CHAPTER 3
MARKSMANSHIP

Sniper marksmanship is an extension of basic rifle marksmanship and focuses on the techniques needed to engage targets at extended ranges. To successfully engage targets at increased distances, the sniper team must be proficient in marksmanship fundamentals and advanced marksmanship skills. Examples of these skills are determining the effects of weather conditions on ballistics, holding off for elevation and windage, engaging moving targets, using and adjusting scopes, and zeroing procedures. Markmanship skills should be practiced often.

Section I
FUNDAMENTALS

The sniper team must be thoroughly trained in the fundamentals of marksmanship. These include assuming a position, aiming, breath control, and trigger control. These fundamentals develop fixed and correct firing habits for instinctive application. Every sniper should periodically refamiliarize himself with these fundamentals regardless of his experience.

3-1. STEADY POSITION ELEMENTS

The sniper should assume a good firing position (Figure 3-1, page 3-2) in order to engage targets with any consistency. A good position enables the sniper to relax and concentrate when preparing to fire.

a. **Position Elements.** Establishing a mental checklist of steady position elements enhances the sniper's ability to achieve a first-round hit.

(1) ***Nonfiring hand.*** Use the nonfiring hand to support the butt of the weapon. Place the hand next to the cheat and rest the tip of the butt on it. Bail the hand into a fist to raise the weapon's butt or loosen the fist

to lower the weapon's butt. An effective method is to hold a sock full of sand in the nonfiring hand and to place the weapon butt on the sock. This reduces body contact with the weapon. To raise the butt, squeeze the sock and to lower it, loosen the grip on the sock.

(2) ***Butt of the stock.*** Place the butt of the stock firmly in the pocket of the shoulder. Insert a pad on the ghillie suit (see Chapter 4) where contact with the butt is made to reduce the effects of pulse beat and breathing, which can be transmitted to the weapon.

(3) ***Firing hand.*** With the firing hand, grip the small of the stock. Using the middle through little fingers, exert a slight rearward pull to keep the butt of the weapon firmly in the pocket of the shoulder. Place the thumb over the top of the small of the stock. Place the index finger on the trigger, ensuring it does not touch the stock of the weapon. This avoids disturbing the lay of the rifle when the trigger is squeezed.

(4) ***Elbows.*** Find a comfortable position that provides the greatest support.

(5) ***Stock weld.*** Place the cheek in the same place on the stock with each shot. A change in stock weld tends to cause poor sight alignment, reducing accuracy.

(6) ***Bone support.*** Bone support is the foundation of the firing position; they provide steady support of the weapon.

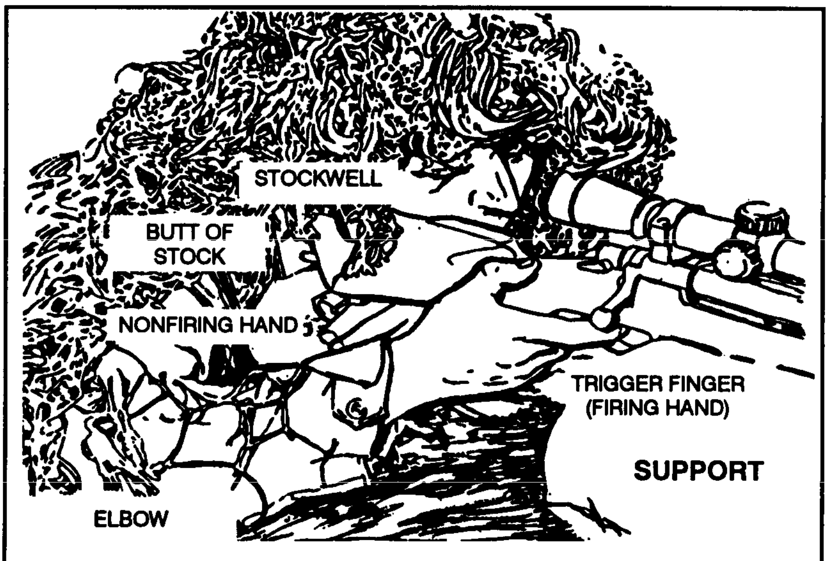

Figure 3-1. Firing position.

