

CHAPTER 5

TECHNIQUES OF FIRE

Firing techniques allow the gunner to deliver controlled, effective fire on target. This chapter covers the characteristics and classes of fire; range determination; application of fire; firing under degraded conditions; and predetermined fires.

Section I. CHARACTERISTICS AND CLASSES OF FIRE

To effectively employ the MK 19, gunners must understand the definitions of the terms used to describe the actions and effects of firing the MK 19. This section discusses the characteristics and classes of fire.

5-1. CHARACTERISTICS OF FIRE

The following are definitions of the characteristics of fire:

- a. **Trajectory.** The path of the projectile in flight. The path is curved due to gravity and elevation of the barrel. The trajectory increases as the sights are elevated for far targets.
- b. **Line of Sight.** An imaginary line from the gun to the target, as seen through the sights.
- c. **Ordnate.** The vertical distance that occurs anywhere between the line of sight and the trajectory.
- d. **Maximum Ordnate.** The highest point of trajectory, at which the vertical distance between the trajectory and line of sight is greatest.
- e. **Danger Space.** The area in which the impact of the round or the dispersal of fragmentation causes injuries to personnel or destruction of the target.
- f. **Dead Space.** The area(s) in which personnel or targets are safe from the gun's fire. Dead space can be, ditches, depressions, or ravines.
- g. **Cone of Fire.** The dispersion of the rounds as they leave the gun.
- h. **Beaten Zone.** The area in which the cone of fire strikes the ground or target. Terrain slope and range to the target affect the beaten zone. If the cone of fire falls on upward-sloping ground, the beaten zone is shortened, and vice versa. As range increases, the beaten zone is shortened and widened.
- i. **Center of Impact.** The area where the heaviest concentration of fire impacts.

5-2. CLASSES OF FIRE

Fire is classified with respect to the ground, target, and the MK 19.

- a. **Respect to the Ground.** Normally, this means either plunging or grazing fire. However, since grazing fire is not practical for use with the MK 19, only plunging fire will be considered. Plunging fire strikes the target from a high angle and confines the danger space to the beaten zone. For example, when fired from the top of a hill, projectiles follow an arcing trajectory and land in the valley (Figure 5-1).

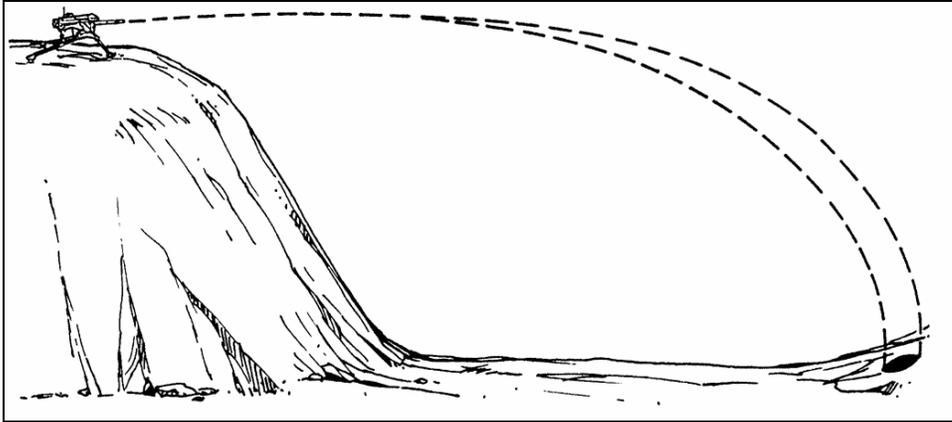


Figure 5-1. Plunging fire.

b. **Respect to the Target.** This class of fire is divided into four types of fire (Figure 5-2a and 5-2b):

(1) **Frontal.** The long axis of the beaten zone is at a right angle to the long axis of the target.

(2) **Flanking.** This type of fire is delivered against the flank of the target.

(3) **Oblique.** This type of fire is directed at a target moving at any angle other than directly toward or perpendicular to the gun.

(4) **Enfilade.** This type of fire occurs when the long axis of the beaten zone coincides with the long axis of the target. Enfilade fire may be frontal or flanking, depending on which way the target is facing. For example, frontal enfilade occurs if the MK 19 is in the middle of a road and the target is approaching on the same road. Flanking enfilade occurs if the target is moving either way, left or right, yet is still in a long axis configuration away from the MK 19.

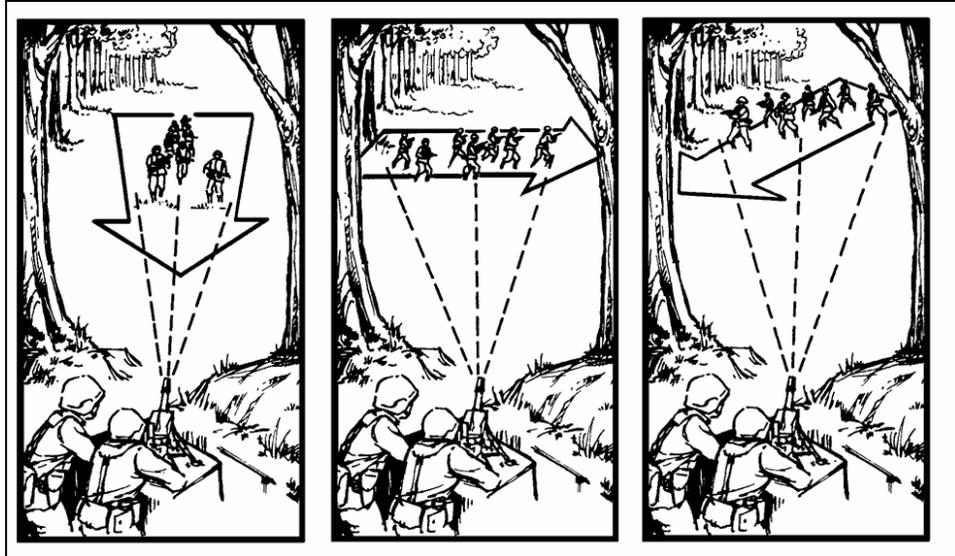


Figure 5-2a. Classes of fire with respect to the target: frontal, flanking, and oblique fires.

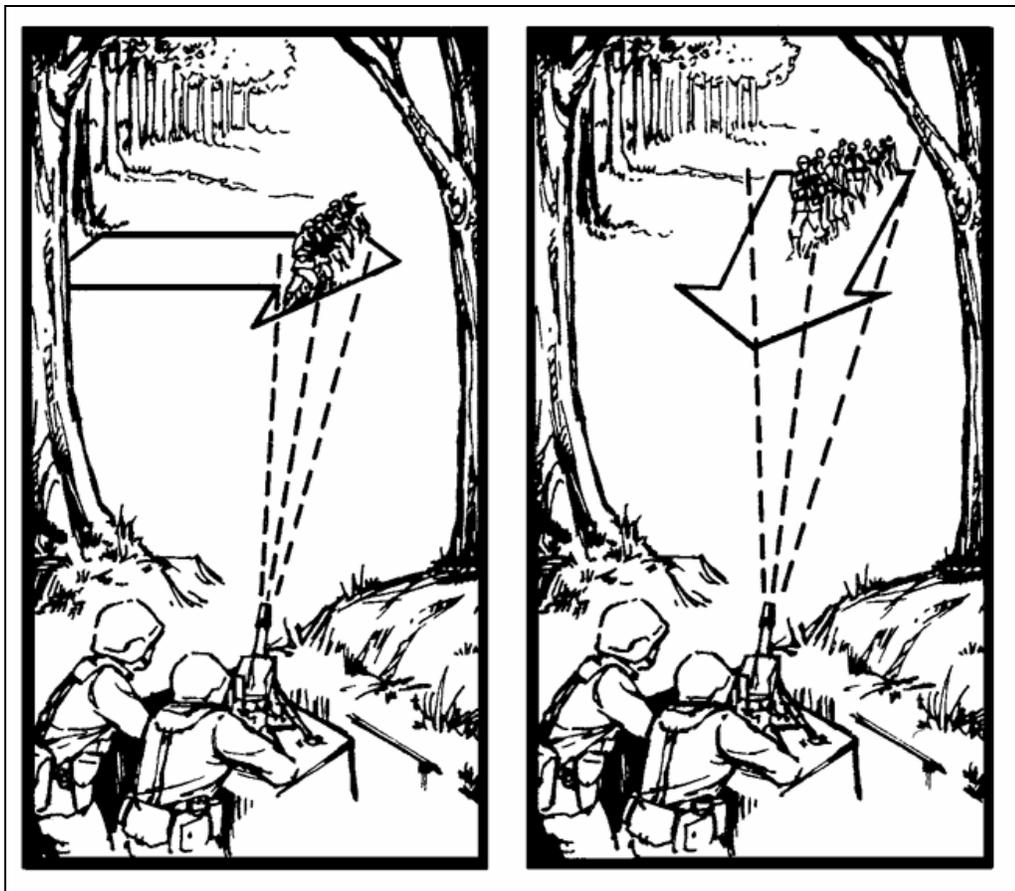


Figure 5-2b. Classes of fire with respect to the target: flanking and frontal enfilade fires.

c. **Respect to the MK 19.** Fire from the MK 19 may be conducted in six ways (Figure 5-3).

(1) **Fixed.** Fire is delivered against a target with one aim point, which concentrates the beaten zone.

(2) **Traverse** Fire is moved from left to right or right to left, with no range change. It may be used against frontal or flanking targets.

(3) **Search.** Fire is directed against a deep target. Elevation changes are made, but direction changes are not. Searching fire is used against enfilade targets.

(4) **Traverse and Search.** This is a combination of traversing and searching fires used against a target with depth and width (most likely an oblique target).

(5) **Swinging Traverse.** This fire is slightly different from traversing and searching. Although it is delivered against a wide target, with major changes in direction, no elevation changes are made. To deliver fire using a swinging traverse, the gunner releases the traversing slide lock, allowing the gun to travel freely across the traversing bar.

(6) **Free Gun.** Fire is delivered with the T&E mechanism removed and is used when quick changes in direction and depth are needed to engage moving targets.

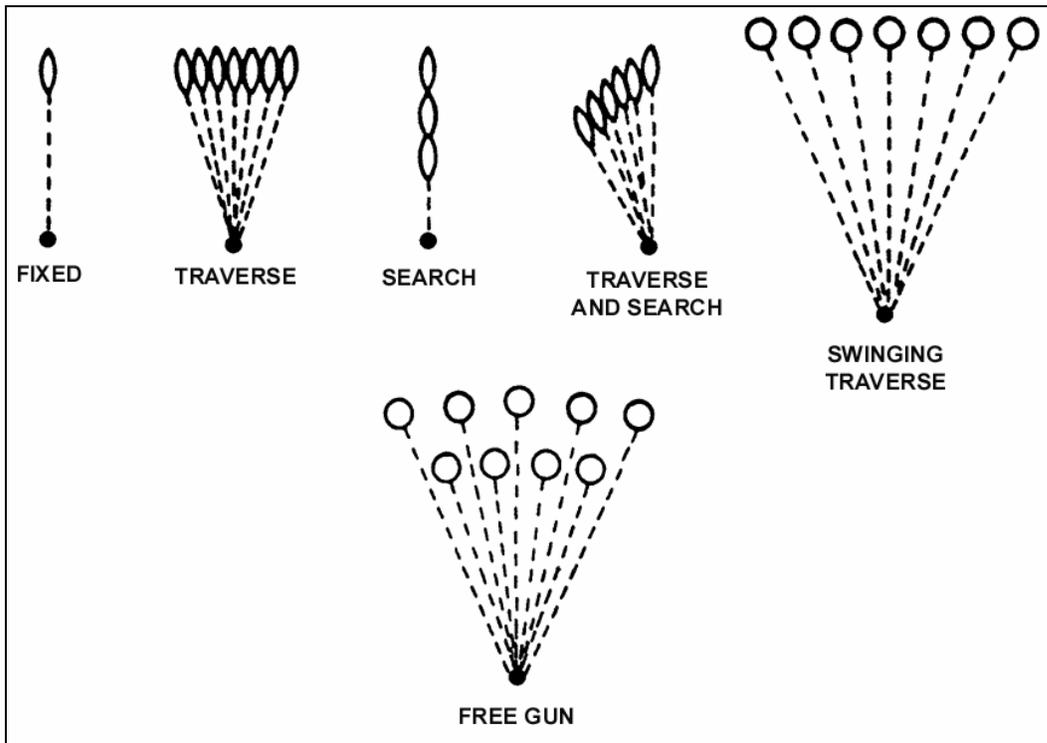


Figure 5-3. Classes of fire with respect to the MK 19.

Section II. RANGE DETERMINATION

Range determination is the process of finding the distance between the gunner's position and his target. The gunner's ability to engage a target effectively depends on determining the correct range to the target.

5-3. MEASUREMENT BY VISUAL ESTIMATION

Range is often determined by this method. There are two ways to estimate range visually.

a. Using the 100-meter unit-of-measure method, visualize 100 meters on the ground (this takes practice) and determine how many units of 100 meters there are to the target (Figure 5-4). For targets more than 500 meters (5 units) away, pick a point about halfway, estimate the range to that point, and double it (Figure 5-5).

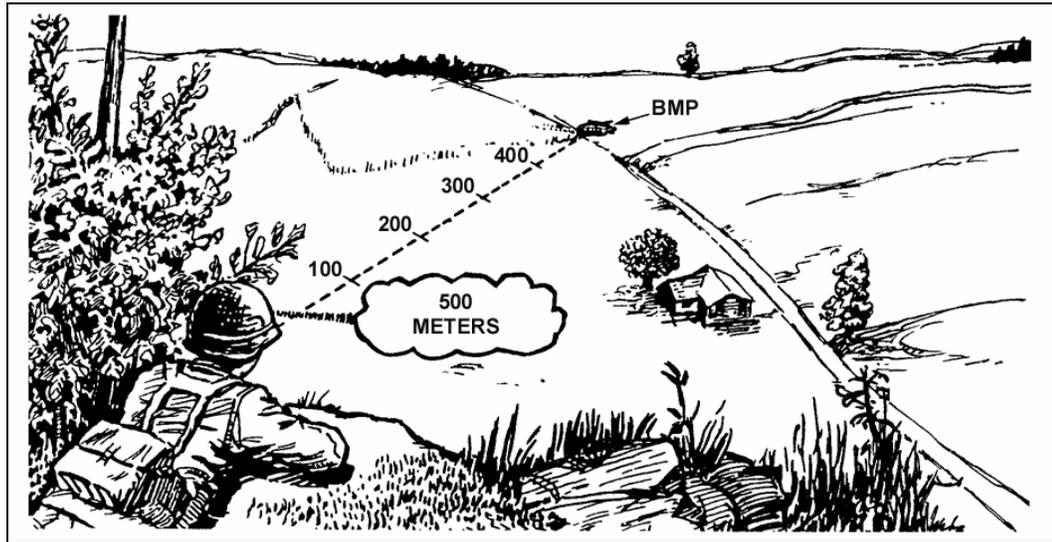


Figure 5-4. Application of the 100-meter unit-of-measure method for ranges up to 500 meters.

