



## Machine Gun Marksmanship

Marksmanship with machine guns uses the same concepts of Shot Process and Functional Elements as all small arms.

### Stability

We'll start with Stability. Stabilizing the machine gun or automatic rifle to provide a consistent base to fire from and maintain through the shot process until the recoil pulse has ceased.

A firm grasp, solid cheek-to-stock weld, natural point of aim on target, at shooter-gun angle that is straight and inline to the target, all set into a position that naturally returns back to target after each recoil pulse are the key concepts. Binding against the tripod, or bipod legs, or mount, or other support needs to be firm but holding too hard can worsen the results.

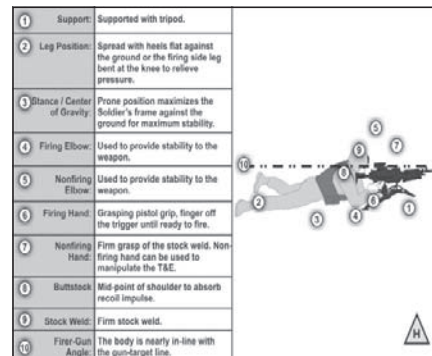
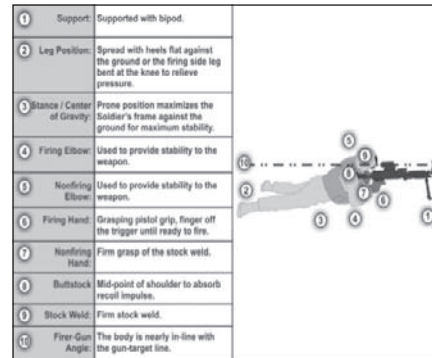
A good check series is, first, check natural point of aim by closing the eyes after aligning on a target and then re-checking alignment after opening the eyes. Make position adjustments until the sights want to remain on target.

Second, repeat this procedure but inhale and exhale while keeping the eyes closed. Finally, have an experienced or peer coach push and release the front sight housing several times with closed eyes to simulate recoil pulse. In all cases, the sights will remain aligned on target after rechecking if the position is aligned and the hold is good.

### Aim

Aim is the continuous process of orienting the weapon correctly, aligning the sights, aligning on the target, and the appropriate lead and elevation (hold) during a target engagement.

Sight alignment works the same as all other small arms. For example, focus on the front sight with irons. Sight picture is best described as center base, or just above a 6 o'clock hold. No,



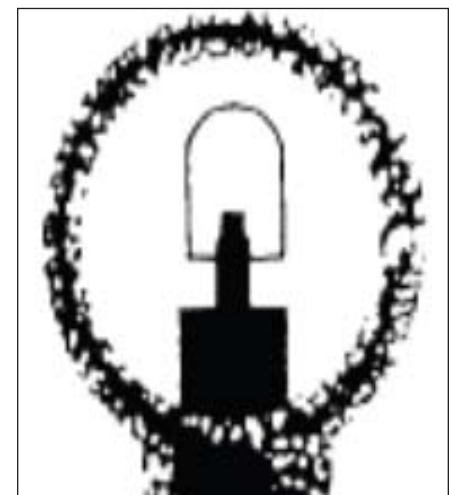
this is not because of wrong claims that machine guns rise during a burst. If a burst of shots string continuously upward then Stability is very poor as the position and hold have been compromised. Anyone claiming a machine gun climbs in recoil during a burst doesn't understand how to control a machine gun and should remain quiet about such matters. A well-controlled cone of fire should be roughly circular and the highest shot from the burst in the cone of fire likely isn't the last one fired.