(7) ***Muscle relaxation.*** When using bone support, the sniper can relax muscles, reducing any movement that could be caused by tense or trembling muscles. Aside from tension in the trigger finger and firing hand, any use of the muscle generates movement of the sniper's cross hairs.

(8) ***Natural point of aim.*** The point at which the rifle naturally rest in relation to the aiming point is called natural point of aim.

(a) Once the sniper is in position and aimed in on his target, the method for checking for natural point of aim is for the sniper to close his eyes, take a couple of breaths, and relax as much as possible. Upon opening his eyes, the scope's cross hairs should be positioned at the sniper's preferred aiming point. Since the rifle becomes an extension of the sniper's body, it is necessary to adjust the position of the body until the rifle points naturally at the preferred aiming point on the target.

(b) Once the natural point of aim has been determined, the sniper must maintain his position to the target. To maintain his natural point of aim in all shooting positions, the natural point of aim can be readjusted and checked periodically.

(c) The sniper can change the elevation of the natural point of aim by leaving his elbows in place and by sliding his body forward or rearward. This raises or lowers the muzzle of the weapon, respectively. To maintain the natural point of aim after the weapon has been fired, proper bolt operation becomes critical. The sniper must practice reloading while in the prone position without removing the butt of the weapon from the firing shoulder. This may be difficult for the left-hand firer. The two techniques for accomplishing this task are as follows:

- After firing, move the bolt slowly to the rear while canting the weapon to the right. Execution of this task causes the spent cartridge to fall next to the weapon.
- After firing, move the bolt to the rear with the thumb of the firing hand. Using the index and middle fingers, reach into the receiver and catch the spent cartridge as it is being ejected. This technique does not require canting the weapon.

NOTE: The sniper conducts bolt operation under a veil or equivalent camouflage to improve concealment.

b. **Steady Firing Position.** On the battlefield, the sniper must assume a steady firing position with maximum use of cover and concealment. Considering the variables of terrain, vegetation, and tactical situations, the sniper can use many variations of the basic positions. When assuming a firing position, he must adhere to the following basic rules:

(1) Use any support available.

(2) Avoid touching the support with the barrel of the weapon since it interferes with barrel harmonics and reduces accuracy.

(3) Use a cushion between the weapon and the support to prevent slippage of the weapon.

(4) Use the prone supported position whenever possible.

c. **Types of Firing Positions.** Due to the importance of delivering precision fire, the sniper makes maximum use of artificial support and eliminates any variable that may prevent adhering to the basic rules. He uses the prone supported; prone unsupported; kneeling unsupported; kneeling, sling supported; standing supported; and the Hawkins firing positions.

(1) ***Prone supported position.*** The prone supported position is the steadiest position; it should be used whenever possible (Figure 3-2). To assume the prone supported position, the sniper should—

(a) Lie down and place the weapon on a support that allows pointing in the direction of the target. Keep the position as low as possible. (For field-expedient weapon supports, see paragraph 3-1d.)

(b) Remove the nonfiring hand from underneath the fore-end of the weapon by folding the arm underneath the receiver and trigger, grasping the rear sling swivel. This removes any chance of subconsciously trying to exert control over the weapon's natural point of aim. Keep the elbows in a comfortable position that provides the greatest support.

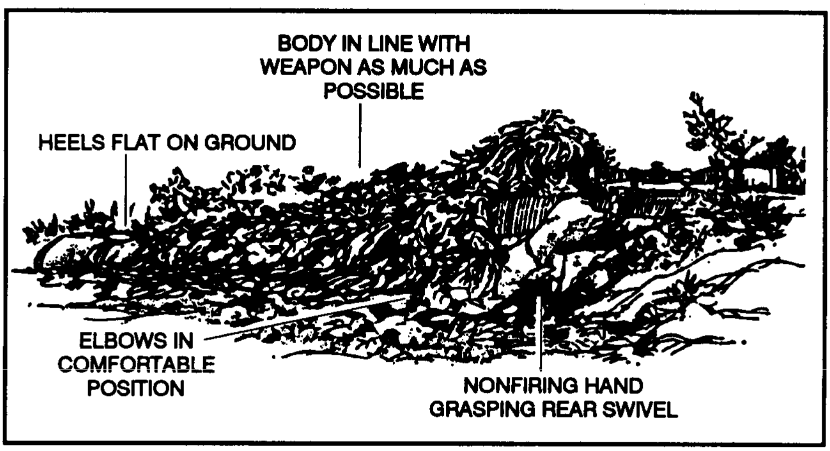

Figure 3-2. Prone supported position.