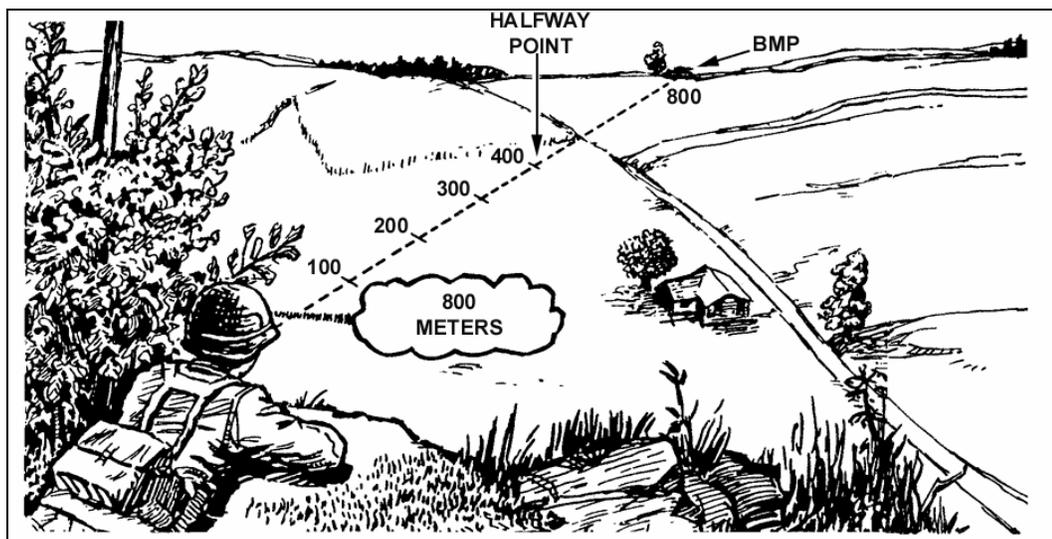


Figure 5-5. Application of the 100-meter unit-of-measure method for ranges greater than 500 meters.

b. Use the appearance-of-objects method, which is fairly reliable, to determine range (this also takes practice). Memorize the sizes and shapes of familiar objects at different ranges. Consider the factors in Table 5-1, which affect the appearance of objects.

FACTORS AFFECTING RANGE ESTIMATION	FACTORS CAUSING UNDERESTIMATION OF RANGE	FACTORS CAUSING OVERESTIMATION OF RANGE
<p>The clarity of outline and details of the target.</p> <p>Nature of terrain or position of the observer.</p> <p>Light and atmosphere.</p>	<p>When most of the target is visible and a clear outline can be seen.</p> <p>When looking across a depression that is mostly hidden from view.</p> <p>When looking downward from high ground.</p> <p>When looking down a straight, open road or along a railroad.</p> <p>When looking over uniform surfaces like water, snow, desert, or grain fields.</p> <p>In bright light or when the sun is shining from behind the observer.</p> <p>When the target is in sharp contrast with the background or is silhouetted because of its size, shape, or color.</p> <p>When seen in the clear air or high altitudes.</p>	<p>When only a small part of the target can be seen or the target is small in relation to its surroundings.</p> <p>When looking across a depression that is totally visible.</p> <p>When looking from low ground toward high ground.</p> <p>When vision is narrowly confined as in streets, draws, or forest trails.</p> <p>In poor light such as dawn and dusk; in rain, snow, fog; or when the sun is in the observer's eyes.</p> <p>When the target blends into the background or terrain.</p>

Table 5-1. Factors affecting visual range estimation.

5-4. MEASUREMENT FROM A MAP

Another way range may be determined is by using a military map. The gunner locates his position and the target's position on the map. He measures the distance and uses the legend scale at the bottom of the map to find the range.

5-5. MEASUREMENT BY PACING

When using this method, the leader ensures there is no immediate danger to the gun's crew. The crew sets up its position, and the gunner selects the target. The assistant gunner walks to the target in a straight line, counting the number of paces it takes to reach the target. As the distance is paced off, the gunner can determine dead space when the assistant gunner disappears from view.

5-6. MEASUREMENT USING BINOCULARS

Binoculars can be used to determine range. The recently adopted M19 binocular, unlike other models, is a lightweight, compact instrument intended for use in general field observation and fire direction. The binocular's left lens includes horizontal and vertical reticles graduated in 10-mil increments (Figure 5-6). When using binoculars to determine range, the soldier must understand the mil relationship (Figure 5-7).

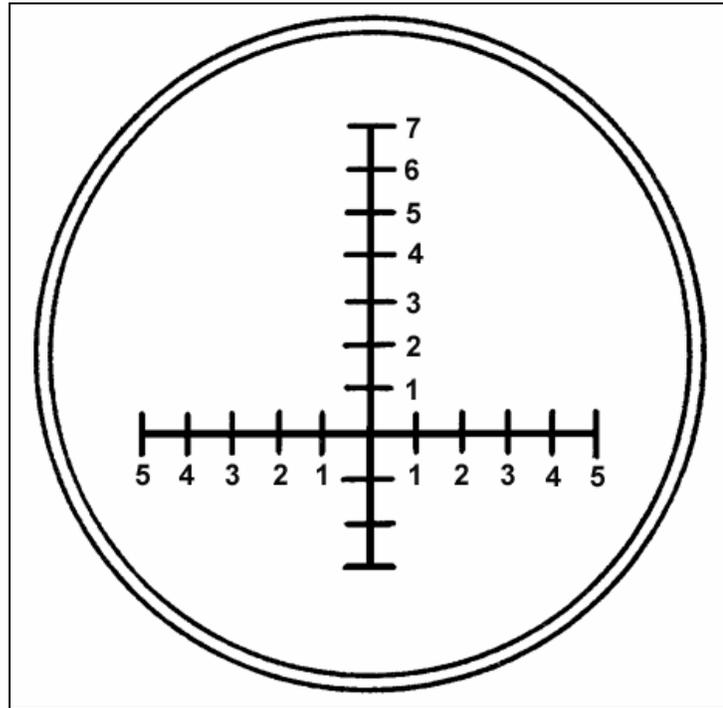


Figure 5-6. M19 binocular reticle.

a. The mil (m) is the unit of angular measurement used in adjusting fire. A circle has 6,400 mils. At a distance of 1,000 meters, an object 1 meter wide measures 1 mil. Change mils to meters by multiplying the number of mils times the range (distance) in thousands of meters. Obtain the unknown width or range to an object using a similar method (Figure 5-7).

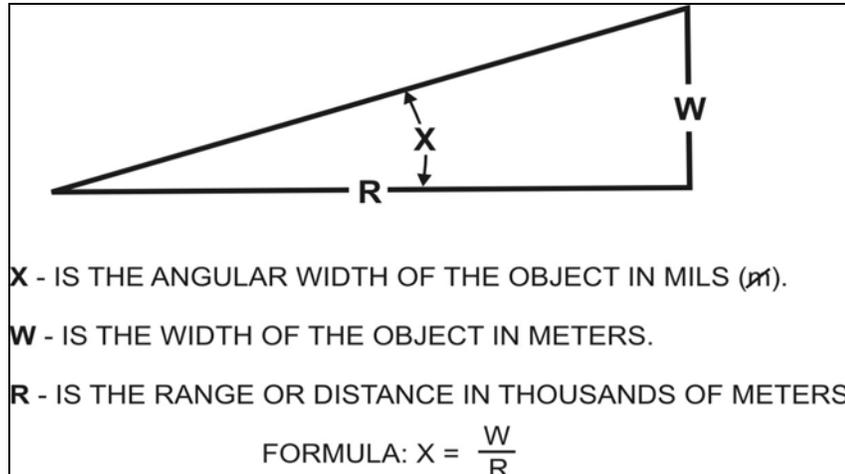


Figure 5-7. Mil relationship.

b. The mil relationship, as shown in Figure 5-7, is $X = W \div R$; where X is the angular width of the object in mils (m), W is the width of the object in meters, and R is the range or distance in thousands of meters.

(1) To find Width when the known Range is 4,000 meters and the object is 15 m wide, multiply R times X m or 4 (range in thousands) times 15 (mils). The answer is 60 (meters), or $4 \times 15 = 60$ meters.

$$W = \frac{R \text{ times}}{Xm}$$

$$W = \frac{4 \text{ times } 15}{1}$$

$$W = 60$$

(2) To find Range when the known Width in meters (between two bursts or two objects) is 60 and the angular measurement for the same width, when measured with binoculars, is known to be 15 mils, divide (W: m) 60 (meters) by 15 (mils).

The answer is 4,000 meters:

$$R = \frac{W}{X \text{ } \mu}$$

$$R = \frac{60}{15}$$

$$R = 4 \text{ (in thousands of meters)} = 4,000 \text{ meters}$$

(3) To find the angle A in μ when the known Width in meters between a reference point and the target is 60 meters and the known Range to the target is 4,000 meters, divide W by: R or 60 (meters) by 4 (range in thousands) and the answer is 15 mils (mils):

$$A \text{ } \mu = \frac{W}{R}$$

$$A \text{ } \mu = \frac{60}{4}$$

$$A \text{ } \mu = 15$$

c. The observer uses the mil relation in computing direction shifts as indicated in Figure 5-8.

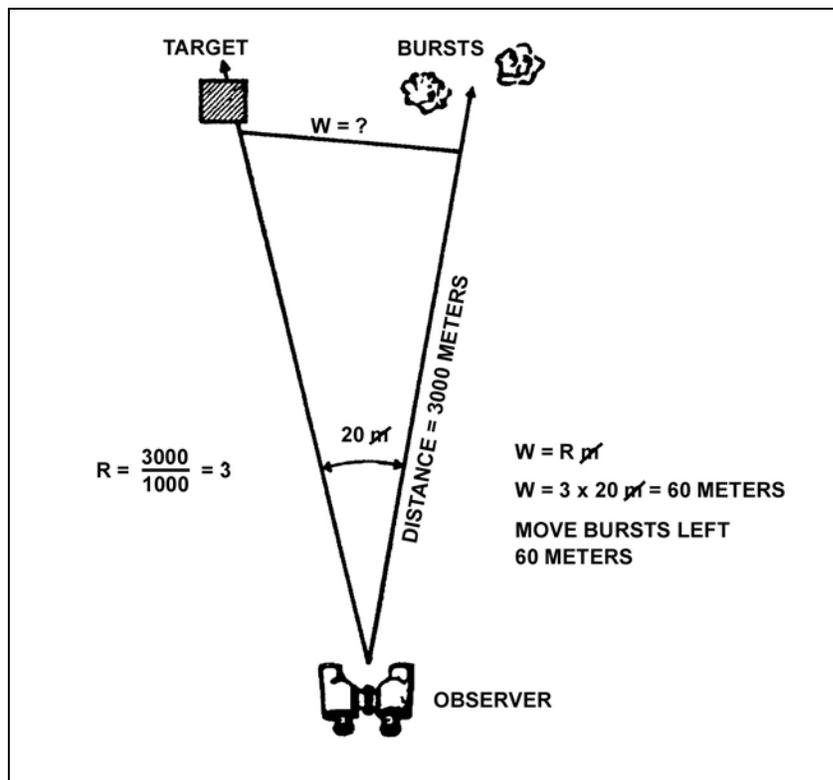


Figure 5-8. Computation of direction shift.

5-7. MEASUREMENT USING AN/GVS-5 LASER RANGE FINDER

The handheld AN/GVS-5 laser range finder provides observers and small-unit leaders the ability to more accurately determine range to targets and other known points. This range finder allows first-round fire for effect, which results in increased enemy casualties and saves ammunition. Friendly units can use the range finder to precisely locate themselves using intersection and modified resection techniques. The range finder aids in the determination of sector depth, range to suspect enemy locations, distance to targets along avenues of approach, and information for overlapping fires. When an AN/GVS-5 is available, it should be used to construct range cards. Information about placing the AN/GVS-5 into action can be found in TM 11-5860-201-10.

5-8. MEASUREMENT BY FIRING

The gunner can determine range by firing a zeroed MK 19. The gunner fires a burst and uses the T & E mechanism to “walk” the rounds on target. The gunner sets and reads the sights on the target, and notes the range. This measurement method is used frequently in combat situations.

5-9. MEASUREMENT OF LATERAL DISTANCE

The gunner can use the finger method to find distance. He extends his arm toward the target with his palm out, elbow locked, one eye closed, and index finger raised (Figure 5-9). He sights along the edge of the finger, adding extra fingers to fill in the space (the average finger is 30 mils wide). One finger equals 30 mils, two fingers equals 70 mils, three fingers equals 100 mils (Figure 5-10).

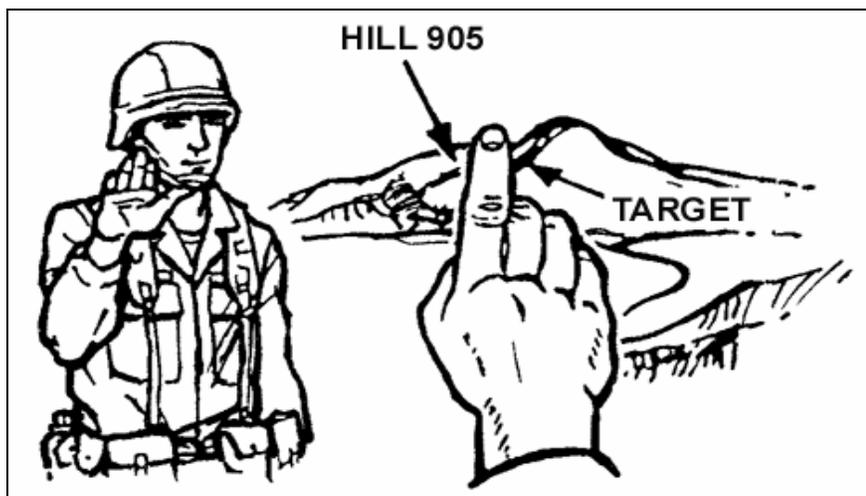


Figure 5-9. Use of fingers to measure deviation.

