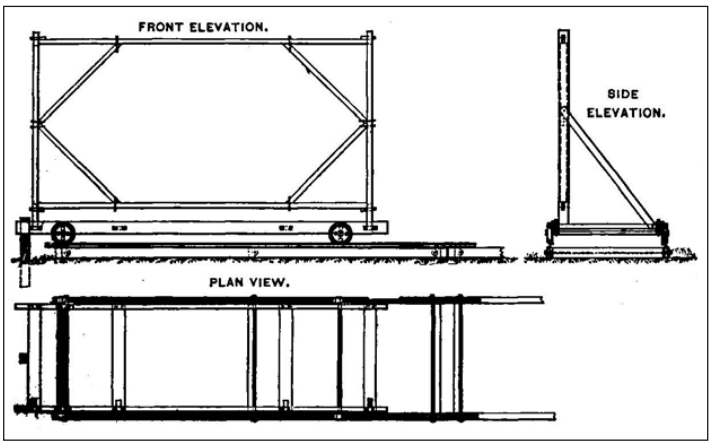


Figure 1 — The Cushing Target

should be raised at either end, forming two inclined planes, and two marker's shelters so placed as to permit of a run of about 40 or 50 yards. When it is not practicable to construct an inclined plane, the target, by means of a rope, may be drawn across the open space between shelters.

368. The ordinary B target, the skirmish figure target (Target D), or the figure of a horse or deer, may be used. For either of the latter, the frame supporting the target should be so constructed that it can be revolved around a centre pin, so that the figure may not appear to be moving backward.

371. Firing at running targets should commence at 50 yards, to be afterward increased to 100 yards.

372. In firing at a moving object, whether it be a target, or a man walking, or a horse at a gallop, the soldier must remember that the object will pass over a certain distance between the moment when the aim is completed and the rifle is discharged and the time the bullet reaches it, and that this distance must be calculated and allowed for. To accomplish this, if the object be moving across his front, the soldier must carry his aim or little in advance of it, depending on the speed at which it is moving, on the distance which it is from him, and the resulting time required for the flight of the bullet. If the object is moving from him, he must fire high, and if approaching him, low; while these different allowances can be readily calculated, their application will only produce good results when they have been actually determined by the experience of the individual soldier.

373. In firing at an object moving across the line of fire, the soldier should first aim directly at it, and that the aim may be caught quickly and clearly, he should use a full sight and aim low. He then, without dwelling on the aim, moves the rifle laterally and to the extent required, by simply turning on the hips, the arms and eye being kept steady and the shot fired the instant the aim is judged to be correct.

Note: It's interesting to find the comment in the above text that although leads can be calculated, the Soldier's judgment — when developed through live-fire practice — gives the best results. This publication also provides specific guidance on courses of fire and targets to be used in training.

Early 20th Century

Given all the current interest in using robots to provide three-dimensional moving targets to create down-range scenarios, we should also look across the Atlantic to the British Army's Aldershot Training Area in 1901 and a field fire exercise developed in response to the Second Boer War (11 October 1899 - 31 May 1902).[3] The targets and scenarios for this exercise were based on situations that confronted British soldiers while serving in South Africa against the guerrilla forces known as Boer Commandos.

An article in *Strand Magazine* by Albert H. Broadwell about this training featured photos of the moving targets the British Army crafted; these included the "Running Men" (two men skylining themselves), a Boer attack against an armored train, and a Boer signaler who had to be engaged, all culminating in the