(c) Keep the body in line with the weapon as much as possible-not at an angle. This presents less of a target to the enemy and more body mass to absorb recoil.

(d) Spread legs a comfortable distance apart with the heels on the ground or as close as possible without causing strain.

(2) ***Prone unsupported position.*** The prone unsupported position (Figure 3-3) offers another stable firing platform for engaging targets. To assume this position, the sniper faces his target, spreads his feet a comfortable distance apart, and drops to his knees. Using the butt of the rifle as a pivot, the firer rolls onto his nonfiring side. He places the rifle butt in the pocket formed by the firing shoulder, grasps the pistol grip in his firing hand, and lowers the firing elbow to the ground. The rifle rests in the V formed by the thumb and fingers of the nonfiring hand The sniper adjusts the position of his firing elbow until his shoulders are about level, and pulls back firmly on the rifle with both hands. To complete the position, he obtains a stock weld and relaxes, keeping his heels close to the ground.

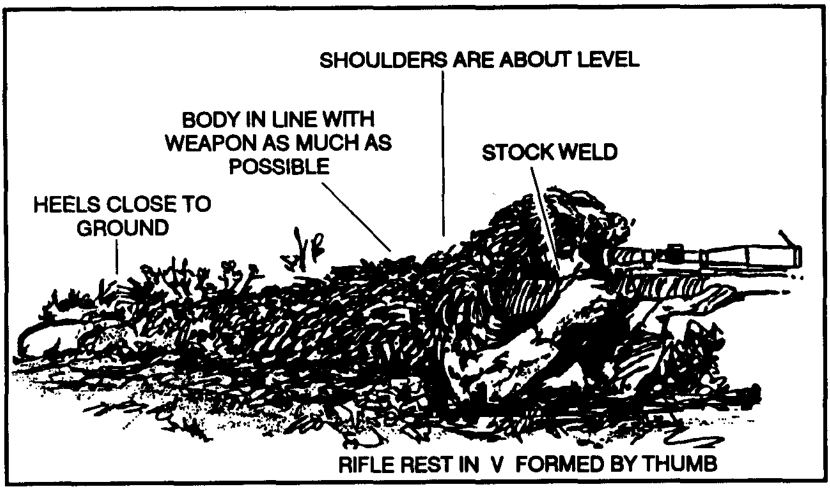

Figure 3-3. Prone unsupported position.

(3) ***Kneeling unsupported position.*** The kneeling unsupported position (Figure 3-4, page 3-6) is assumed quickly. It places the sniper high enough to see over small brush and provides for a stable position.

(a) Place the body at a 45-degree angle to the target.

(b) Kneel and place the right knee on the ground.

(c) Keep the left leg as perpendicular to the ground as possible; sit back on the right heel, placing it as directly under the spinal column as possible. A variation is to turn the toe inward and sit squarely on the right foot.

(d) Grasp the small of the stock of the weapon with the firing hand, and cradle the fore-end of the weapon in a crook formed with the left arm.

(e) Place the butt of the weapon in the pocket of the shoulder, then place the meaty underside of the left elbow on top of the left knee.

(f) Reach under the weapon with the left hand, and lightly grasp the firing arm.

(g) Relax forward and into the support position, using the left shoulder as a contact point. This reduces transmission of the pulsebeat into the sight picture.

(h) Lean against a tree, building, or vehicle for body support.