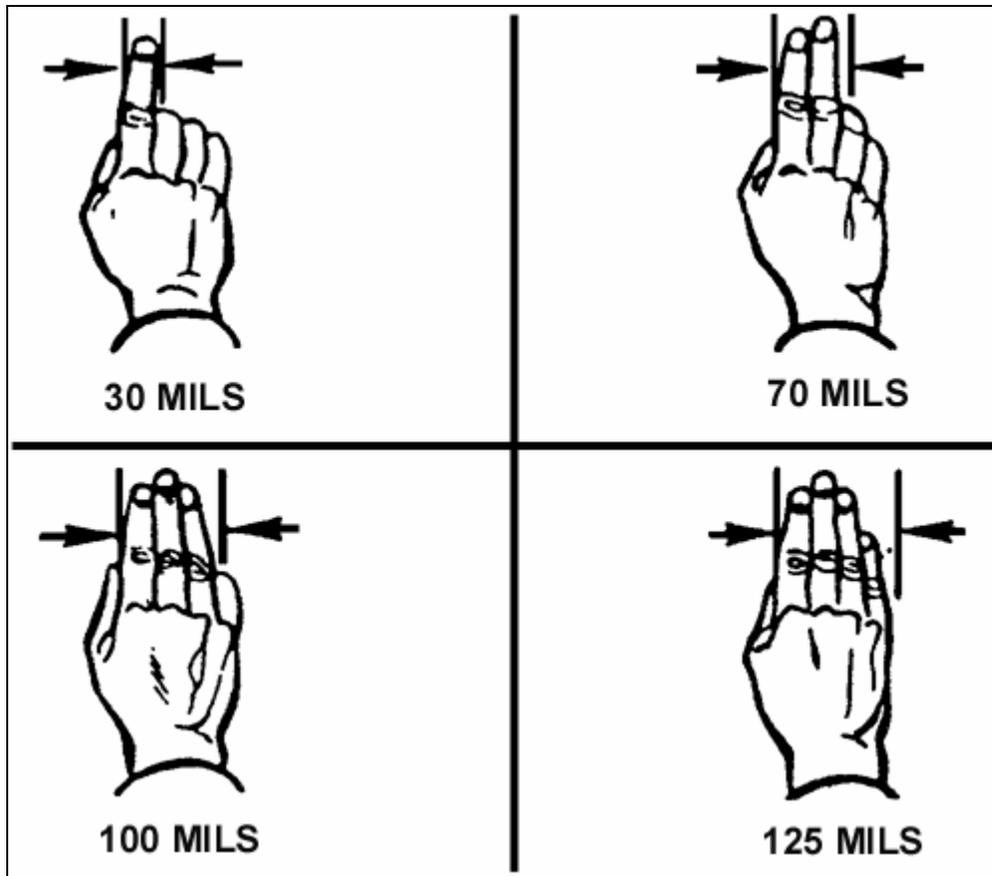


Figure 5-10. Hand-and-finger value estimates.

Section III. APPLICATION OF FIRE

This section includes information about MK 19 fire control and target engagement. Fire control includes all operations connected with the preparation and application of fire to a target.

5-10. FIRE CONTROL

To correctly exercise fire control, the gunner must be able to:

- Open fire at the instant desired.
- Adjust fire on the target.
- Regulate the rate of fire.
- Shift fire from one target to another.
- Cease fire.

Failure to exercise correct fire control results in danger to friendly troops, loss of surprise, premature disclosure of position, misuse of fire on unimportant targets, loss of time in securing adjustments, and waste of ammunition. The main factors to consider for effective fire control are as follows:

a. **Sector of Fire.** This is an area of terrain that an assigned unit covers. It has specific, designated boundaries. Sectors of fire vary in size but are generally limited areas that can be engaged without movement of the tripod.

b. **Rate of Fire.** Surprise and shock effect may be obtained by firing all MK 19s at the same time, using the rapid rate for at least the first few bursts. Engage fleeing targets as soon as possible and with all available fire. Use the rapid rate for the initial delivery of fire to make adjustment of fire easier. Also, whenever the rate of fire is not stated, use the rapid rate. In all cases, unless otherwise ordered, fire the first few bursts at the rapid rate; thereafter, use the prescribed rate.

c. **Adjustment of Fire.** Adjustments may be made before or after firing.

(1) **Initial Adjustment.** Set the sights on the range to the target, lay on the target, fire an aimed burst, and observe the impact. When the initial burst is correct, continue to fire (manipulating if necessary) until the target is covered. When the initial burst is not correct, determine from its impact the amount of traverse and search required to place the next burst on the target. Manipulate the gun with the T&E handwheels, making large range corrections by resetting the sights and re-laying on the target.

(2) **Subsequent Correction and Adjustment.** Observation and adjustment of fire is the most important element of fire control. It is continuous throughout the action. The gunner is trained to observe and adjust fire without command and to check the lay of the gun frequently. The gunner is also trained to foresee the action of the enemy after he opens fire, and to shift fire to cover any changes in the formation or location of the target. If the gunner fails to do these things, the leader promptly corrects him by announcing or signaling subsequent fire commands. This responsibility to adjust fire continues up through the chain of command. When subsequent fire commands are issued, the gunner makes the required adjustments. When the gun is fired from the tripod mount, subsequent commands are given as adjustments to the elevation or deflection at which the last burst was fired. The adjustments are given in mils and are announced or signaled as ADD, DROP, RIGHT, or LEFT so many mils. Changes in deflection and elevation such as RIGHT 2 or ADD 5 are made with the T&E handwheels.

5-11. FIRE COMMANDS

Fire commands are the means by which leaders control fires. A fire command is a set of instructions, given in a prescribed format that enables the gun crew to properly engage the desired targets. There are two types of fire commands: initial and subsequent. Initial fire commands are used for engagement of targets and the shifting of fire to new targets. Subsequent fire commands are used to adjust fire, change the rate of fire, and cease-fire. The explanation below is based on two gun crews. A good fire command is brief and clear, and in the proper sequence. It is given clearly at a rate that is easily understood by the gunner. Gunners repeat each element to ensure understanding. It is unlikely for a complete initial fire command to be issued during a fire fight. The leader determines which elements of a fire command are obvious to the gunners and which elements must be given to them. Some targets may be engaged with only the alert, range, and command of fire. For example: FIRE MISSION, SEVEN HUNDRED, FIRE. The procedures outlined below are used to accustom gunners to issuing and executing instructions in a logical sequence. The use of complete fire commands in training prepares the gunners to receive fragmentary fire commands in combat.

a. **Initial Fire Command.** This contains the following elements:

- ALERT.
- DIRECTION (as needed).

- RANGE.
- DESCRIPTION (as needed).
- ASSIGNMENT/METHOD (division, manipulation, rate; all only as needed).
- CONTROL.

(1) **Alert.** The alert is the first element of the initial fire command. Its purpose is to choose the gun crews and ready them to receive and execute the fire command. FIRE MISSION is announced for all targets. When two or more guns are to fire, the leader announces, FIRE MISSION. If only one gun is to fire, then NUMBER 1 (2) FIRE MISSION is given. When the leader wants to alert all guns, but only wants one gun to fire, the announcement is FIRE MISSION, NUMBER 1 (2).

(2) **Direction.** There are several ways to designate target direction:

(a) *Oral.* When the target is not obvious, the leader must tell the gunners where to look. The leader gives direction as: FRONT, RIGHT FRONT, LEFT FLANK, and so on. The leader may identify an indistinct target by the use of a reference point. The selected reference point, announced as REFERENCE, must be a distinctive terrain feature or object in or near the target area. The word TARGET precedes the target description when a reference point is used.

- When the reference point is within the target area, the leader may describe the target as extending so many mils, meters, or fingers from that point. He announces range to the reference point. For example:
REFERENCE: BUNKER, FIVE ZERO ZERO.
TARGET: TROOPS EXTENDING RIGHT TWO FIVE, LEFT TWO FIVE.
- If the selected reference point is outside the target area, the leader announces the range to the target. For example:
REFERENCE: LONE TREE.
TARGET: MACHINE GUN IN EDGE OF WOODS; FIVE ZERO ZERO.
- The leader may identify the direction to a target that is not obvious by selecting an obvious feature, and (by naming successive reference points) leading the gunner to the target step by step. For example:
REFERENCE: RED-ROOFED HOUSE, RIGHT OF HOUSE, HEDGE,
CENTER OF HEDGE, GATE, ABOVE GATE.
TARGET: MACHINE GUN.
- For a tripod-mounted MK 19, the interval between the reference and the target is measured by laying the gun on the reference point and manipulating the gun a given number of mils to the target.

(b) *Firing a MK 19.* Pointing out an obscure target by firing a MK 19 is simple, fast, and accurate. However, it may cause loss of surprise or premature disclosure of the gun's position. The leader announces the general direction of fire, if it is not obvious. He then lays one gun on the target, commands: WATCH MY BURSTS, and fires one or more on the target. The leader completes the designation orally using the target's midpoint or extremes: RIGHT FLANK, MIDPOINT, or NEAR END. Firing rifle tracers at the target also makes it easier for the gunners to find.

(c) *Laying a MK 19.* Laying the gun on a target is a simple and accurate method that does not sacrifice surprise. The leader goes to each gun, lays it on the target, and has the gunners check the lay. The gunners open fire at the same time on command.

(3) **Range.** This element follows the target description. The leader announces it in even digits, hundreds or thousands. For example: FOUR FIVE ZERO; THREE HUNDRED; ONE ONE HUNDRED; ONE THOUSAND.

(4) **Description.** The leader gives a brief target description to inform the gunners of the nature of the target. Examples of target descriptions include TROOPS, which refers to any dismounted enemy personnel; MACHINE GUN, which refers to any automatic gun; and TANK, which refers to any armored vehicle. If several targets are in view, the leader may describe the target or part of a target to be engaged as LEADING TRUCK, RIGHT BUILDING, FAR END, HALTED COLUMN, and so on. If the target is obvious, no description is necessary.

(5) **Assignment Method.** This element is used only when specific assignments are required to divide or subdivide the target, assign class of fire, or announce a rate of fire.

(a) **Division (or subdivision).** The leader gives this element only when it is required (paragraph 5-12). Division may be announced as follows:

NUMBER 1 RIGHT HALF, NUMBER 2 LEFT HALF.

NUMBER 1 RIGHT TWO-THIRDS, NUMBER 2 LEFT TWO-THIRDS.

NUMBER 1 RIGHT TWO-THIRDS, NUMBER 2 LEFT ONE-THIRD.

(b) **Manipulation.** The leader gives this element to prescribe the class of fire with respect to the gun, and gives it only if the required manipulation is not obvious. For example:

FIXED.

TRAVERSE.

SEARCH.

TRAVERSE AND SEARCH.

SWINGING TRAVERSE.

(c) **Rate.** The greatest effect results from having two guns open fire at the rapid rate, at the same time. Regardless of the rate announced, gunners open and adjust fire at the rapid rate, and use the announced rate (sustained, rapid, or cyclic) thereafter. Size of target, type of target, and ammunition supply are the factors that influence selection of a rate of fire. Rates of fire are distinguished as follows:

- **Sustained.** The sustained rate of fire is measured in rounds for each minute and is the rate at which a MK 19 may be fired indefinitely without damage from overheating (40 rounds per minute). The leader announces SUSTAINED.
- **Rapid.** The rapid rate is measured in rounds for each minute and is the rate at which a MK 19 may be fired for a limited time without danger of overheating (60 rounds per minute). This rate permits a high volume of fire to be delivered for a short, set time. Gunners use the rapid rate unless another rate is announced.
- **Cyclic.** The cyclic rate is the rate at which a MK 19 can be fired for a limited time only, at the fastest rate the gun will fire (325 to 375 rounds per minute). This rate may be used when the target or area needs the greatest possible suppression. The leader announces CYCLIC.

(6) **Control.** The leader uses this element to give the command to open fire. For immediate engagement of the target, the leader gives the command, FIRE, or the arm-and-hand signal to fire without pause. Fire is often withheld for surprise and effect, and both guns open fire at the same time. To ensure this, the leader may preface the command or signal to fire with the words AT MY COMMAND or ON MY SIGNAL. When the gunners are ready

to engage the target, they report UP or announce: NUMBER 1 (2) UP, READY, and the leader gives the command or signal to fire.

b. **Subsequent Fire Commands.** The leader uses these to repeat or correct a fire command, to adjust fire, to cease or commence fire, or to terminate the alert. The deflection correction must always be given first.

(1) **Repeat Fire Commands.** If the gunner fails to understand any element of the fire command, a repetition of the element may be requested by announcing the misunderstood element with rising inflection to denote a question. When repeating any portion of the fire command, the leader will preface it with the words THE COMMAND WAS.

(2) **Correct Fire Commands.** The leader changes or corrects a portion of the fire command by announcing CORRECTION and giving a command. For example, to change an incorrect range command of 500 meters to 600 meters, the command is CORRECTION, SIX HUNDRED.

(3) **Adjust Fire.** The leader adjusts fire if the initial burst was not on target. The leader does this by announcing the direction and elevation needed to get on target ADD 100, RIGHT 20; or DROP 200, LEFT 50.

(4) **Cease and Commence Fire.** CEASE FIRE is announced if the leader wishes to interrupt for any reason. This type of subsequent fire command informs the MK 19 crew that it will remain on the alert and that more instructions will follow. Firing is renewed by announcing a subsequent fire command or by announcing a new fire command. Firing is resumed with the same data by using the command FIRE.

(5) **Terminate the Alert.** To allow the MK 19 crew to relax between fire missions, termination of the alert is announced as CEASE FIRING, END OF MISSION.

5-12. TARGET ENGAGEMENT

The method chosen depends on terrain, target presentation, type of target, and tactical situation.

a. **Distribution of Fire.** To be effective, fire must be distributed over an entire target. Improper distribution results in gaps between beaten zones and allows some of the enemy to escape or to use guns without effective opposition.

(1) **Factors Affecting Distribution of Fire.** No fixed rule can be given as to the widest target that a single MK 19 may effectively engage. Ideally, the target should be no more than 100 mils wide. The traversing screw on the T&E mechanism limits the gun's traverse unless the traversing slide lock lever is unlocked. Wider targets require more traversing time, which prevents the gunner from placing a continuous volume of fire on the whole target. The engagement of a wide target by a single MK 19 requires excessive ammunition.

(2) **Fire Unit.** This consists of a pair of MK 19s. If possible, at least two guns should be assigned to the same mission, although sometimes a single MK 19 may be effective. The assignment of a pair to a single mission ensures continuous fire in case either gun is put out of action. Two guns can provide a great volume of fire on the target, and can reduce the time required to cover it.