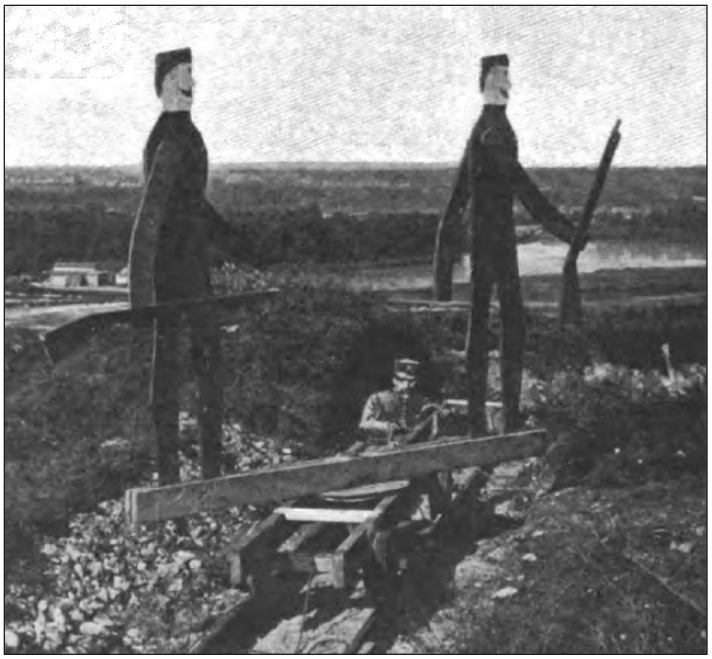


Figure 2 — The "Running Men" Moving Target

objective of capturing a Boer inn with an armed, moving target "landlord" that comes out carrying a rifle then executes an about face and heads back to the inn unless hit (see Figure 2).[4]

Some few years later, back in the States….

***Small Arms Firing Manual*, 1913, War Department**

> *219. Fire at Moving Targets*
>
> *[…] In firing at a target moving across the line of fire it is desirable, on account of the confusion caused thereby, to hit the head of the column. It is necessary therefore to hold to the front a distance sufficient to allow for the time of flight and the rate of march. This will be accomplished by the observance of the following rough rules:*
>
> *Against infantry it is sufficient to hold against the head of the marching column.*
>
> *In the case of mounted troops at a trot, hold to the front 1 yard for every 100 yards of range; and at a gallop, 2 yards to every 100 yards of range.*

Note: The emphasis here was still on engaging masses of enemy troops while on the march, and a formula for figuring leads against Soldiers on horseback was mentioned. This manual includes a table of leads for engaging troops and mounted cavalry (see Figure 3) as well as mentions training rifleman on Target K (see Figure 4).

In the same manual, Target K is described:

> *Target K - Sled target. The disappearing target beam (target I) is lashed lengthwise to two sleds. A rope from 200 to 300 yards long is used to pull this target and an escort wagon and team has been found to be the best motive power. The rope can be run through a snatch block and the team concealed by inequalities of the ground.*
>
> *If no cover can be found for hiding the sled before it starts, it can be easily masked with brush, grass, etc., which will fall* when the targets start.[5]

Distance (yards).	Man walking.		Man double timing.		Horse walking.		Horse trotting.		Horse running.	
	Ft.	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*
100	Front edge.		.....	6	Front edge of body.		Front of body..		Front edge of body.	
200	.....	8	1	8	Front edge of body.		Front of body..		1	4
300	1	5	3	.....	Front of body..		1	6	3	10
400	2	2	4	5	Front of body..		3	4	6	6
500	3	1	5	11	1	.....	5	4	9	6
600	4	.....	7	7	2	.....	7	7	12	10