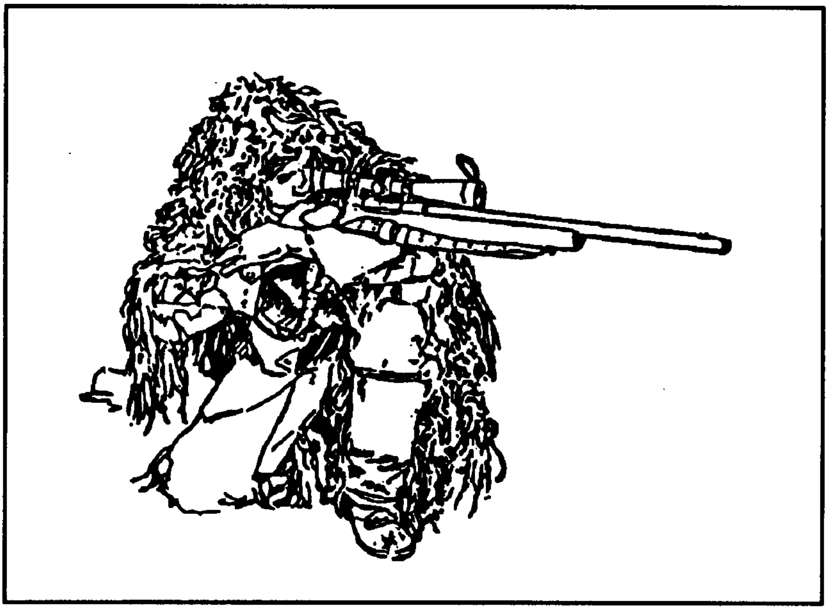

Figure 3-4. Kneeling unsupported position.

(4) ***Kneeling, sling supported position.*** If vegetation presents a problem, the sniper can raise his kneeling position by using the rifle sling. To assume the kneeling, sling supported position, he executes the first three steps for assuming a kneeling unsupported position. With the leather sling mounted to the weapon, the sniper turns the sling one-quarter turn to the left. The lower part of the sling will then form a loop.

(a) Place the left arm (nonfiring) through the loop; pull the sling up the arm and place it on the upper arm between the elbow and shoulder, but not directly over the biceps.

(b) Tighten the sling by sliding the sling keeper against the loop holding the arm.

(c) Rotate the left arm in a clockwise motion around the sling and under the rifle with the sling secured to the upper arm. Place the fore-end of the stock in the V formed by the thumb and forefinger of the left hand. Relax the left arm and hand, let the sling support the weight of the weapon.

(d) Place the butt of the rifle against the right shoulder and place the left elbow on top of the left knee (Figure 3-5). Pull the left hand back along the fore-end of the rifle toward the trigger guard to add to stability.

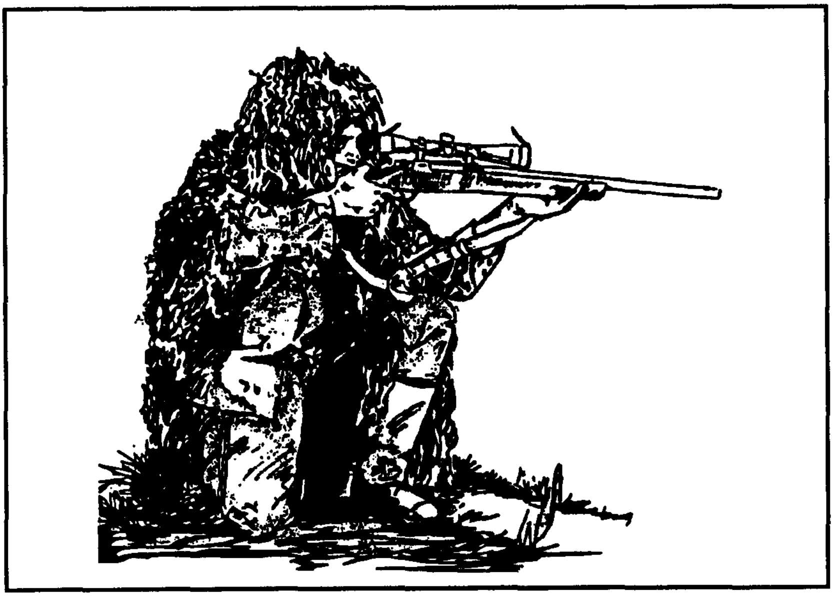

Figure 3-5. Kneeling, sling supported position.