(3) **Manipulation of the Tripod-mounted MK 19.** Traversing fire is moved in 5-mil increments. The MK 19s are fired after each manipulation to ensure the beaten zones overlap. Searching fire is often used on level or evenly sloping ground. When the ground is

irregular, however, the amount of search to apply between bursts in order to ensure overlap of the beaten zones is determined by observation.

b. **Engagement of Point Target.** Any target no larger than the beaten zone is a point target, and is engaged by fixed fire. The command is FIXED. MK 19 crews are trained to follow any movement or change in formation made by the enemy after the initial burst of fire. An example of a fire command for a point target is as follows:

FIRE MISSION.
FRONT.
MACHINE GUN.
SIX HUNDRED.
FIXED.
RAPID.
FIRE.

c. **Engagement of Linear Target.** There are several ways to engage a linear target. The method used is chosen based on the number of MK 19s available and whether or not the entire target is visible to the gunner.

(1) **Linear Engagement with One MK 19.** A single MK 19 engages the target the same as either one of a pair. The MK 19 is laid just outside either flank (or on a reference point within the target area) and the gunner adjusts fire on the flank (or point). The gunner traverses back and forth across the entire area until told to cease firing. The leader may designate where he wants initial fire. For example, if he directs a single gunner to engage a target with width he may announce:

FIRE MISSION.
FRONT.
TROOPS EXTENDING FROM DEAD TREE RIGHT 20 MILS.
FIVE HUNDRED.
TRAVERSE.
RAPID.
AT MY COMMAND.
FIRE (given after the gunners announce "Up").

(2) **Linear Engagement with Two MK 19s.** A linear target may be engaged two ways when a pair of MK 19s is used, depending on the width of the target in mils.

(a) *Target 100 mils or Less in Width.* The normal traversing method is used in this case. Each MK 19 delivers the initial burst of fire on its corresponding flank of the target. Fire is adjusted on that point. Each MK 19 is traversed across the target to the other flank, covering the entire target, until the gunners are told to cease firing (Figure 5-11). The command for this type of fire is TRAVERSE. An example of a fire command used for this situation follows:

FIRE MISSION.
RIGHT FRONT.
TROOPS, EXTENDING FROM DEAD TREE RIGHT TO CLEARING.
SEVEN FIVE ZERO.
TRAVERSE.
RAPID.
AT MY SIGNAL.

FIRE (given after the gunner announces “Up”).

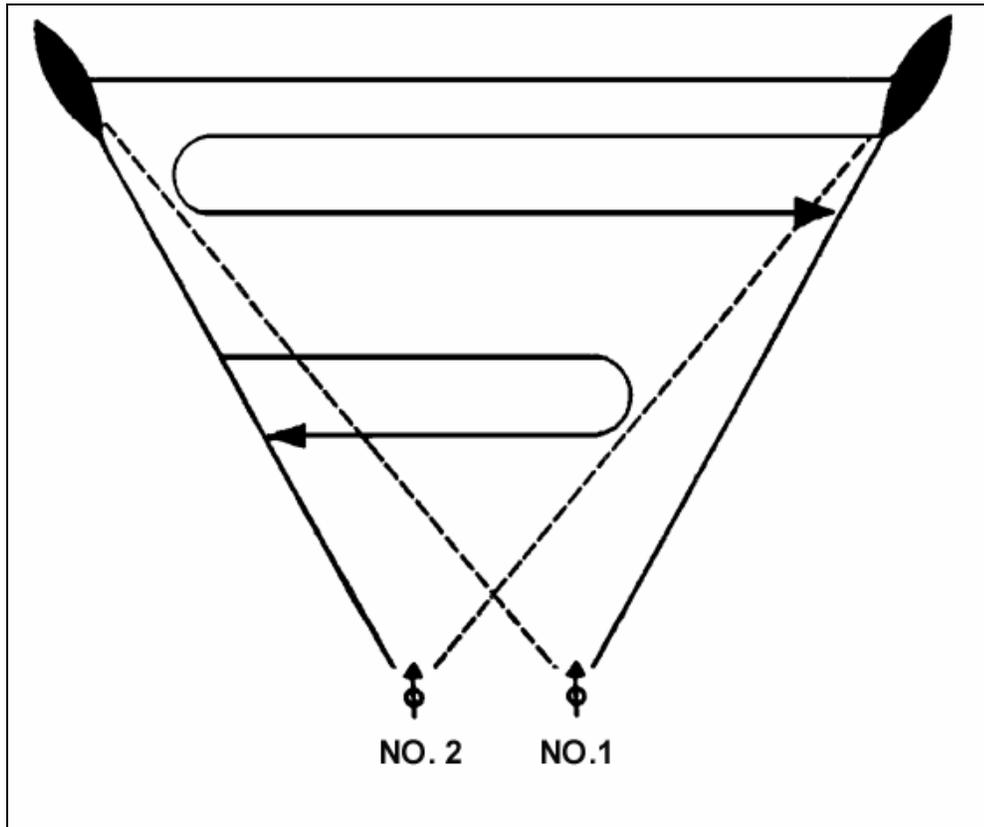


Figure 5-11. Traversing method, pair of MK 19s, target 100 mils or less in width, both flanks visible.

(b) *Target More than 100 mils in Width.* In this case, the leader assigns part of the target to each MK 19 (Figure 5-12). One part may be smaller than the other to ensure it receives a heavier concentration of fire. Each gun fires an initial burst on its respective flank, and covers its assigned part of the target as described in subparagraph (a). An example of a fire command follows:

FIRE MISSION.

RIGHT FRONT.

TROOPS, EXTENDING FROM DEAD TREE RIGHT TO CLEARING, ROW.

EIGHT HUNDRED.

NUMBER 1, RIGHT ONE-THIRD; NUMBER 2, LEFT TWO-THIRDS.

TRAVERSE.

RAPID.

AT MY COMMAND.

FIRE (given after the gunners announce “Up”).

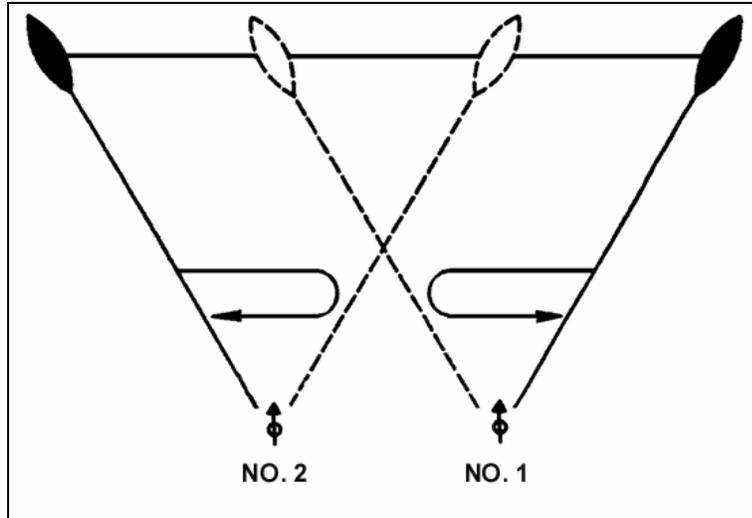


Figure 5-12. Traversing method, pair of MK 19s, target more than 100 mils in width.

(3) **Linear Engagement with Four MK 19s.** Four guns may be needed to concentrate a heavy volume of fire into a wide target area. Methods used are similar to the ones described for a pair of MK 19s. The width of the target in mils determines which type of linear engagement is used.

(a) *Target 100 to 200 mils in width:*

- Each pair of MK 19s engages the whole target (Figure 5-13).

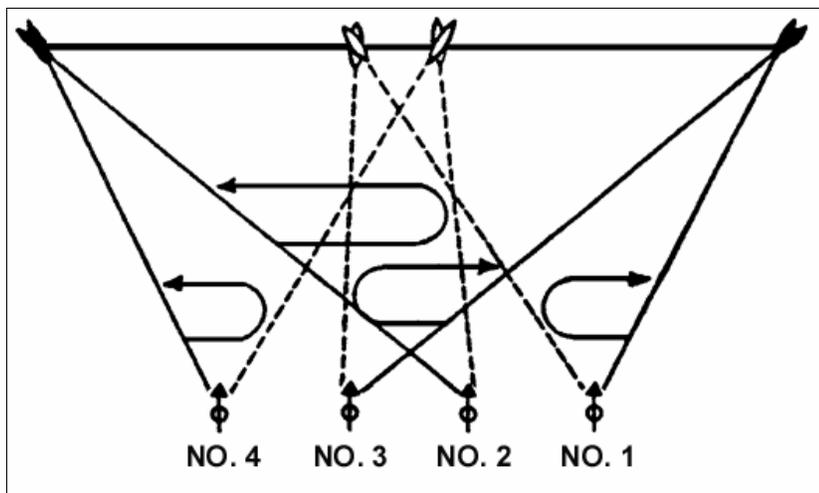


Figure 5-13. Four MK 19s, target 100 to 200 mils in width.

- Each pair of MK 19s engages half the target (Figure 5-14).

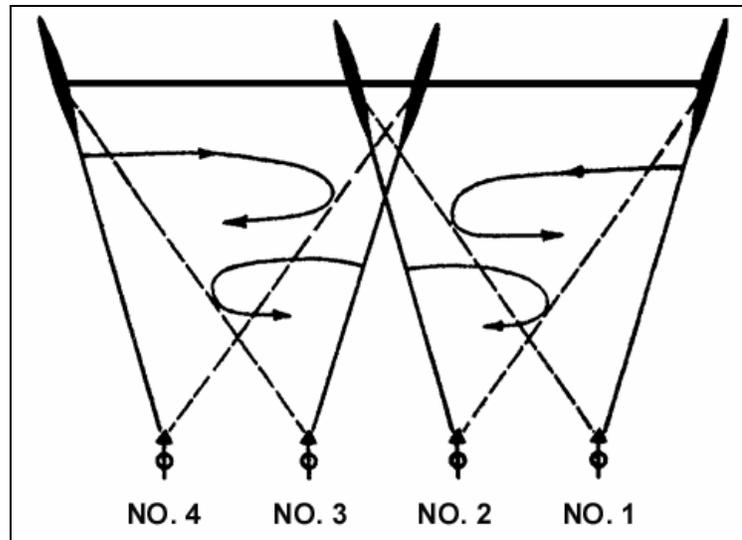


Figure 5-14. Two pairs of MK 19s engaging each half of a target 100 to 200 mils in width.

(b) *Target Greater than 200 mils in Width.* The leader may assign part of the target to each gun in this case. The target may be divided in half for each fire unit or in four parts, one for each MK 19 (Figure 5-15).

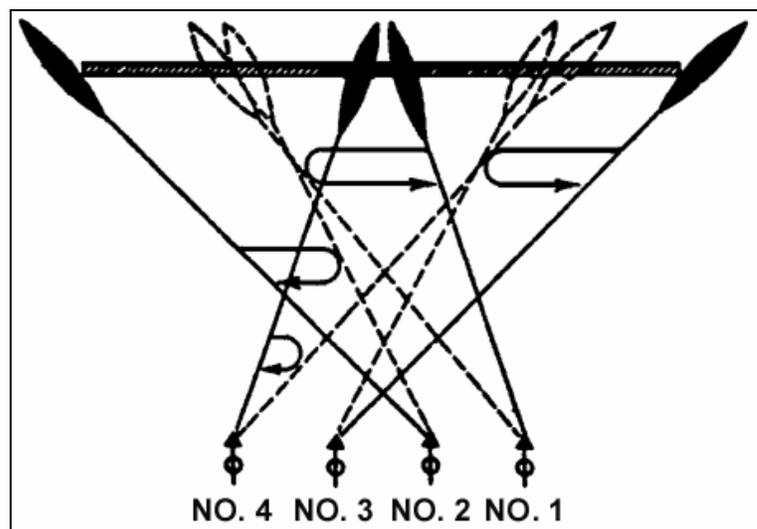


Figure 5-15. Four MK 19s, each pair engaging part of target with extreme width.

(4) **Linear Engagement with the Flanks of Target Not Identifiable.** The target may be located by firing tracers from an observer's gun, laying MK 19s, or using a reference point. The reference point may be in or near the target area.

(a) When a reference point is outside the target area, the leader may direct the gunner to it by announcing the interval (right or left, long or short) between the reference point and the target. With the MK 19 on a tripod mount, the gunner measures the interval right or left

between the reference point and the flank of the target by laying on the reference point, with the sights set at the range to the target, and then shifting the MK 19 the designated number of mils. The interval long or short may be measured in mils using the computed search method, or it may be estimated in meters. When the gunners lay each MK 19 on its respective flank, they adjust fire and engage the target.

(b) When a reference point is in the target area, the leader may identify the flanks of an obscure target as extending so many mils from the reference point. In this case, gunners use the swinging traverse. With the swinging traverse each MK 19 is laid on the announced reference point (initial aiming point), adjusted for fire, and traversed the given distance to its corresponding flank and back, firing after each manipulation (Figure 5-16). Each gunner continues traversing back and forth across the entire target until told to cease-fire. Each gunner stops firing while traversing past the reference point. Examples of fire commands that may be used are as follows:

- The leader designates the target by firing one gun:
FIRE MISSION.
LEFT FLANK.
WATCH MY BURSTS (OR TRACERS).
(Lays and fires MK 19 at left flank) LEFT FLANK.
(Lays and fires MK 19 at right flank) RIGHT FLANK.
TROOPS.
NINE HUNDRED.
TRAVERSE.
RAPID.
AT MY COMMAND.
FIRE (given after gunners announce “Up”).
- The leader designates the target by using a reference point outside the target area (MK 19s on tripod mounts):
FIRE MISSION.
RIGHT FRONT.
REFERENCE: DEAD TREE.
RIGHT SIX ZERO MILS; DROP THREE FIVE ZERO METERS
(or drop so many mils, if using computed search).
TARGET: TROOPS EXTENDING RIGHT FIVE ZERO MILS.
SIX HUNDRED.
TRAVERSE.
RAPID.
AT MY COMMAND.
FIRE (given after the gunners announce “Up”).