Figure 3 — Table of Leads

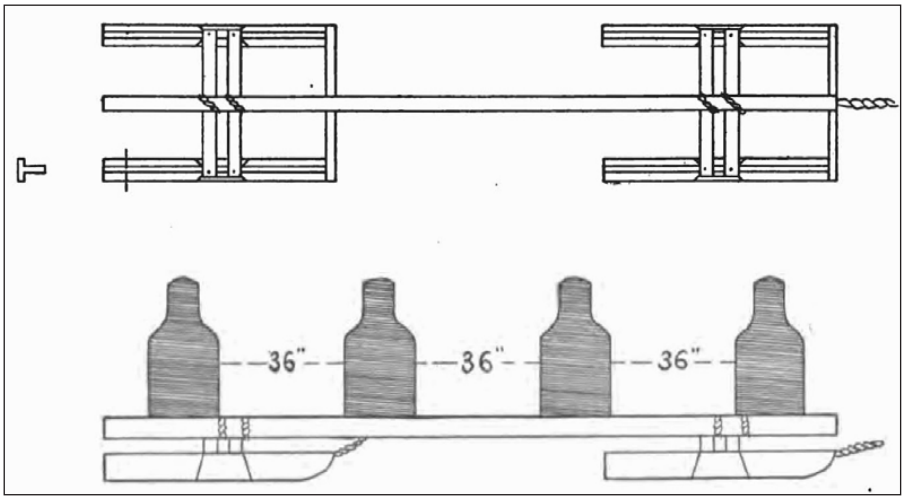


Figure 4 — Target K

Mid to Late 20th Century

Field Manual (FM) 23-10, *U. S. Rifle, Caliber .30, M1903*, War Department, 2 January 1940

48. Scope of Training. Rifle units will be trained to fire at moving targets, such as tanks, armored vehicles, trucks, and personnel at appropriate ranges. Rifle fire may be employed to repulse or harass unarmored vehicles and motorized troops. Rifle units will be trained to meet a tank attack by taking cover, standing their ground, and delivering the maximum possible aimed fire with armor-piercing or ball ammunition at the enemy tanks and hostile foot troops which may accompany them. To this end they must be trained in the technique of such fire.

Section III - Moving Personnel

53. Technique – a. Sight to be used. Under field conditions, moving personnel presents a fleeting target, and one more difficult to hit than a moving vehicle. This fact makes the use of the peep sight desirable for greater accuracy. However, the use of battle sight may be necessary when targets appear suddenly, allowing no time for sight adjustment. It is therefore desirable that the individual rifleman be trained in the employment of both sights in this type of firing.

b. Method of aiming. An elaborate system of calculating leads is neither necessary nor desirable. The following general rule forms the basis for estimating the proper leads.

When firing at a man walking across or at right angles to the line of fire, the points of aiming at the various ranges are as follows:
(1) At 100 yards, aim at forward half of body.
(2) At 200 yards, aim at forward edge of body.

(3) At 300 yards, lead him one-half the width of his body.
(4) At 400 yards, lead him the width of his body.

Proficiency in this type of firing depends largely upon the amount of time devoted to it by the individual in the practice of aiming, squeezing the trigger, and leading with appropriate speed.

54. Place in Training. As in the case of practice in firing at moving vehicles, instruction in this type of firing should follow instruction in known-distance firing and should immediately precede the training of the squad in technique of fire (musketry) when practicable.

Note: When examining this manual in detail, it states that moving targets are to be fabricated locally. Also note that it asserts that moving target training "should" follow a known distance range or individual rifleman training. The manual further advises that the training should immediately precede what was called technique of fire training, which focused on collective firing of rifle squads and platoons. By being wedged into the period after qualification badges were issued and before field firing started, moving target training could literally fall through the cracks of instruction. Also consider that unlike known distance marksmanship and unknown distance field fire, there were no courses of fire or grading standards for moving target training.

FM 23-5, *U.S. Rifle Caliber .30, M1*, Department of the Army, 2 October 1951

208. Method of Aiming

b. Leads. To get the proper lead for firing at a man walking across your line of fire, aim the rifle as shown in figure 103. If the man is running, double the lead. Accuracy in this type of firing depends largely on the amount of time you devote to the practice of leading the target, aiming, squeezing the trigger, following through, and the correct battle sight setting. Use the following aiming points as a basis for obtaining the proper leads:

(1) At ranges less than 300 yards, aim at the forward edge of the body.