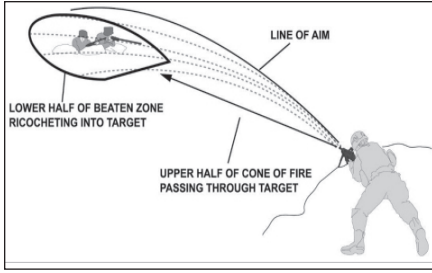
When watching a good gunner, the machine gun moves rearward due to the recoil impulse, rocking against the bipod/tripod (or other) point of support and the gunner's position naturally allows the weapon to re-

**Right:** Aim center base helps place the burst on target, especially when firing at targets with depth. Contrary to popular myth, it is NOT because the "gun climbs in recoil."

turn back to the position's start point prior to the next round in the burst being fired. There is no indication of continuing muzzle climb from shot-to-shot in the burst because the gun is returning back each time, rather like an artillery piece recuperating after discharge. A cone of fire on a target that shows stringing up due to climbing indicates a Stability and Control problem from a poor position and poor shooting.

The real reason for using a center base aim is to better place the beaten zone for maximum target effect. Unlike training ranges which normally used two dimensional targets, targets in the real world have depth. Shooting a cone of fire with a proper center base hold centers the beaten zone on top of the target area. Shots lower in the cone of fire strike in front of the target area. This makes it easier for the assistant gunner to locate and adjust from a fired burst, it places low shots directly in front of the target's view and better convinces them to be suppressed, plus any low shots are more likely to ricochet up into the target area. In a properly-centered beaten zone, high shots will tend to be caught by target itself. This adds up to a more effective placement of all shots in a burst.





**Above:** The real reason for using a center base aim is to better place the beaten zone for maximum target effect. Unlike training ranges which normally used two dimensional targets, targets in the real world have depth.

### Control

Control entails all the conscious actions of the Soldier before, during, and after the shot process that the Soldier specifically is in control of. The first of which is trigger control. This includes whether, when, and how to engage. It incorporates the Soldier as a function of safety, as well as the ultimate responsibility of firing the weapon.

With fully-automatic weapons, control as includes modulating the number of shots in a burst, be it three rounds for an automatic rifle, seven for a machine gun, or any other number. This should never compromise stability or aim. Unskilled personnel throwing their finger off the trigger to abruptly end the burst, the so-called “thousand degree trigger”, may disrupt their shot process and scatter rounds away from the target area.

The final, ultimate goal with machine gun marksmanship is to produce a centered circular cone of fire of the correct number of rounds wanted. This should be no bigger than

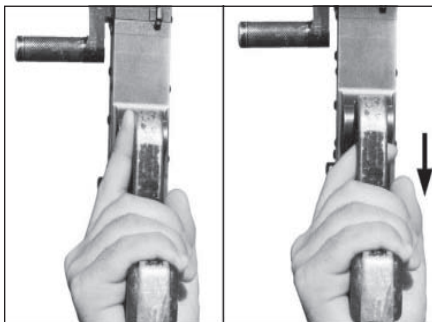
four mils. The paster used at 10 meters (1,000 cm) is 4 centimeters wide, which is 4 mils at that distance. The cone of fire must be centered just above the point of aim and no bigger than that. Any failure to accomplish this indicates a failure to apply a proper shot process and functional elements with the machine gun or automatic rifle. Good gunners can half the size of that cone of fire and approach two mils in diameter.

### Machine Gun Qualification

**OBJECTIVES:** The objective of machine gun marksmanship training is to produce gunners who can fire an accurate initial burst, adjust fire, and develop speed.

**FIRE AN ACCURATE INITIAL BURST:** Obtaining an accurate initial burst of fire on the target requires good marksmanship and is essential to gunnery. The crew (either gunner or assistant gunner) estimates the range to the target, sets the sights, and applies marksmanship skills to achieve an accurate initial burst of fire.

No, you don’t “just walk it in”. Machine guns demand as much attention to zero as any weapon you intend to hit targets with. Failure to use the sights and get a solid zero confirmed at distance means that every nearly engagement starts with a miss, wasting ammunition and time, and giving the gun’s position away before having strikes to register the gun and adjust fire from. It also means that any data on the bottom half of a range card is useless because T&E data is dependent on confirming the lay of the machine gun is correct, which you can’t do if the zero is so far off that you’re unable to regularly hit known distance targets with the first burst.