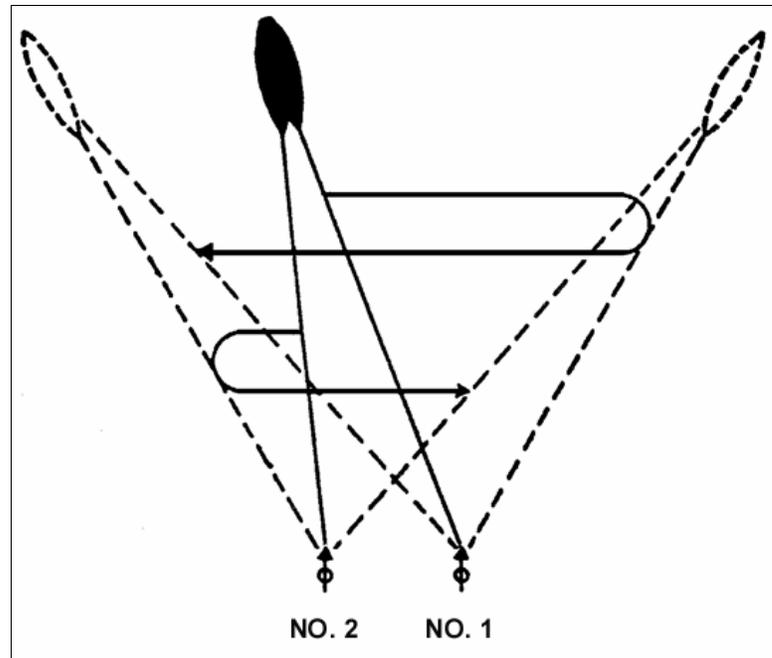


Figure 5-16. Two MK 19s, deep enfilade target, ends not visible.

- The leader designates the target by using a reference point within the target area (MK 19s on tripod mounts):
 FIRE MISSION.
 FRONT.
 REFERENCE: LONE TREE.
 TARGET: TROOPS EXTENDING RIGHT TWO ZERO MILS, LEFT,
 THREE ZERO MILS.
 SEVEN HUNDRED.
 TRAVERSE.
 RAPID.
 AT MY COMMAND.
 FIRE (given after the gunners announce “Up).

(5) **Linear Engagement with Swinging Traverse.** As previously described, a single gun uses this method against massed or rapidly moving targets at short ranges. The leader’s fire command for a swinging traverse can be:

FIRE MISSION.
 LEFT FRONT.
 TRUCKS.
 SWINGING TRAVERSE.
 FIRE.

d. **Engagement of Deep Targets Using Searching Fire.** There are several ways for leaders to use two guns to engage a stationary deep target, depending on whether the ends of the target are visible to the gunner. If the target location is unknown, the computed search method may be used to engage the target. A deep target that is stationary or that has limited mobility may be engaged with searching fire.

(1) **Target Ends Visible to Gunner.** The Number 1 gun is adjusted first on the near end and the Number 2 gun on the far end. Each gunner searches to the opposite end and back again repeatedly, until told to cease firing (Figure 5-17). Target depth is considered in determining sight settings. The command is SEARCH.

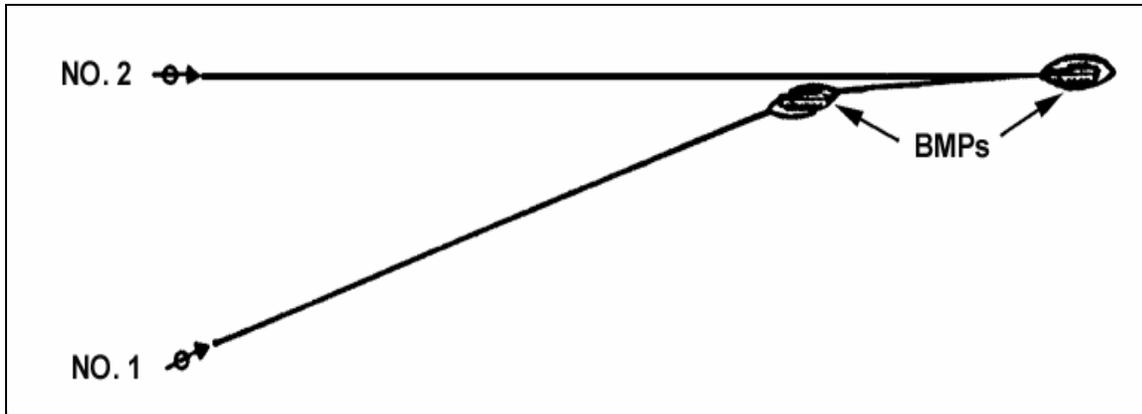


Figure 5-17. Two MK 19s, deep enfilade target, ends visible.

(a) *Target Less than 200 meters Deep.* The leader announces the range to the midpoint of the target for both MK 19s, using the length of the beaten zones to ensure the initial bursts impact on the target. An example of a fire command for this situation follows:

FIRE MISSION.
 FRONT.
 HALTED COLUMN.
 SEVEN HUNDRED (midrange).
 SEARCH.
 RAPID.
 AT MY COMMAND.
 FIRE (given after gunners announce "Up").

(b) *Target Depth Greater than 200 meters.* The leader announces the range to the near end for the Number 1 gun, and to the far end for the Number 2 gun. An example of a fire command for this situation follows:

FIRE MISSION.
 LEFT FRONT.
 TROOPS ALONG RIGHT EDGE OF WOODS.
 NUMBER 1, SIX HUNDRED; NUMBER 2. NINE HUNDRED.
 SEARCH.
 RAPID.
 AT MY COMMAND.
 FIRE (given after gunners announce "Up").

(2) **Target Ends Not Visible to Gunner.** The target may be located by having an observer fire tracers at the target, by laying the MK 19s, or by using a reference point. The reference point must be visible to the gunner and in the vicinity of the target. When a selected reference point is outside the target area, the leader may direct the gunner to the target and announce the interval to the right or left (long or short) between the reference point and the target. If the

MK 19 is on a tripod, the gunner lays on the reference point with the sights set at the range to the midpoint of the target; he measures the interval and shifts the appropriate number of mils. Using the computed search method, the gunner may measure the long or short interval in mils, or he may estimate the interval in meters. When the gunners lay their MK 19s on the right or left flank (near or far end), respectively, they adjust fire and engage the target. When the gunners lay their MK 19s on the announced release point (initial aiming point), they set their sights at the range to the reference point, and adjust fire. The gunner on the Number 1 gun searches down the designated number of meters (or mils), firing after each manipulation until the gun is set on the near end of the target. The gunner on the Number 2 gun searches up the designated number of meters (or mils), firing after each manipulation, until the gun is set on the far end of the target. When each gun has reached the near or far end, respectively, the gunners reverse the direction and both search up and down between the two limits, covering the entire target, until told to cease firing.

e. **Engagement of Deep Targets Using Computed Search Method.** When the depth of a target must be described in mils (search), the leader may compute the depth from the reference point using the computed search method. The leader determines the ranges to the near and far ends of the target and finds the required AE (angles of elevation) in mils for both ranges (Appendix F, Firing Table). The leader then computes the difference between the two. This is the amount of search required when the MK 19 and target are at the same elevation on level ground. If the fire is plunging, the amount of search should be increased. For example, when using M430 ammunition, a deep target has been sighted (the ends of which are not visible to the gunners). A reference point is also visible on the target at a range of 1,100 meters, the depth of the target is estimated at 200 meters, and the reference point appears to be midway between the ends of the target:

$$\begin{aligned} \frac{200 \text{ meters}}{2} &= 100 \text{ meters from the reference point to each end of target} \\ 1,100 + 100 &= 1,200 \text{ meters to far end of target} \\ 1,100 - 100 &= 1,000 \text{ meters to near end of target} \\ \text{AE } 1,200 \text{ meters} &= 175 \text{ mils} \\ \text{-AE } 1,000 \text{ meters} &= 132 \text{ mils} \\ \text{depth of target} &= 43 \text{ mils} \\ \frac{43 \text{ mils}}{2} &= 21.5 \text{ mils from release point to each end of target} \end{aligned}$$

To search in 5-mil increments, the gunners cover the target by searching 25 mils long and 25 mils short of the reference point, or a total of 50 mils. The leader describes the target to the gunner as TARGET; TROOPS EXTENDING LONG 25 MILS; SHORT 25 MILS. The following are examples of fire commands:

- Reference point in target area, ends of target not visible to the gunner.
 FIRE MISSION.
 RIGHT FRONT.
 REFERENCE: LONE BUSH.
 TARGET: TROOPS EXTENDING SHORT ONE HUNDRED YARDS, LONG TWO HUNDRED YARDS.
 SIX HUNDRED (range to reference point).
 SEARCH.

RAPID.

AT MY COMMAND.

FIRE (given after gunners announce “Up”).

- Reference point outside target area, gun on tripod.

FIRE MISSION.

LEFT FRONT.

REFERENCE: DEAD TREE.

RIGHT THREE ZERO MILS; ADD TWO HUNDRED METERS

(or add so many mils, using computed search).

TARGET: TROOPS EXTENDING OVER TWO HUNDRED METERS

(or long so many mils, using computed search).

NINE HUNDRED.

SEARCH.

RAPID.

AT MY COMMAND.

FIRE (given after gunners announce “Up”).

f. **Engagement of Moving Targets.** Due to the slow flight of the MK 19 round, it is not practical to engage moving targets using the track-and-lead methods of engaging moving targets. In order to effectively engage moving targets with the MK 19, use the trapping method of engaging targets. The gunner chooses an aiming point forward of the target and on the target path, and presses the trigger before the target comes into the sights. After starting to fire, the gunner moves the MK 19 slowly toward the target. The target moves into the impact area, and is “trapped.” The gunner must begin firing before the target is in the sights or in the impact area (Figure 5-18).

(1) **Engagement of Deep Target Moving Away from the MK 19 Position.** If the target is moving rapidly away, both gunners lay their MK 19s on the far end of the target with the range set to that point, and search up.

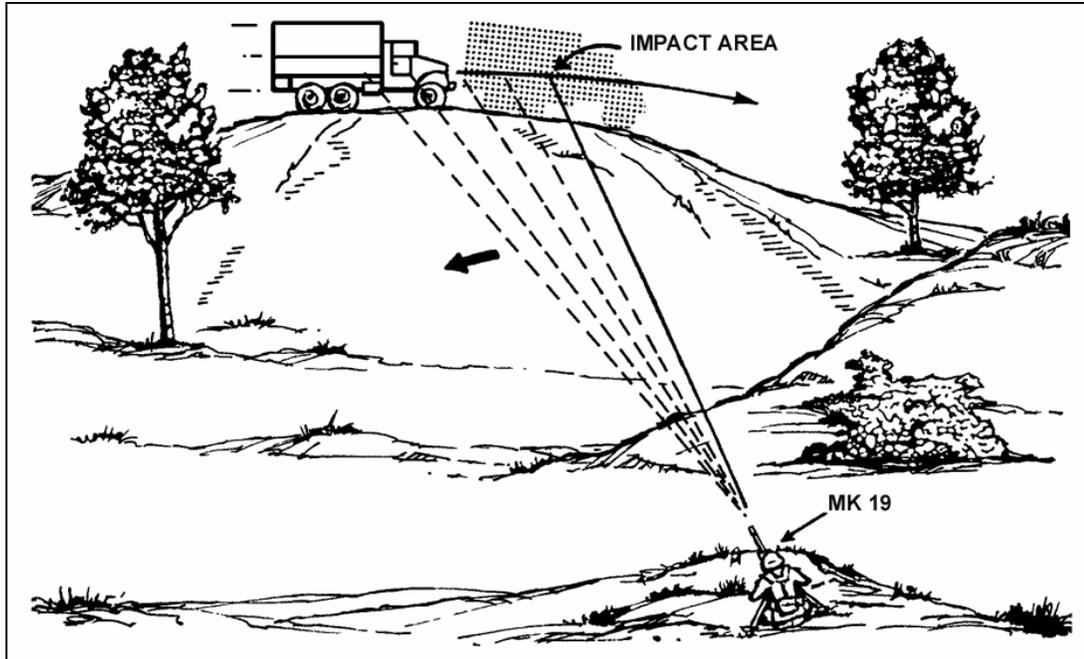


Figure 5-18. Target-trapping method.

(2) **Engagement of Deep Target Moving toward the MK 19 Position.** If the target is moving rapidly toward the MK 19 position:

(a) *One MK 19.* The gunner lays the MK 19, adjusts on the near end of the target with a range to the target's midpoint, and searches up and down the entire target. When a reference point within the target area is announced, the gunner lays on it with the range to that point. The gunner adjusts fire and searches up and down the entire target, beginning with the near end, until told to cease firing.

(b) *Two MK 19s.* The gunners lay both guns on the near end of the target, set the sights on the range to that point, and search down. The manipulation element of the fire command for a rapidly approaching or receding target is BOTH WEAPONS; FAR (NEAR) END; SEARCH.

(c) *Four MK 19s.* Each pair of gunners engages the target as if they were acting alone. If one pair must be switched to a different target, the other pair continues to cover the original target. A deep target should never be subdivided since the elevating mechanism on the M3 tripod allows enough search to cover any deep target within the maximum effective range for direct lay (1,500 meters).

g. **Engagement of Linear Target with Depth Using Traversing and Searching Fire.** The method used depends on the number of MK 19s available and whether the flanks of the target are visible to the gunner.

(1) *One MK 19, Flanks Visible.* The gunner lays initially on the near flank of the target with range set to the midpoint, adjusts fire on the near flank, and traverses and searches back and forth, covering the entire target, until told to cease-fire.

(2) **Two MK 19s, Flanks Visible.** Gunners use the same method as for engagement of a deep linear target: they must search to keep the center of impact on the target. The leader determines the range for the initial fire command the same as for a deep target (Figure 5-19).

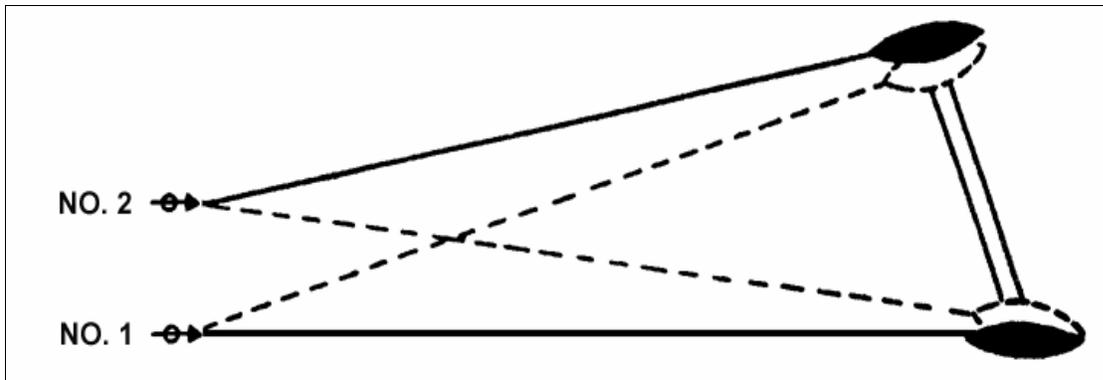


Figure 5-19. Two MK 19s, linear target with depth.