(2.) At ranges of 300 yards or more, lead your target by the width of the body. [See Figure 5]

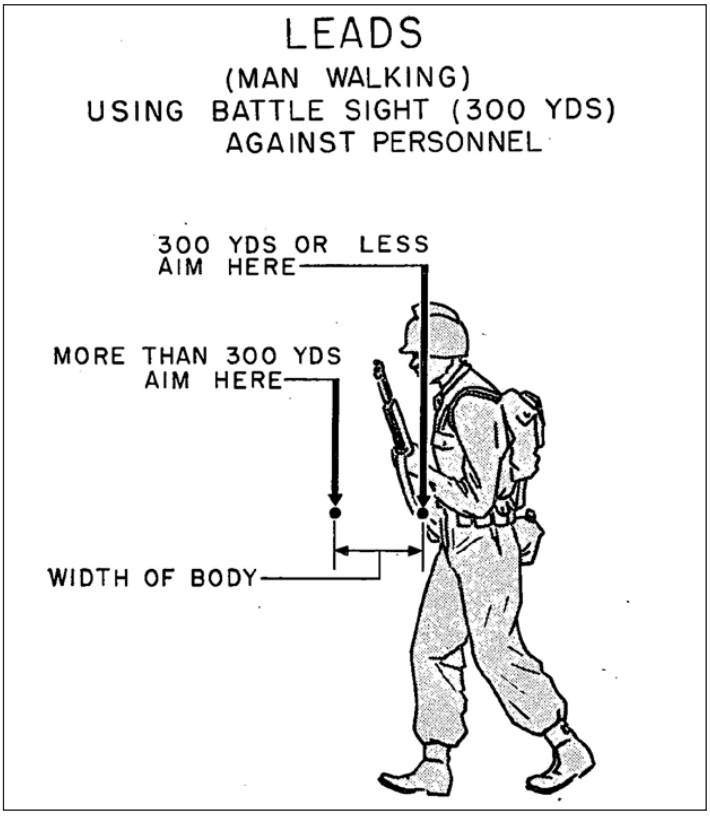


Figure 5 — Leads

Note: Despite what was written in doctrine, the Army had no requirements to engage moving targets as part of live-fire training. Also note the change from the pre-war 1940 lead rules in 100-yard increments out to 400 yards, which was likely due to marksmanship training mostly taking place on known distance ranges. Six years after the end of WWII, the lead rules had been vastly simplified, even if they probably weren't being trained on.

***Trainfire I: A New Course in Basic Rifle Marksmanship* by Howard H. McFann, John A. Hammes, and John E. Taylor; published by the George Washington University Human Resources Research Office, October 1955**

Although much maligned and misunderstood (particularly by those claiming we're still using it for basic rifle marksmanship), Trainfire underwent a great deal of research, experimentation, and testing prior to its adoption by the Army.

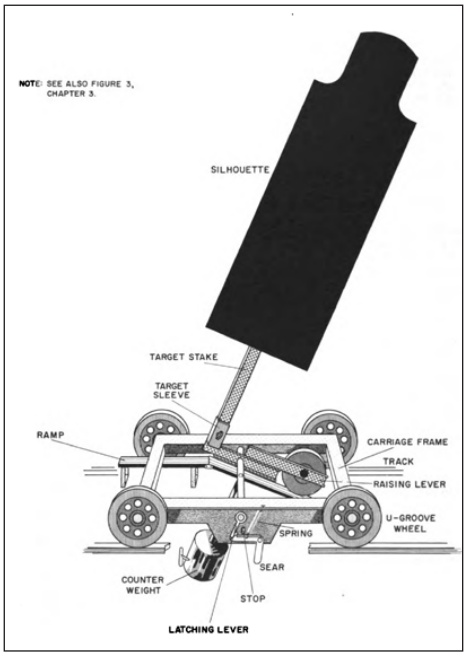
Originally, "[l]aterally moving surprise silhouette" targets were "considered essential for individual marksmanship instruction." To this end, there were originally two periods of range practice against pop-up moving targets:

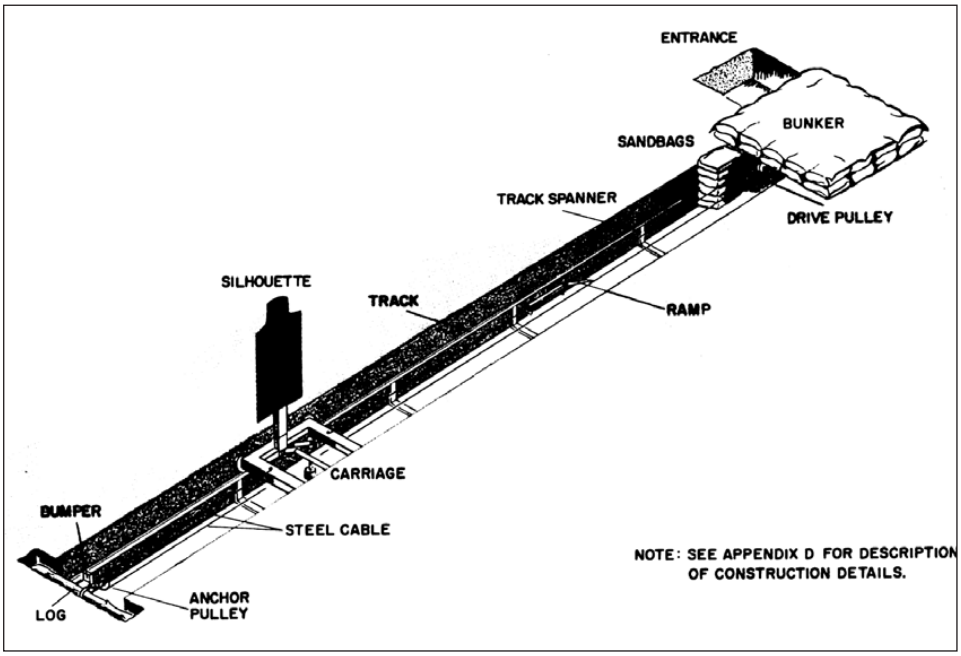
Period 15. Firing Practice on Silhouetted Moving Targets (4 hours, 8 rounds) — Dry and live firing from supported, foxhole position upon laterally moving pop-up targets at 200 yards with targets silhouetted against a white background to increase visibility and to make spotting of misses possible.

Period 16. Firing Practice on Non-Silhouetted Moving Targets (4 hours; 16 rounds) — Dry and live firing from supported, foxhole position upon laterally moving pop-up targets at 200 yards with targets not silhouetted against a white background.

However, by the time FM 23-71, R*ifle Marksmanship Course, Trainfire I,* was published in September 1957, the only moving targets encountered by trainees were the downrange role players during the 16 hours of target detection training. Given the notorious budget cuts in the U.S. Army at that time, I suppose Army leadership considered themselves lucky they were able to afford stationary pop-up target ranges. (Note: Some designs of pop-up moving targets that complemented the pop-up stationary targets from Trainfire are still in use today.)

Figures 6 and 7 — Proposed (But Not Adopted) Moving Targets for Trainfire





U.S. Army Technical Note 1-67, *Small Arms Use in Vietnam: M14 Rifle and .45 Caliber Pistol*, Human Engineering Laboratories, Aberdeen Proving Ground, MD, January 1967

The following question was part of a survey of personnel who had experienced combat in Vietnam:[6]

24. When you see an enemy soldier is he usually:

Running Standing Hidden Prone

3 percent of respondents said 'standing' while 44 percent said 'running.'

And yet, there was still no requirement to qualify on moving targets at that point in time.

Field Circular (FC) 23-11, *Unit Rifle Marksmanship Training Guide*, U.S. Army Infantry School, 1 August 1984, and FM 23-9, *M16A1 and M16A2 Rifle Marksmanship*, Department of the Army, 3 July 1989