(5) ***Standing supported position.*** The standing supported position is the least steady of the supported positions and should be used only as a last resort (Figure 3-6, page 3-8).

(a) To assume the standing supported position with horizontal support, such as a wall or ledge, the sniper proceeds as follows:

- Locate a solid object for support. Avoid branches as they tend to sway when wind is present.

- Form a V with the thumb and forefinger of the nonfiring hand.
- Place the nonfiring hand against the support with the fore-end of the weapon resting in the V of the hand. This steadies the weapon and allows quick recovery from recoil.
- Then place the butt of the weapon in the pocket of the shoulder.

Figure 3-6. Standing supported position (horizontal support).

(b) To use vertical support (Figure 3-7), such as a tree, telephone pole, comer of building, or vehicle, the sniper proceeds as follows:

- Locate stable support. Face the target, then turn 45 degrees to the right of the target, and place the palm of the nonfiring hand at arm's length against the support.
- Lock the left arm straight, let the left leg buckle, and place body weight against the nonfiring hand. Keep the trail leg straight.
- Place the fore-end of the weapon in the V formed by extending the thumb of the nonfiring hand.
- Exert more pressure to the rear with the firing hand.

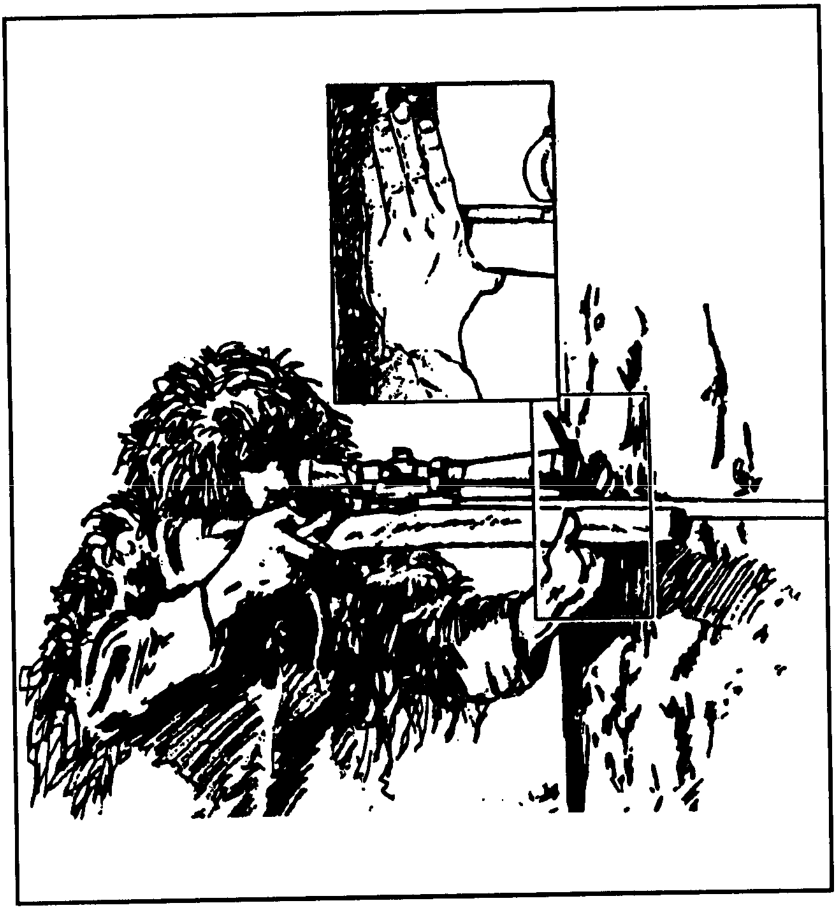

Figure 3-7. Standing supported position (vertical support).