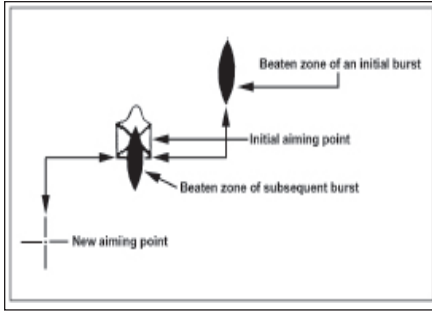
**Left:** Machine gun trigger control must cause no additional movement to the gun, just like every other type of weapon. A good gunner can modulate the trigger to fire an exact number of rounds in a burst on demand while retaining a good circular cone of fire.

This is doubly true with a Soldier so low skilled and unknowledgeable about machine guns that he foolishly believes that machine guns don’t need to be zeroed.

**ADJUST FIRE:** The assistant gunner observes the location of the beaten zone from the initial burst, giving the gunner a correction as needed. Corrections must be bold and stated with the direction and specific amount of adjustment given in mils. The gunner puts this correction on the Traverse and Elevation mechanism and fires another burst. Repeat as needed. The assistant gunner must be proficient in observing the strike of rounds and giving positive corrections. In a training environment, the A-gunner must give a definite adjustment in mils and the gunner must follow. This helps both learn how much adjustment effects changes at distance. Optics and binoculars with a mil reticle help this greatly. The assistant gunner’s proficiency helps the gunner re-lay the machine gun back on target.

**DEVELOP SPEED:** Speed is essential to good marksmanship also. Practicing dry-fire and live-fire exercises increases the gunner’s speed. Novice gunners fumble their T&E and often have to move in the wrong direction to remember what the controls do while proficient gunners can spin and move the controls of their gun smoothly where it needs to go. This work can and should be done away from the range. Aiming and T&E exercises can be done with any mark on a wall. Set at a known distance, such as 10 meters, makes it easy to scale aiming marks into mil-sized increments. Remember, one mil is one thousandth the distance to the target. 10 meters is 1,000 centimeters, so one mil is one centimeter at that distance.

**APPLY GUNNERY:** The 10 meter and Transition qualification courses test basic machine gun proficiency concerning marksmanship. The 10 meter target uses a series of pasters representing target areas, **NOT** individual targets or silhouettes. These target areas are a simple way to learn



**Above:** Gunnery requires learning to fire an accurate initial burst, adjust fire, and develop speed in doing it.

engaging an area beyond a single, fixed target, demanding the gunner traverse and/or search across an area, thus moving the grazing fires or beaten zones across a frontage.

**The pasters are NOT individual targets.** The individual and groups of pasters represent a target area that the cone of fire should fit inside of.

Merely hitting the paster is NOT the only goal. At 10 meters, a 4 cm paster is 4 mils wide. An E-type silhouette target 19 inches wide is 4 mils wide at 121.7 meters. Do the math. A mil is one thousandth of the radius of a circle. 19 inches divided by four is 4.75. 4.75 inches is a thousandth of 4,750 inches. 4,750 inches is 121.79 meters.

Merely hitting a silhouette at 122 meters from a bipod or tripod position is not a challenge. Keeping all the rounds from a single burst is.

Training Circular 3-22.249 and 3-22.240 specifically states this. With the machine gun qualifications, the manual directs that "the gunner using the traverse and search technique, engages pasters, either B5 and B6 or B7 and B8, firing a 5- to 7-round burst at each." For the automatic rifle qualification the instructions are specifically to fire a three-round burst for each paster. Not to fire as many short bursts as you like in any order until you've finally expended all ammo but to start on one end of the target area and **systematically place ONE, single, accurately-fired burst** at each paster representing a section of the

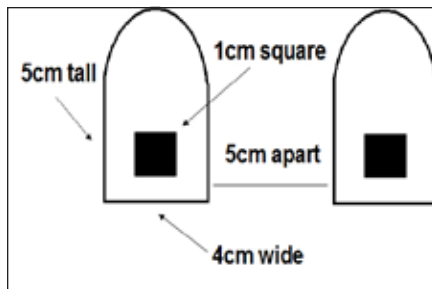


**Above:** A good gunner can produce a centered, circular cone of fire no larger than four mils. The pasters on 10 meter target are four centimeters wide, which is four mils at that distance.

entire target area, and then traverse and/or search to the adjoining target area as represented by the next paster, and fire a single burst there, repeating until done.