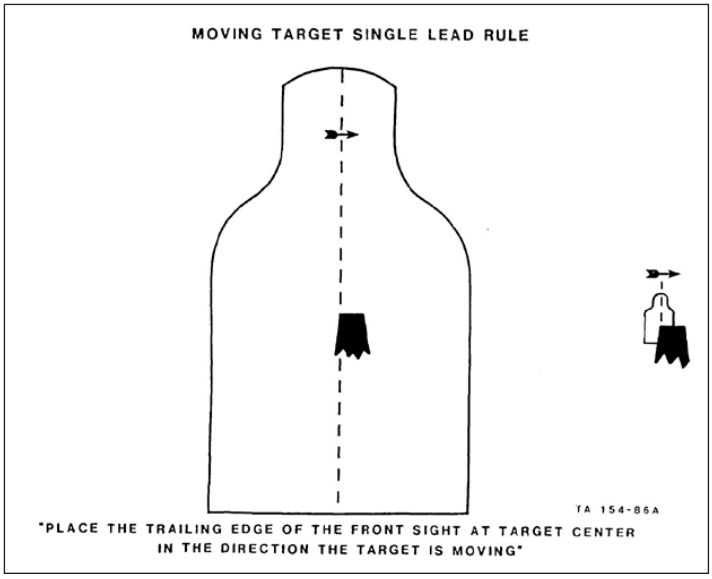
After decades of problems with Army marksmanship doctrine, the Army Research Institute was tasked with conducting new research and experimentation to correct some fundamental flaws in training. One topic addressed was engaging moving targets, with the results being described in FC 23-11 and authorized as doctrine in the 1989 edition of FM 23-9 (replacing an interim change to the 1974 edition).

It is doctrinely (sic) unsound to move laterally in front of an enemy position. Therefore, you would not expect to engage many combat targets moving at 90 degrees from the firer's position. Combat targets can be expected to be moving at any angle, with some moving directly at the firer. Also, in the case of close-in targets, or in the case of targets moving at a small angle (5 to 40 degrees) even the perfect application of the complicated lead rules would result in many target misses.

In view of the above, a single lead rule has been developed for field testing. This single rule, place the trailing edge of the front sight post at target center, will allow the teaching of one sight rule for all laterally moving targets at all ranges moving at all angles, moving at any speed, and with no decrease in hit probability over the previous sight rules. This sight/target relationship is shown in Figure 17-2. This one rule causes lead to automatically increase as the range to the target increases.

Note: Even though a well-thought-out technique, the manual makes the mistake of illustrating it using a full-on E type silhouette target. The technique will still work against a reduced width silhouette representing the profile of an enemy. The main takeaway is that the Soldier doesn't have to be constantly drilled in correctly estimating target distance, speed, AND angle in order to use this technique.

Figure 8 — Moving Target Single Lead Rule



Of course, this method would have to be updated and tested for using a red dot sight as found on current weapons. Also of interest in the 1984 manual, Chapter 34 identifies and discusses problems when attempting moving target training with the Multiple Integrated Laser Engagement System (MILES):

> *MILES is a tactical shooting device — it is not a marksmanship device.*
>
> *The use of MILES devices can make some contribution to a unit's marksmanship program; however, care must be taken that negative training does not occur.*
>
> *Using MILES to practice the engagement of moving targets may be very misleading. Particularly since this may be the only moving target training some soldiers have had. The laser is not affected by range, gravity, or wind and is much faster than a bullet, making the engagement of moving targets vastly different for the two systems. To illustrate, we will use a man-size target at 450 meters, running 10 mph, with a 10 mph crosswind. When the laser is aimed at this target, it will hit where it is aimed. (The target actually moves a distance which would fit 15 times into the thickness of this page while the laser is traveling to the target.) If a rifle barrel is lined up on the same target and fired, during the bullet flight time the target will have moved 10 feet, the wind will have blown the bullet 3 feet off course, and the bullet will have dropped 5 feet from the boreline — certainly a significant difference.*

So, although the manual diplomatically says that use of MILES "may be very misleading," I'm prepared to say that it provides negative reinforcement and rewards behavior that would guarantee a miss in combat while punishing behavior (like leading the target) that would likely result in a hit.