(6) ***Hawkins position.*** The Hawkins position (Figure 3-8) is a variation of the prone unsupported position. The sniper uses it when firing from a low bank or a depression in the ground, over a roof, or so forth. It cannot be used on level ground since the muzzle cannot be raised high enough to aim at the target. It is a low-profile position with excellent stability and aids concealment. To assume this position, the sniper uses the weapon's sling and proceeds as follows:

CAUTION
LOCK THE NONFIRING ARM STRAIGHT OR THE FACE WILL ABSORB THE WEAPON'S RECOIL.

(a) After assuming a prone position, grasp the upper sling swivel and sling with the nonfiring hand, forming a fist to support the front of the weapon.

(b) Ensure the nonfiring arm is locked straight since it will absorb the weapon's recoil. Wearing a glove is advisable.

(c) Rest the butt of the weapon on the ground and place it *under* the firing shoulder.

The sniper can make minor adjustments in muzzle elevation by tightening or relaxing the fist of the nonfiring hand. If more elevation is required, he can place a support under the nonfiring fist.

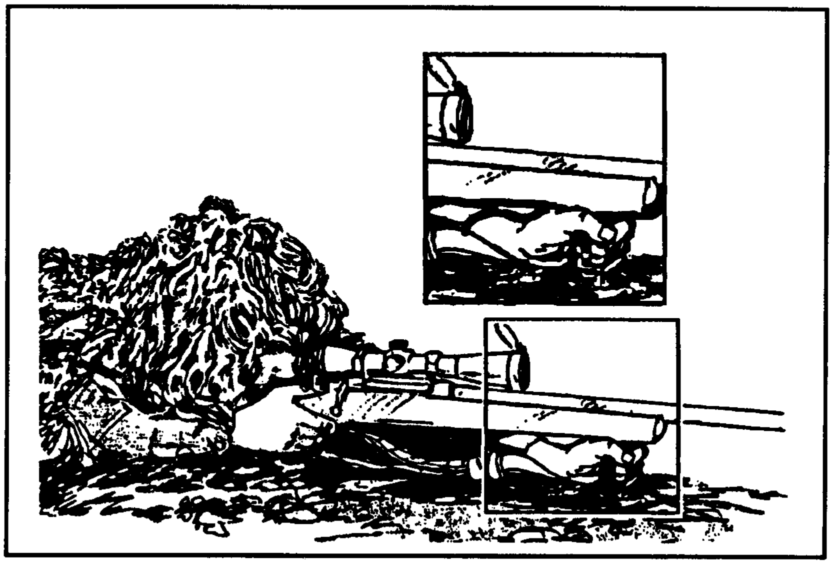

Figure 3-8. Hawkins position.

d. **Field-Expedient Weapon Support.** Support of the weapon is critical to the sniper's success in engaging targets. Unlike a well-equipped firing range with sandbags for weapon support, the sniper can encounter situations where weapon support relies on common sense and imagination. The sniper should practice using these supports at every opportunity and select the one that best suits his needs. He must train as if in combat to avoid confusion and self-doubt. The following items are commonly used as field-expedient weapon supports

(1) ***Sand sock.*** The sniper needs the sand sock when delivering precision fire at long ranges. He uses a standard issue, olive-drab wool sock filled one-half to three-quarters full of sand and knotted off. He places it under the rear sling swivel when in the prone supported position for added stability (Figure 3-9). By limiting minor movement and reducing pulse beat, the sniper can concentrate on trigger control and aiming. He uses the nonfiring hand to grip the sand sock, rather than the rear sling swivel. The sniper makes minor changes in muzzle elevation by squeezing or relaxing his grip on the sock. He uses the sand sock as padding between the weapon and a rigid support also.

Figure 3-9. Sand sock.

(2) ***Rucksack.*** If the sniper is in terrain without any natural support, he may use his rucksack (Figure 3-10). He must consider the height and presence of rigid objects within the rucksack. The rucksack must conform to weapon contours to add stability.