That means for pasters 5 and 6, which has five pasters in it, the gunner or automatic rifleman should fire exactly five bursts and for 7 and 8 with eight pasters there should be exactly eight bursts. No more and no less. **TC 3-20.40 explicitly confirms this.** This is not a change to the qualification standard. This has always been the standard but most Army personnel have been doing it wrong.

The gunner or automatic rifleman should be stopped after firing the pre-determined number of bursts EVEN IF TIME AND AMMUNITION REMAIN. If there is ammunition left after firing five or eight bursts, the shooter should NOT shoot it because it means they didn't fire the correct number of rounds per burst, meaning they failed to perform the task



correctly. Specifically, they screwed up the trigger control portion of the Control functional element. Likewise, they should be stopped after the time limit expires, even if ammunition remains. In both cases, pal, because you just ate them. Failing to cease fire after firing the correct number of bursts or after time expires should result in a penalty to the score. Realize many units don't enforce this because most Soldiers don't bother to read and understand this standard. Doing it correctly is more difficult but that is how these courses are intended. Again, each paster is the same width as an E-type silhouette less than 122 meters away. Merely hitting it is not the challenge.

Likewise, each target engagement during the transition course is limited to two bursts. If the target is not hit after two bursts, it is lost and should not be engaged for another burst **EVEN IF AMMUNITION AND TIME REMAIN.** These courses are far too easy with too much time and extra allowed ammunition to merely keep shooting and make a third attempt. Many units fail to enforce this standard due to ignorance and low skills. A gunner or automatic rifleman failing to fire a full burst and hit gets a second burst to make a hit. If the target fails to fall on the second burst, that target should be scored a miss because the crew failed to fire an accurate initial burst and adjust fire as needed. Using more than two total bursts, regardless of how few rounds are fired, is a failure. The purpose is to create crews that can engage targets and make correct adjustments with confidence, not to make multiple guesses, sling out a bunch of random shots, and hope they eventually get lucky. Read the Training Circulars to verify this.

Doing it right is harder but will create better gunners. **ARMP**



# Machine Gun Gunnery Theory

Effective machine gun use requires understanding machine gun gunnery theory. This understanding is what makes a machine gun an effective crew-served weapon capable of suppressing and controlling large target areas. Failing to understand and apply these concepts reduces a machine gun to a large and clumsy belt-fed rifle limited to engaging single point targets.

## Characteristics Of Fire

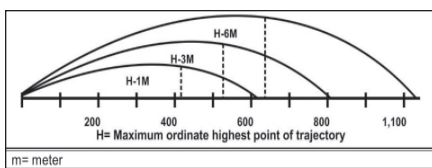
A gunner's knowledge of the machine gun is not complete until they learn about the action and effect of the projectiles.

The Line of Sight is an imaginary line drawn from the firer's eyes through the sights to the point of aim. The Burst of Fire is a number of successive rounds fired from the same hold and aim point, such as the same Traverse and Elevation mechanism setting, when the trigger is held to the rear. The number of rounds in a burst varies depending on the type of fire employed.

The trajectory is the curved path of the projectile in flight from the muzzle to impact. As the range to the target increases, so does the curve of trajectory.

Maximum ordinate is the highest point above the LOS the trajectory reaches between the muzzle of the weapon and base of target. It always occurs about two-thirds of

**Below:** Trajectory showing Height (in meters for the burst's path to reach different distances. Grazing fire (1 meter height is normally effective to about 600 meters. The height is 3 meters to reach 800 meters and 6



the distance from weapon to target and increases with range.