(3) **Four MK 19s, Flanks Visible.** Gunners use the same method for two pairs as is used for two guns. If one pair must be switched to another target, the other continues to cover the original target.

(4) **Flanks Invisible.** The leader may designate the target using a reference point. However, a reference point in the target area is not used as an initial aiming point because of the difficulty in describing an oblique target.

(5) **Fire Commands.** The leader may use the following fire commands for linear targets with depth.

- When the target is not wide enough to require subdivision, is 200 meters or less in depth, and is to be engaged by either one or two MK 19s:
 - FIRE MISSION.
 - RIGHT FRONT.
 - TROOPS EXTENDING FROM BLACK STUMP RIGHT TO LONE PINE.
 - SEVEN HUNDRED (midrange).
 - TRAVERSE AND SEARCH.
 - RAPID.
 - AT MY SIGNAL.
 - FIRE (given after gunners announce “Up”).
- When the target is 100 m wide or less, is 200 meters deep or less, and is to be engaged by four MK 19s:
 - FIRE UNIT, FIRE MISSION.
 - FRONT.
 - TROOPS TO THE RIGHT OF RED BANK.
 - SEVEN HUNDRED (midrange).
 - TRAVERSE AND SEARCH.
 - RAPID.
 - AT MY SIGNAL.
 - FIRE (given after gunners announce, “Up”).

- When the target is wide enough to require subdividing, is more than 200 meters in depth, and is to be engaged by either two or four MK 19s:

FIRE MISSION.

FRONT.

TROOPS EXTENDING FROM TRUCK, RIGHT TO BRIDGE.

NUMBER 1 (and 3 if four MK 19s are engaging the target),
SEVEN HUNDRED.

NUMBER 2 (and 4 if four MK 19s are engaging the target),
ONE THOUSAND.

NUMBER 1 (and 3), RIGHT HALF.

NUMBER 2 (and 4), LEFT HALF.

TRAVERSE AND SEARCH.

RAPID.

AT MY SIGNAL.

FIRE (given after gunners announce “Up”).

h. **Engagement of Target Using Combined Sights.** Leaders may choose this expedient way to engage a linear target with depth. They may lengthen the beaten zone of a two- to four-gun fire unit by having gunners set the sights differently on each gun. The leader gives one gunner a setting 150 meters less than the estimated range, and the other a setting 50 meters more than the estimated range. When four guns are used, one pair of gunners sets sights 150 meters less than the range, the other 150 meters more than the range. This technique sacrifices precision for speed, but may be necessary for fast-moving or fleeing targets. A sample fire command for the use of combined sights follows:

FIRE MISSION.

RIGHT FRONT.

TROOPS EXTENDING FROM CROSSROADS TO HOUSE.

1,300 METERS (midrange).

COMBINED SIGHTS; NUMBER 1, 1,350 METERS; NUMBER 2, 1,250
METERS.

TRAVERSE.

RAPID.

FIRE (given after gunners announce “Up”).

i. **Engagement of Area Target.** This applies to a target that cannot be covered by either traversing fire, searching fire, or traversing and searching fire. Area target engagement requires that the leader mass fires from four to six guns. Examples of area targets include:

- Large troop or mechanized formations.
- Targets that must be suppressed (if the exact positions are unknown or are not visible).
- Large kill zones or engagement areas for which predetermined fires have been planned.

j. **Engagement of Target Using Massed Fires.** Leaders can mass fires in both offensive and defensive operations, depending on the time available to plan and conduct the engagement.

(1) **Defensive Operations.** There are two types of defensive operations.

- **Defense, Time Not a Factor.** Massing fires into an engagement area has advantages over other types of area fire engagements. Once TRPs are designated, gunners may fire upon them to register or rehearse the MK 19s. After the target has been subdivided and TRPs registered, the gunners traverse, search up, traverse back, and search down through their assigned parts of the target to assure full coverage of the target (Figure 5-20). The same method applies regardless of how many MK 19s are used. If four or six guns are used, the leader must subdivide the target and assign more TRPs than for a pair of MK 19s. An example of a fire command for this situation follows:
 - FIRE MISSION.
 - FRONT TRPs 1, 2, 3, 4.
 - (MK 19s are laid on respective TRPs)
 - AREA: ENEMY COMPANY ENTERING EA GOLD.
 - (Range omitted MK 19s on TRPs.)
 - TRAVERSE.
 - SEARCH UP 50 MILS.
 - RAPID.
 - AT MY COMMAND.
 - FIRE (given after the enemy is completely within the engagement area and the gunners announce “Up”).
- **Defense, Time a Factor.** Leaders may not have the luxury of registering their MK 19s on TRPs before chance contacts due to time factors or the elements of surprise. However, the lethal effect of massed MK 19 fire on an area target should not be overlooked. Units should develop and practice SOPs that enable them to engage large-area targets on quick notice. For example, the leader may give each MK 19 a section or quadrant for all quick area engagements. He may assign the upper left side of the target to the Number 1 gun, the upper right to Number 2, and so on.

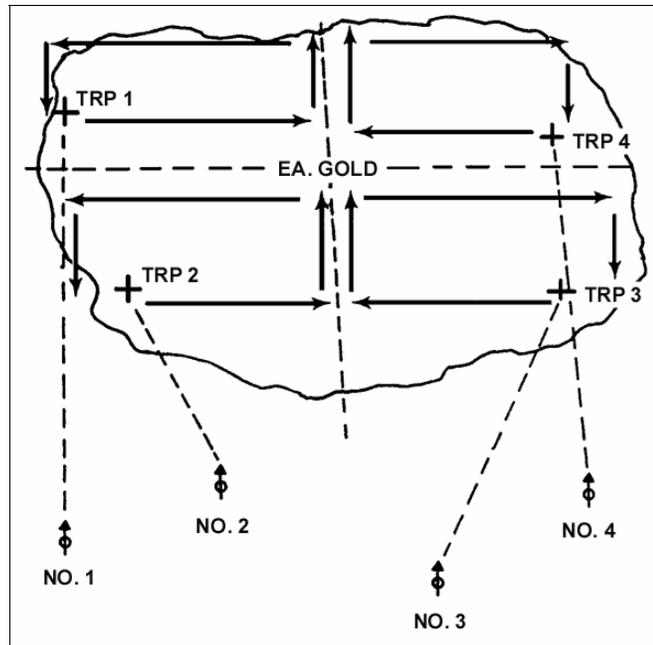


Figure 5-20. Use of massed fires, time not a factor.

(2) **Offensive Operations.** Massing fires into an area target can also be useful for offensive operations. During a movement to contact or an attack where time is a factor, massed fires may be used to suppress a suspected or actual enemy position, allowing the unit to flank or bypass the enemy. Although fast target acquisition and volume of fire are primary goals, the leader should subdivide the target for control, and adjust fires for greatest effect. Massed fires are especially useful in support of an attack where time is not a factor, which may require the use of overhead fire.

WARNING

Overhead fire should not be used unless the vertical interval between friendly soldiers and the target line is great enough to ensure safety.

5-13. DEFILADE POSITION

The MK 19 is most effective when laid directly on a target. Depending on the tactical situation, however, defilade could be the most desirable position.

a. **Definition.** A MK 19 is in defilade position when the gun and its crew are hidden by a landmass such as the crest of a hill from enemy ground (Figure 5-21). The position can be on the reverse slope of a hill, on the forward slope of the next high ground to the rear of a hill, or in a small fold in the ground. A defilade firing position does not necessarily reduce the effectiveness of fire against a stationary enemy target or preclude fire over the heads of friendly troops. Defilade may also be useful in providing predetermined fire into an EA.

b. **Advantages.** Some advantages of using the defilade position are that the MK 19 and

a crew have cover and concealment from direct fire guns; the crew has some freedom of movement near the MK 19 position; control and supply are facilitated; and the characteristic smoke and flash of the MK 19 are partly concealed from observation.

c. **Disadvantages.** Disadvantages of using the defilade position are that targets close to the mask usually cannot be engaged, and (because adjustment of fire must be made through an observer) rapidly moving ground targets are not easily engaged.

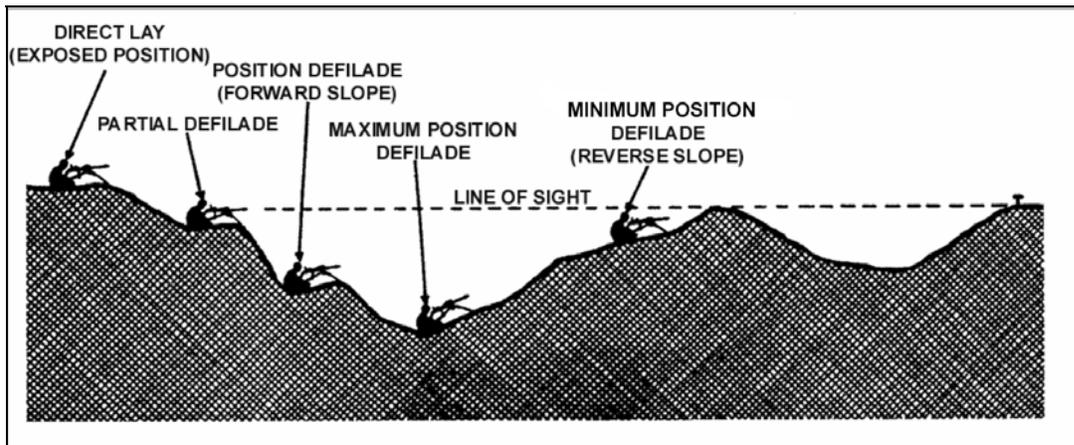


Figure 5-21. Defilade positions (and direct lay).

d. **Options.** A defilade position can either be on a forward or reverse slope.

(1) **Reverse Slope Positions.** These positions afford some protection from high-angle enemy fire and direct-fire cannon.

(a) **Partial Defilade Position.** The MK 19 is in partial defilade position when it is sited at the highest point on a slope on which it is defiladed. Partial defilade position provides great flexibility in engagement of new targets, although it does not provide the best cover. The MK 19 crew positioned in partial defilade can be grazed by enemy machine gun fire, but is concealed from enemy observation near the target area.

(b) **Maximum Defilade Position.** The MK 19 is in maximum defilade position when it is sited at the lowest point on a slope from which it can engage a target. The MK 19 crew positioned in maximum defilade has relatively good cover but lacks the flexibility to engage new targets.

(2) **Forward Slope Defilade Position.** A forward slope defilade position is not vulnerable to grazing fire from the target area, but it is open to attack or damage from mortar and artillery fire. The MK 19 is in partial defilade on a forward slope if the gun and gunner have some protection from direct fire, and if the gunner is able to engage the target using direct lay. Partial defilade is used only when a fire mission cannot be completed from defilade. The MK 19 is held in defilade and moved into partial defilade to fire.

e. **Considerations.** Direction, elevation, mask clearance, and adjustment of fire are four essential elements that must be considered when using the MK 19 in defilade position.

(1) **Direction.** There are four ways to lay the gun for direction.

(a) **Direct-alignment Method.** The observer selects a position on the gun-target line from which the target can be seen. The gunner loosens the traversing slide and, directed by the observer, moves the MK 19 right or left until it is aligned on the target.

(b) *Aiming-point Method.* For an aiming point, the gunner selects a prominent landmark visible through the sights (Figure 5-22). An aiming point on the gun-target line and at an equal or greater range than the target is desirable; however, the gunner may use an aiming point on the mask.

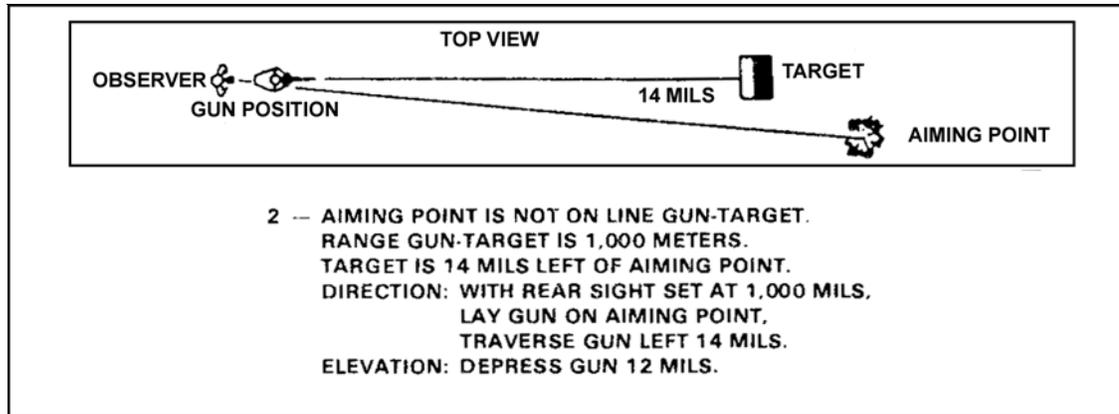


Figure 5-22. Aiming-point method.

- When the aiming point is on the gun-target line, the gunner lays the MK 19 on the aiming point, which aligns it on the target.
- When the aiming point is not on the gun-target line, the gunner measures the deflection with binoculars or compass, and adjusts the lay of the MK 19.

(c) *Aiming-stake Method.* When no natural aiming point is available, the assistant gunner sets out an aiming stake, and the gunner aligns the gun on the target.

(d) *Map-and-compass Method.* The leader locates the MK 19 position and target on a map; draws a line between the two points; orients the map to the terrain; and places the line of sight on the compass along the gun-target line drawn on the map. The leader then announces the magnetic azimuth at the compass index to the gunner as the direction of lay (Figure 5-23). Using this method with terrain-profiling techniques permits the MK 19 to be used in various defilade positions.