21st Century

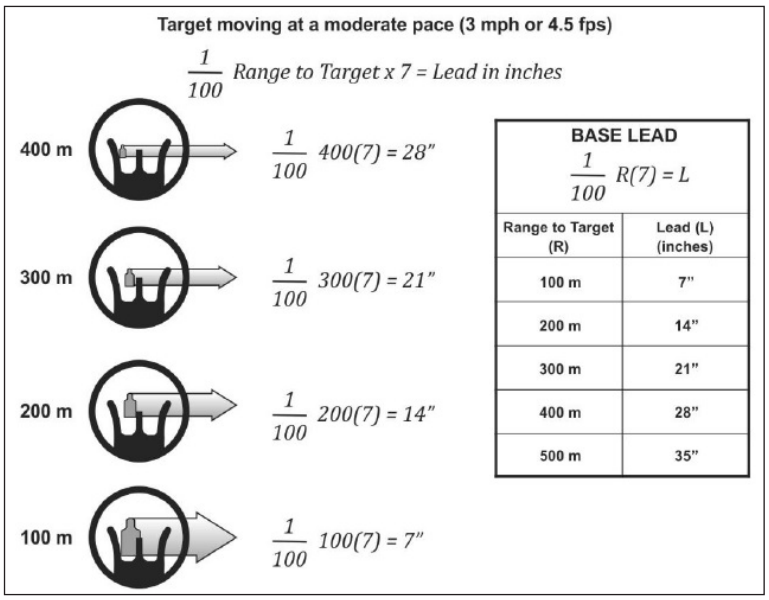
TC 3-22.9, *Rifle and Carbine*, Department of the Army, 20 November 2019

And now we come to the reason why I say that, in my opinion, moving target doctrine for rifle marksmanship has taken a step backwards with the publication of this TC.

The Single Lead Rule is now replaced with a mathematical and ballistics-based theory grounded on the assumption that the individual Soldier fighting on a battlefield will know:
- The distance to a dynamic and non-cooperative target;
- The speed it's moving at;
- The angle it's moving at; and
- The time of flight of the bullet over the assumed distance.

Instead of "Private, align the trailing edge of the front sight post with the center mass of the target and squeeze while tracking to keep that sight picture," we're treated to a complex equation as seen in Figure 9.

Figure 9 — Deliberate Lead Formula Example



Figures 10 and 11— Target Angle Estimation Examples

While it is possible for every rifleman to train on those skills necessary to accurately estimate distance, speed, and angle, what is the chance they will know them to the degree that they'll be available six months from now at 0400 while taking incoming fire? How likely is it that leaders will have the time and resources to get their troops to that level of proficiency and maintain it?

Here's a little visual test for readers; I'll limit it to estimating a target's angle. In the first photo at right, is he at 15 degrees to you? Maybe 45? In the example on the far right, is he at 90 degrees for a full lead or 70 degrees for 94 percent of that?

I'll end the suspense. In the photo at left, he's at 30 degrees (everyone usually guesses 45 degrees), and on the right, he's at 60 degrees. You see, if you don't change the lead based off of target angle, and your estimations of speed and distance are off, then you're likely to miss.

And this matters because, as we see in the 1967 survey, engaging moving targets isn't forbidden knowledge or an advanced skill — it's a part of Basic Rifle Marksmanship as first stated back in 1955 by the developers of Trainfire. This is a skill that needs to be trained, practiced, and tested. And the method used needs to be simple and relevant to the real world — not the known distance range.

Notes

[1] John Simpson, *Foundations of Sniper Marksmanship* (Seattle: Blue360 Media, 2022). This section is a modification of the text found in my book.
[2] Timothy Harrison Place, *Military Training in the British Army, 1940-1944: From Dunkirk to D-Day* (London: Frank Cass Publishers, 2000), 17.
[3] Rudyard Kipling's 1890 poem "Gunga Din" mentions "Aldershot" to contrast the difference between conducting a training exercise in England and performing in combat.
[4] "The New Musketry Practice at Aldershot" by Albert H. Broadwell, *Strand Magazine* 22/132 (December 1901).
[5] War Department, *Small Arms Firing Manual*, 28 February 1913, paragraph 259.
[6] The 83 respondents were assigned throughout various Marine divisions: the 1st Marine Division (9), 3rd Marine Division (52), 5th Marine Division (8), 7th Marine Division (8), 9th Marine Division (2), 26th Marine Division (8) and (1) Not specified.

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Special thanks to 2LT Joseph Galli for assisting with target angle estimation examples.