## Cone Of Fire

The cone of fire is the pattern formed by the different trajectories of individual rounds in a burst as they travel downrange. Fired at a two-dimensional paper target the cone of fire should appear like a group and be roughly circular in shape. Various factors effects this but the gunner's Stability and Control have the biggest influence.

## Beaten Zone

The beaten zone is the elliptical pattern formed when the rounds within the cone of fire strike the

ground or target area. The size and shape of the beaten zone changes based on the distance and slope of the target area but is normally oval or cigar shaped with the long axis along the gun-target line. At closer range the beaten zone is longer and narrower and becomes shorter and wider as distance increases. On rising ground, the beaten zone becomes shorter and ground that slopes away causes the beaten zone to become longer.

Gunners and automatic riflemen can take maximum effect of this by aiming at the center base of a target area as most rounds will either be direct hits or fall a bit short, increasing chances of on-target ricochets, better enabling spotting the strike of the rounds to adjust fire from, and increasing suppressive effect on the target area. The effective zone encompasses about 85% of the fired shots.

The danger space is along the gun-target line from muzzle to target where the trajectory does not rise above 1.8 meters above the ground, or the average height of a human adult.

These characteristics help describe various classes of fire.

## Classification of Fire: Ground

With respect to the ground, the two classes are grazing and plunging fire.

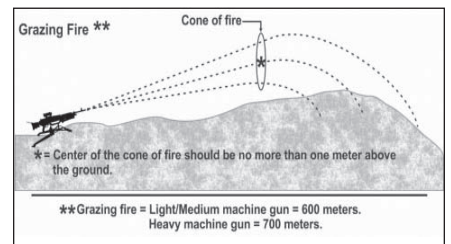


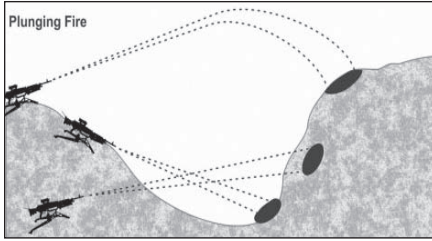
**Above:** Cone of fire creates the beaten zone downrange.

## Grazing Fire

Grazing fire occurs when the center of the cone of fire does not rise more than one meter above the ground. Continuous grazing fire effectively creates a fence that is nearly impassable. The gunner does not have to aim at a particular target along the line when grazing fire is used because anything trying to pass that line when a burst is fired is almost certain to be hit. This is ideal for final protective fires along a final protective line in the defense and can be used offensively as well anywhere the terrain is level or sloping uniformly along a line from the gunner's position. Dead space is any bit of ground that interrupts this continuous line, such as a small depression, and must be covered by a weapon from a different position or one capable of indirect fire, such as a grenade launcher. Over uniformly sloping terrain, 5.56 and 7.62mm machine guns can attain a maximum of 600 meters of grazing fire and heavy machine guns can push this to 700 meters. Grenade machine guns with a sharply arcing

**Below:** Grazing fire requires maintaining continuous danger space over uniform terrain.





**Above:** Plunging fire is when fires are limited to the beaten zone, even

trajectory cannot use grazing fire.

**Plunging Fire**

Plunging fire occurs when there is little or no danger space from the muzzle to the beaten

zone, thus the weapon's effect is limited to placement of the beaten zone as grazing along the length of the gun-target line is not possible. Plunging fires happen when firing at long range beyond the grazing fire maximum effective range, when

**Below:** Tracers from a machine gun illustrate the characteristics of danger space and beaten zone over ground. Good gunnery means learning how to establish and control this "fence" of coordinated fires.



firing high to low ground or low to high ground, or firing across uneven terrain which breaks up the danger space needed to maintain grazing fire at points along the trajectory. Fires from grenade machine guns are always plunging fire.