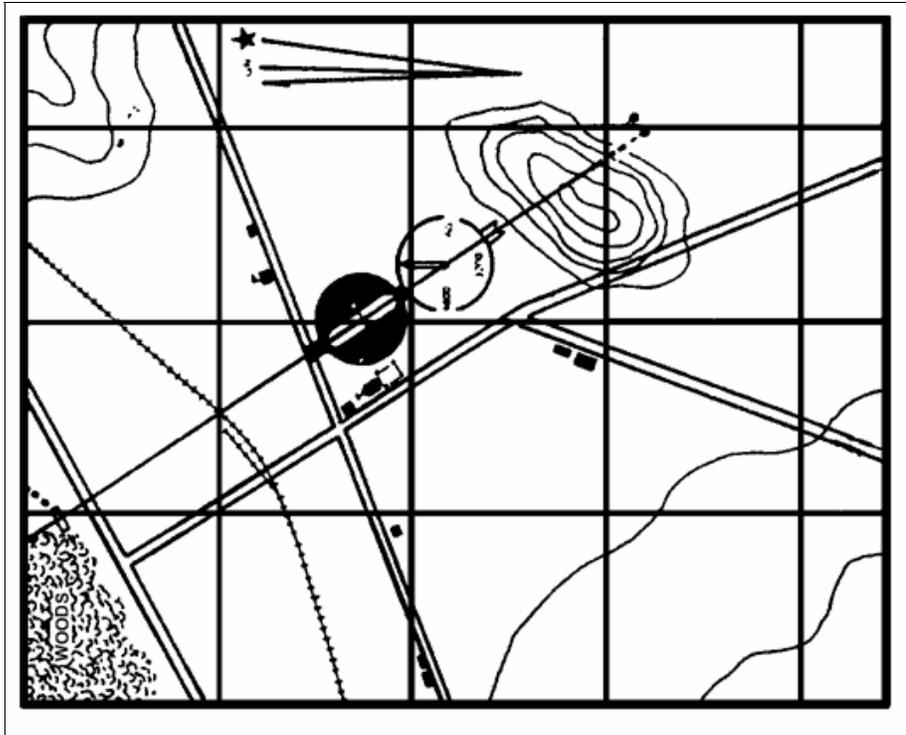


Figure 5-23. Map-and-compass method.

(2) **Elevation.** To lay the gun for elevation when engaging targets from defilade, knowledge of the trajectories of 40-mm rounds and of indirect lay is necessary. The MK 19 mounted on the M3 tripod with the T&E mechanism is not equipped to deliver indirect fire in the traditional sense like a mortar. Because the MK 19 has a high-arc trajectory when in the direct-fire mode, it can be fired effectively from defilade if the gunner positions it properly with the help of a well-trained observer. Discussion of laying the MK 19 for elevation includes those techniques and procedures that do not require a lot of data and calculations.

(a) The AE is the vertical angle between the bore line and the line of sight, when the gun and target are at the same elevation (Figure 5-24). The AE is always a positive (plus) and increases as the range increases. The AE for 40-mm ammunition, for each 100 meters of range up to 2,700 meters, is contained in Appendix F, Firing Table. For example, to hit a target at a range of 1,000 meters with M430 HEDP ammunition, the MK 19 must have an AE of +131.9 mils to the line of sight. Is a discussion on leveling the tripod necessary or can the gunner "eye-ball" it?

(b) When the MK 19 and target are not at the same elevation, an additional angle must be taken into consideration. The angle of sight (AS) is the vertical angle formed by the line of sight and a horizontal line from the base of the gun. When the target is at a higher elevation than the gun, the AS is positive (plus) (Figure 5-24). When the target is lower than the gun, the AS is negative (minus).

(c) The angle of quadrant elevation (QE) is formed between the bore line and the horizontal line through the base of the gun (Figure 5-24). The QE is positive (plus) whenever the gun is aimed above the horizontal, and negative (minus) whenever the gun is aimed

below the horizontal. It is the algebraic sum of the AE and the AS; that is, if the angle of sight is positive, it is added to the AE; if the AS is negative, it is subtracted from the AE.

$$QE = AE + AS \text{ (target above horizontal line)}$$

$$QE = AE - AS \text{ (target below horizontal line)}$$

Other methods of elevation are as follows:

- **Computed quadrant elevation method.** The leader must determine the correct range to the target. Using the range, the leader finds the corresponding AE from Appendix F, Firing Table. The leader must find the AS using binoculars, by measuring in mils the vertical interval between the target and the estimated horizontal. The leader may assume the distant horizon to be at a zero AS, or at the same elevation as the MK 19 position. QE may be determined by algebraically adding this data as previously described.
- **Measured quadrant elevation method.** The gunner should locate the MK 19 in partial defilade and lay it on the target using direct-lay methods. The leader measures the QE with the M2 compass. The gunner moves the MK 19 into defilade position and places the measured QE on the gun. For each meter difference in elevation between the position in partial defilade and the firing position, the gunner adds 1 mil to the QE when firing at a range of 1,000 meters; 1/2 mil when firing at 2,000 meters, and so on.
- **Aiming-point method.** The gunner selects an aiming point visible from the MK 19 position; preferably a point at a greater range than the target and at a higher elevation than the target, and the leader finds the range to the target. Using binoculars, the leader measures the vertical angle in mils from the aiming point to the base of the target. The leader has the gunner lay the MK 19 on the aiming point, with the sight set to hit the aiming point, and then directs the gunner to manipulate the gun through the number of mils measured from the aiming point to the target. For example, the range to the target is 1,000 meters (Figure 5-25). The angle read with the binoculars from the aiming point down to the base of the target is 12 mils. The sight should be set at 1,000 meters, with the MK 19 laid on the aiming point, and the muzzle then depressed 12 mils.

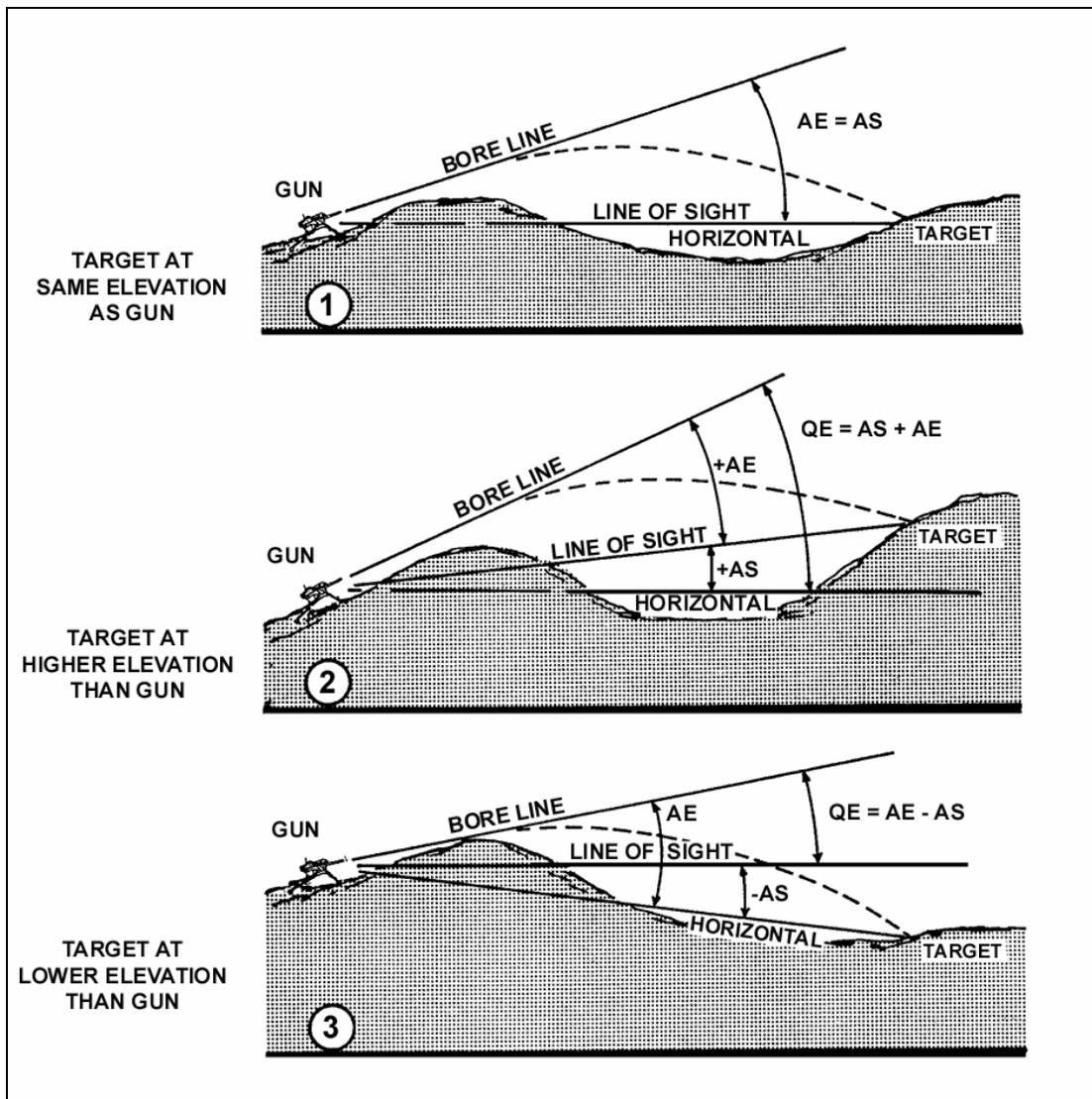


Figure 5-24. Angle of elevation, angle of sight, and quadrant elevation.

(3) **Mask Clearance.** After the gun(s) has been laid, the leader must determine whether or not the entire cone of fire will clear the mask, if mask clearance is not obvious. In order to ensure mask clearance, the leader has the gunner sight on the crest of the mask and re-lays the MK 19 for elevation on the target. The gunner ensures that the difference in elevation from the MK 19 to the target and from the MK 19 to the mask is at least +10 mils. The gunner checks this by sighting along the bottom of the receiver and the barrel.

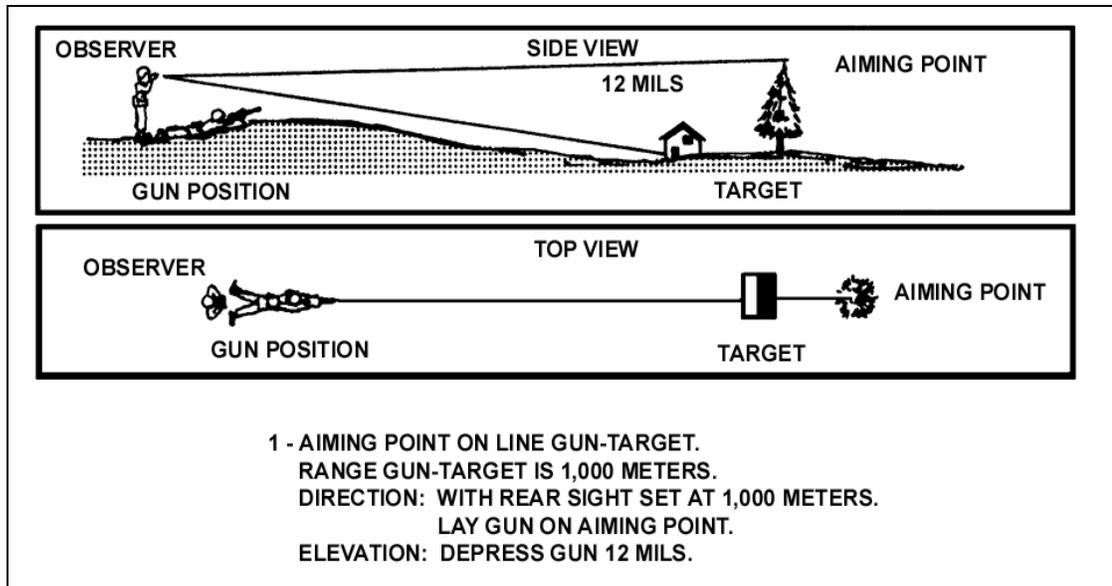


Figure 5-25. Aiming-point method for elevation.

NOTE: The procedures already discussed aid in the initial lay of the gun. The best tactical application of fire from the defilade position is in defense when time is not a factor, especially in a reverse slope defense. Leaders should try to register their MK 19s on selected TRPs, as previously discussed. Use trial and error to adjust for accurate fire from the defilade position. While the MK 19s are being registered, every precaution must be taken to guarantee troop safety.

(4) **Adjustment of Fire.** Under field conditions, the MK 19 that is quickly laid on the target seldom results in an initial impact directly on the target. Rapid adjustment of fire is essential. This is assured by thoroughly training the observer to estimate range and lateral distance. The observer should be in a position to see the initial impact. To ensure this, the burst (three to five rounds) should be long. Except for long ranges, or when for other reasons visual observation is hard, the observer does not ordinarily use binoculars for the initial burst. If the initial lay is incorrect, the binocular's limited field of view can cause the observer to miss the impact of the round. Adjustment of fire should be bold and aggressive. The observer should command large corrections and avoid creeping fire toward the target. When a burst is incorrect for deflection and elevation, the observer's next command should correct both.

f. **Construction of a Terrain Profile.** The leader may use a side view or cross section of the ground along a selected line or direction to determine where friendly and enemy forces can see each other. The leader can also use it to plan fires; that is, to locate dead space, to plan a defilade position, and so on. To construct a terrain profile, locate the gun position on the map and determine the direction of fire, or profile line (Figure 5-26).

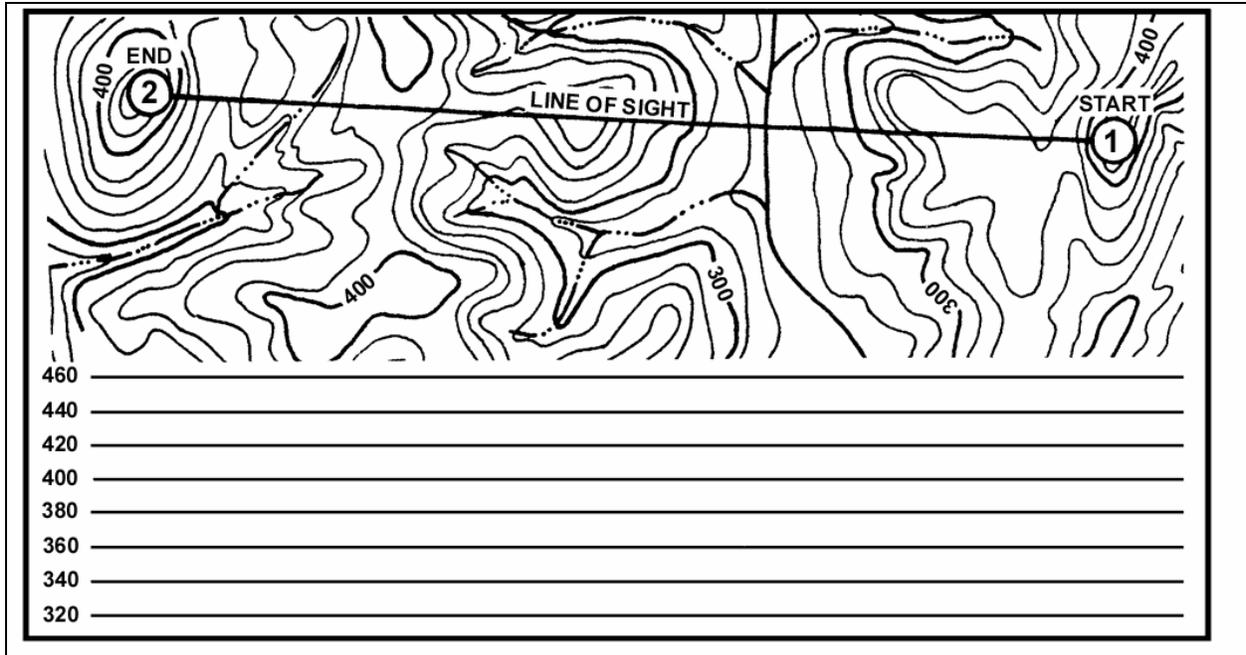


Figure 5-26. Profile line (map contour lines are 20 meters).

(1) Place the edge of a lined piece of paper along the profile line. Tick-mark all points of known elevation on the edge of the paper. These points are the contour lines. Any paper with evenly spaced horizontal lines, such as graph or notebook paper, may be used. The wider the spacing of the lines, the greater the vertical exaggeration in the profile; however this does not affect the information.

(2) Draw perpendicular lines, down across the horizontal lines for each marked point, and identify the high and low points along the profile (Figure 5-27).

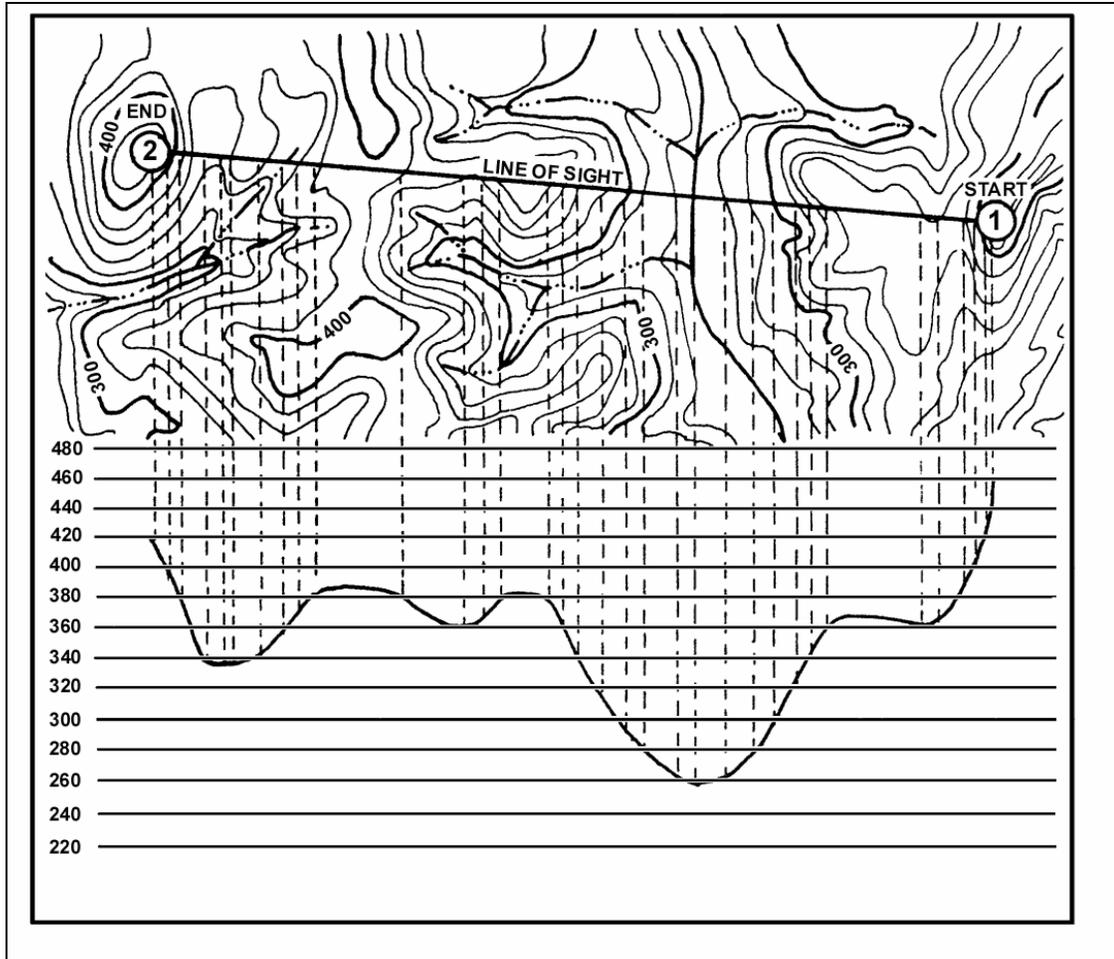


Figure 5-27. Marking of elevation.

(3) Connect all the points with a smooth curve (Figure 5-28).

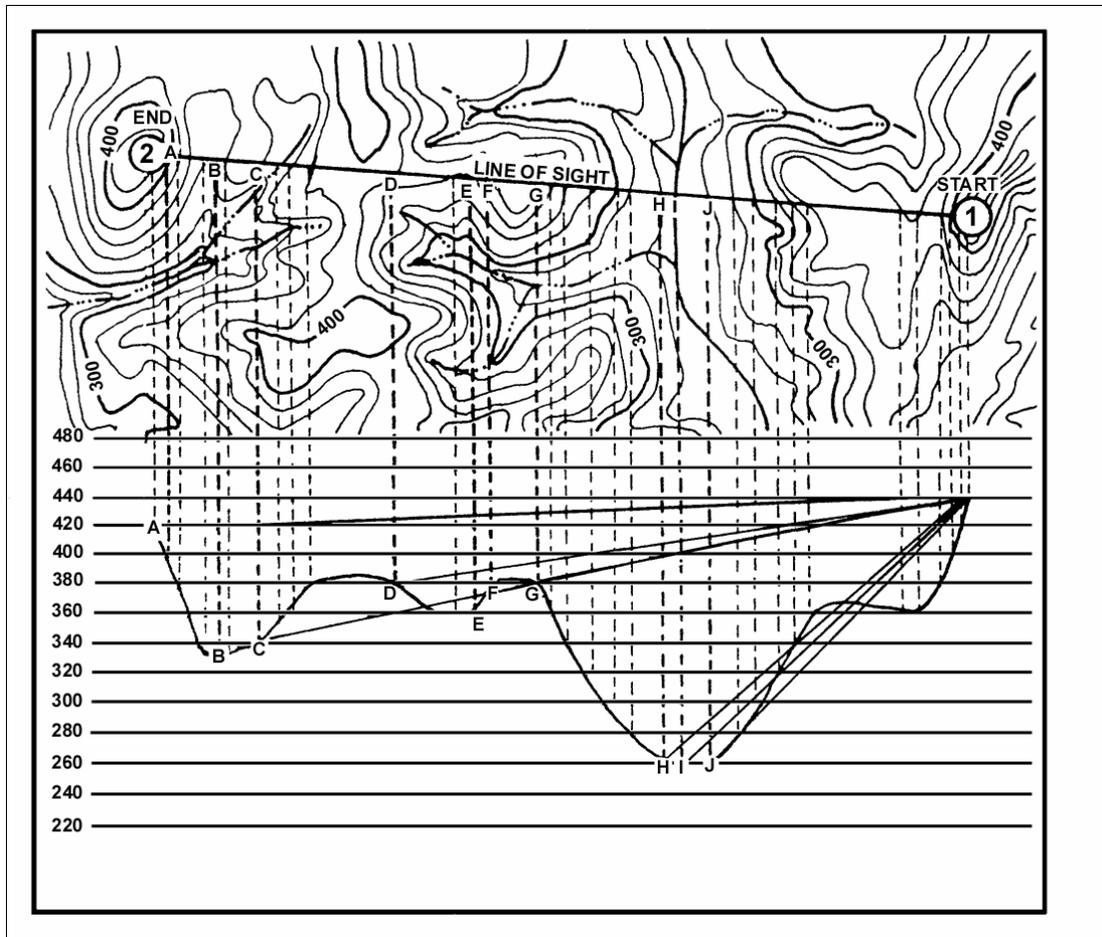


Figure 5-28. Terrain profile.

Section IV. DEGRADED CONDITIONS

The MK 19 is fired the same way under degraded conditions as it is fired under good conditions, except that degraded conditions limit the gunner's ability to observe the impact of rounds in relation to the target and to make adjustments. Refer to Appendix G, Aiming Devices, for additional information.

5-14. NIGHT FIRING

The use of range cards and predetermined fires are important at night or during degraded conditions because the targets or engagement areas are chosen and marked in advance, which enables the gunner to adjust onto targets quickly and easily. The gunner must know how to read his traversing slide bar and T&E mechanism. This task can be difficult at night or during degraded conditions. The gunner can mark targets on the slide bar with luminous tape, use mini-chemical lights, or use flashlights with red lens covers.

a. Firing with the use of illumination has proven to be much the same as firing during normal daylight conditions. Estimation of distances and adjustment of rounds are difficult at night or during degraded conditions. Gunners should be able, using illumination, to effectively engage targets out to 800 meters as well as they can in the daylight. Due to long

shadows and dispersion of light past this distance however, visibility is poor even with illumination.

b. The AN/TVS-5 can be mounted on the MK 19 and used effectively to spot and adjust rounds to targets out to ranges of 800 meters. Past this range, the elevation of the scope on the gun is too high to see the impact of the rounds, so it can be handheld by an observer who calls out adjustments to fire.

5-15. FIRING IN A NUCLEAR, BIOLOGICAL, OR CHEMICAL ENVIRONMENT

Firing the MK 19 during NBC conditions is no different than firing in normal conditions. Wearing the protective mask during firing does not change the way the gunner sights and aims the MK 19 to engage targets. The assistant gunner should take care to avoid catching his clothes or gloves while feeding ammunition. The gunner should also avoid contact with the hot barrel.

5-16. FIRING IN FOG OR SMOKE

Neither the degraded conditions of fog or smoke change the way the gunner fires the MK 19. The only limitations are observation of rounds and adjustment onto targets. The use of predetermined fires, trip flares, PEWS, or forward observers can cut down on these limitations.

Section V. PREDETERMINED FIRES

Predetermined fires are planned to cover target areas such as enemy avenues of approach, likely sites for enemy guns, and probable enemy assault routes. Laying the MK 19 on predetermined targets by either of the following methods may be verified by firing the MK 19 and adjusting it on target.

5-17. T&E MECHANISM METHOD

When the MK 19 is laid on target in the primary sector, the direction and elevation is taken from the traversing bar and the T&E mechanism. Both direction and elevation, as well as the range to each target, are recorded on the range card. Each target in the sector of fire must be numbered and laid on in sequence.

5-18. FIELD-EXPEDIENT METHOD OF LAYING THE MK 19

Another method for laying the MK 19 on predetermined targets is to use field expedients (Figure 5-29). Field expedients must be used in the secondary sector, and consist of aiming and base stakes. They can be used in the primary sector to aid the gunner.

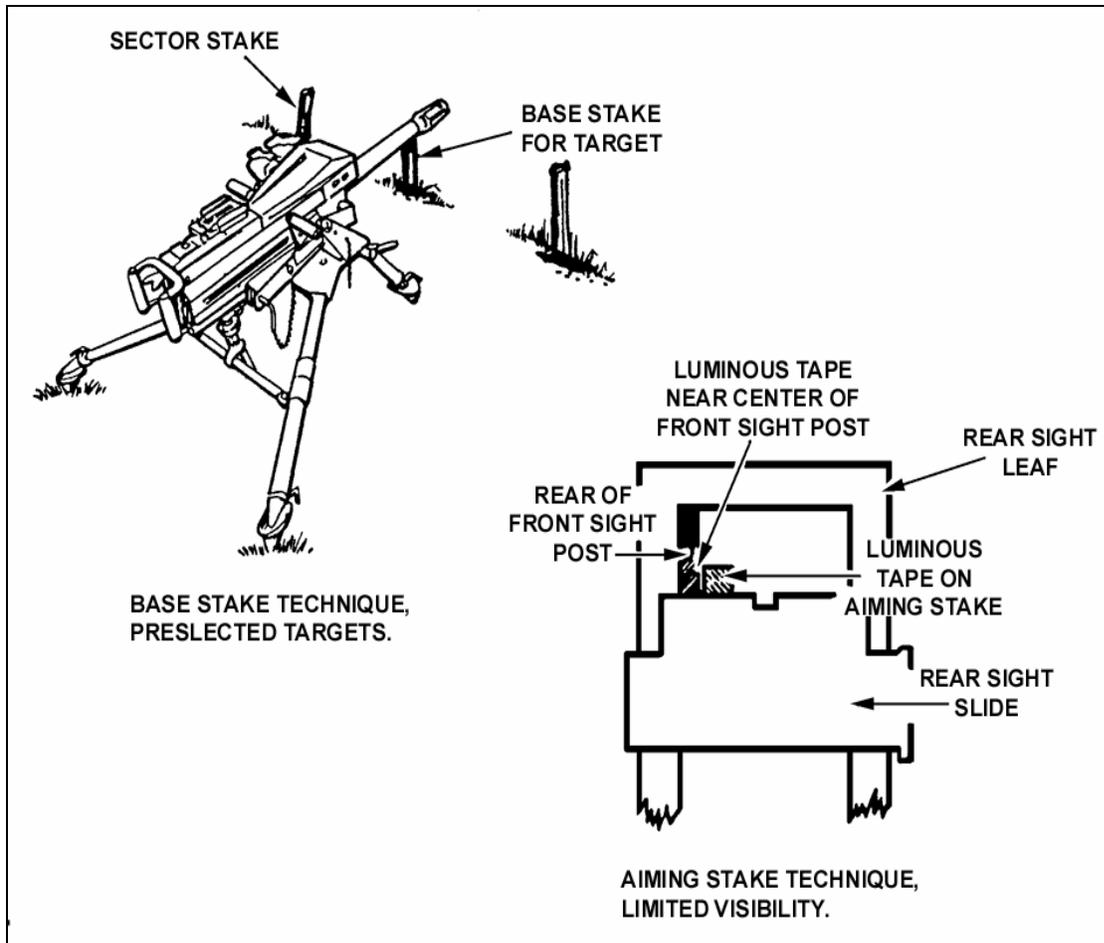


Figure 5-29. Techniques for laying the MK 19 using field-expedient method.