**Classification of Fire: Target**

Fires with respect to the target include enfilade, frontal, flanking, and oblique fires. Leaders and gunners should always strive to position gun teams so that the long axis of fires, grazing and beaten zones falls along the long axis of the target and target areas.

**Enfilade Fire**

Enfilade fire occurs when the long axis of the beaten zone coincides or nearly coincides with the long axis of the target. Derived from the French meaning "to thread" enfilading fires takes maximum benefit of the effects of grazing and beaten zone.

**Frontal Fire**

Frontal fire occurs when engaging a force facing toward the gun position. It is enfilading fire when the target area is advancing forward

in a column formation.

**Flanking Fire**

Flanking fire is delivered directly against the side of the target area and becomes enfilading fire when employed against a line formation.

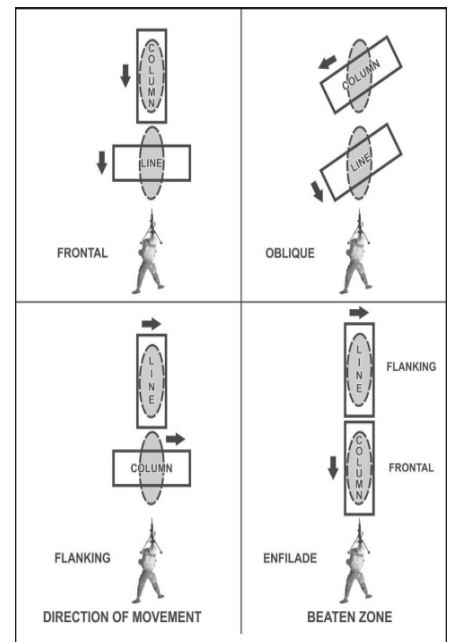
**Oblique Fire**

Oblique fire occurs when the long axis of fires is an angle other than a right angle to the front of the target.

Proper positioning of gun teams requires determining likely avenues of approach and setting up so as to place the long axis of fire along the long axis of the target area.

It's worth noting that routine qualification fails to take this into account as the ideal place to put crews on a transition range would be to fire across the side of the range as that would enfilade fires across all the targets in all of the lanes. Obviously, this will won't fit in the existing Surface Danger Zone and Range Control will be very angry with you, however, understanding this will help taking the machine gun marksmanship skills tested in qualification into real world application.

**Below:** Classes of fire with respect to the target.





**Above:** Enfilading fire on RETS targets from the crew's perspective. From this position the long axis of the target array matches up with the length of danger space and beaten zone, establishing the most effective fire. Note that most training ranges forbid this and force a much less effective face-on target engagement. No wonder our troops are ignorant of machine gun gunnery!

**Above:** Enfilading fires are most effective and may be frontal or flanking depending how the targets are arrayed.

**Classification of Fire: Gun**

Classes of fire with respect to the weapon include fixed, traversing, searching, traversing and searching, swinging traverse, and free gun fires.

**Fixed Fire**

Fixed fire is possible when the point target or target area can be effectively engaged within the width and size of the centered beaten zone or grazing fires with little or no manipulation required.

**Traversing Fire**

Most target areas will likely be bigger than the gun's beaten zone or grazing fire coverage and adjustment is necessary. Traversing disperses fires in width by successive changes left or right but not in elevation. When engaging a wide target area, the gunner selects multiple aim points or makes subsequent traverse adjustments after successfully

landing an initial burst and making T&E adjustments from there in even increments to ensure even, continuous coverage along the target area. Given that a cone of fire should be 2-4 mils in size, an adjustment of 4 mils from burst to burst creates overlapping coverage.

**Searching Fire**

Searching distributes fires in-depth by successive changes in elevation. Gunners employ searching fire against a deep target or a target having depth and minimal width, requiring changes in only the elevation of the gun. The amount of elevation change depends upon the range and slope of the ground.

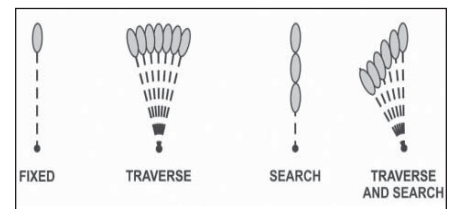
Traversing and Searching Fire combines elements of both traverse and search to distribute fires both in width and depth.

These concepts are important for gunnery but aren't really tested during routine qualification. The

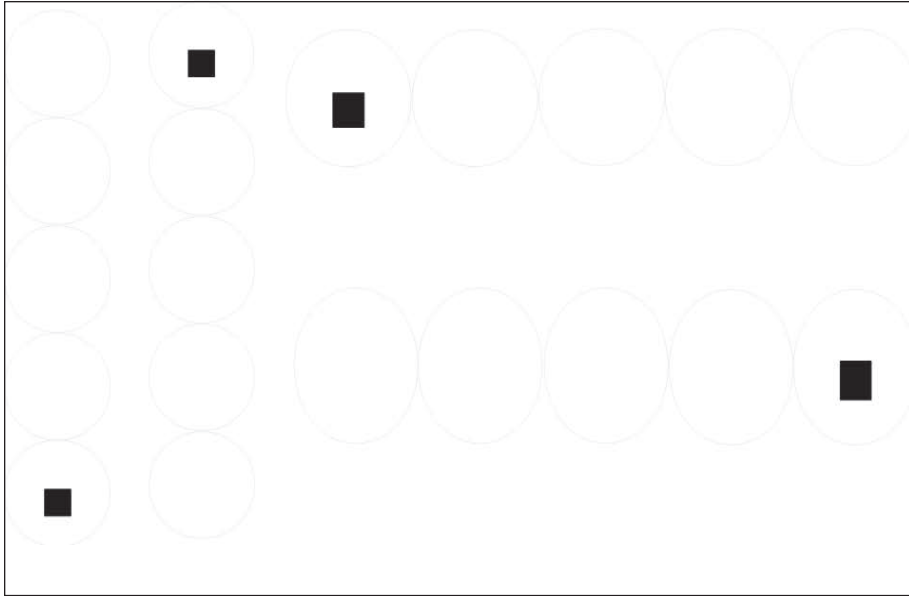
transition course is limited to fixed targets only and the 10-meter target has a bold outline for each paster so as to aim at each one individually.

While not included as a standard qualification, targets can be used to emphasize these points. For example, a target series the has one aim point reference for five target areas that are invisible to the gunner. A one-mil black square is at the bottom, left, top, or right side of a given target area. After aiming in a firing an initial accurate burst, the gunner

**Below:** Classes of fire with respect to the gun.







**Above:** Improved gunnery fundamentals practice target. This target has four separate arrays of five circular pasters each, starting on the left side are Search Up and Search Down arrays. Next are the Traverse Right and Traverse Left. Each paster is a four-mil circle that is invisible from the gunner's position. Only the first target in each array has a one-mil black square at the paster's center base. The gunner aims in there, fires an initial accurate burst, and has to trust the T&E adjustments to engage each area after that as there isn't a visible target to aim at.

has to trust T&E adjustments to engage the remaining target areas.

Machine guns really shine when they apply accurate, controlled fires over a target area. Firing over terrain with grazing or enfilading fires may not give a convenient aim point to hold on. Gunners need to understand how to apply fires to get the desired effect. **ARMY**



**Above:** Soldiers are sometimes confused about the gunnery role of machine guns because the weapons can also be employed as individual small arms. The need for gunnery skills with other crew-served weapons, like this mortar, is obvious because there is no other way to utilize them.

**Left:** Gun crew during field training set up in position. Stakes designate the limits of their sector of fire. The gun is currently set for grazing fire shot down a final protective line protecting the unit position to the crew's right side. Ideally, another gun crew is set up on the opposite end of the unit to protect this gun crew. The range card by the T&E allows the crew to employ their weapon while staying behind cover. The gunner can stay below the gun behind cover and still direct fires.