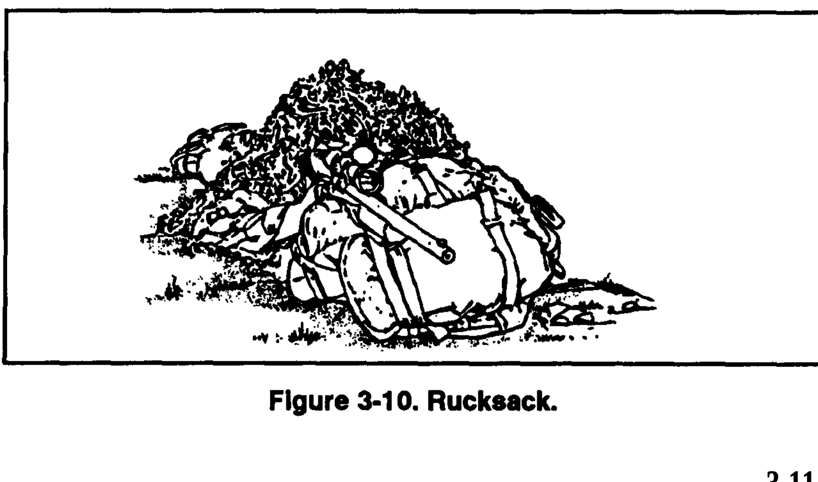

Figure 3-10. Rucksack.

(3) ***Sandbag.*** The sniper can fill an empty sandbag (Figure 3-11) on site.

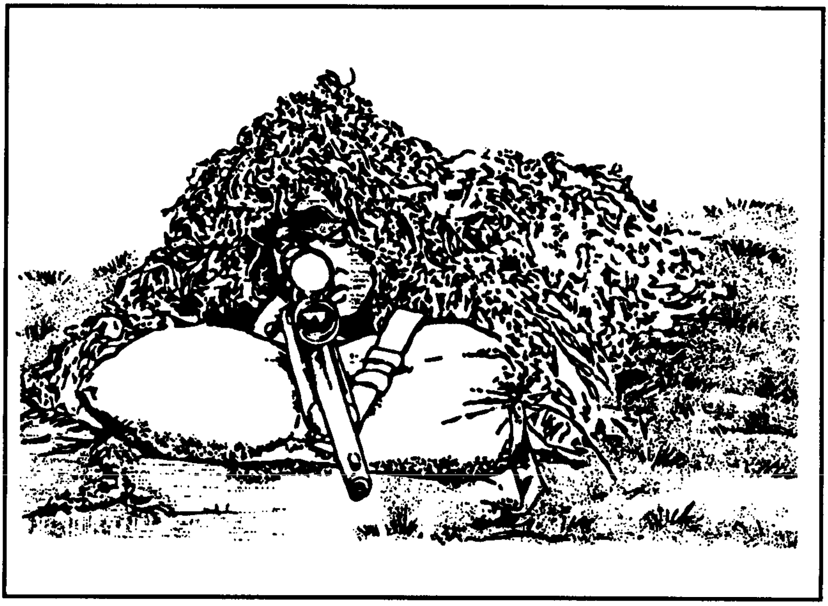

Figure 3-11. Sandbag.

(4) ***Tripod.*** The sniper can build a field-expedient tripod (Figure 3-12) by tying together three 12-inch long sticks (one thicker than the others) with 550 cord or the equivalent. When tying the sticks, he wraps the cord at the center point and leaves enough slack to fold the legs out into a triangular base. Then, he places the fore-end of the weapon between the three uprights.

(5) ***Bipod.*** The sniper can build a field-expedient bipod (Figure 3-12) by tying together two 12-inch sticks, thick enough to support the weight of the weapon. Using 550 cord or the equivalent, he ties the sticks at the center point, leaving enough slack to fold them out in a scissor-like manner. He then places the weapon between the two uprights. The bipod is not as stable as other field-expedient items, and it should be used only in the absence of other techniques.

(6) ***Forked stake.*** The tactical situation determines the use of the forked stake. Unless the sniper can drive a forked stake into the ground, this is the least desirable of the techniques; that is, he must use his nonfiring hand to hold the stake in an upright position (Figure 3-12). Delivering long-range precision fire is a near-impossibility due to the unsteadiness of the position.

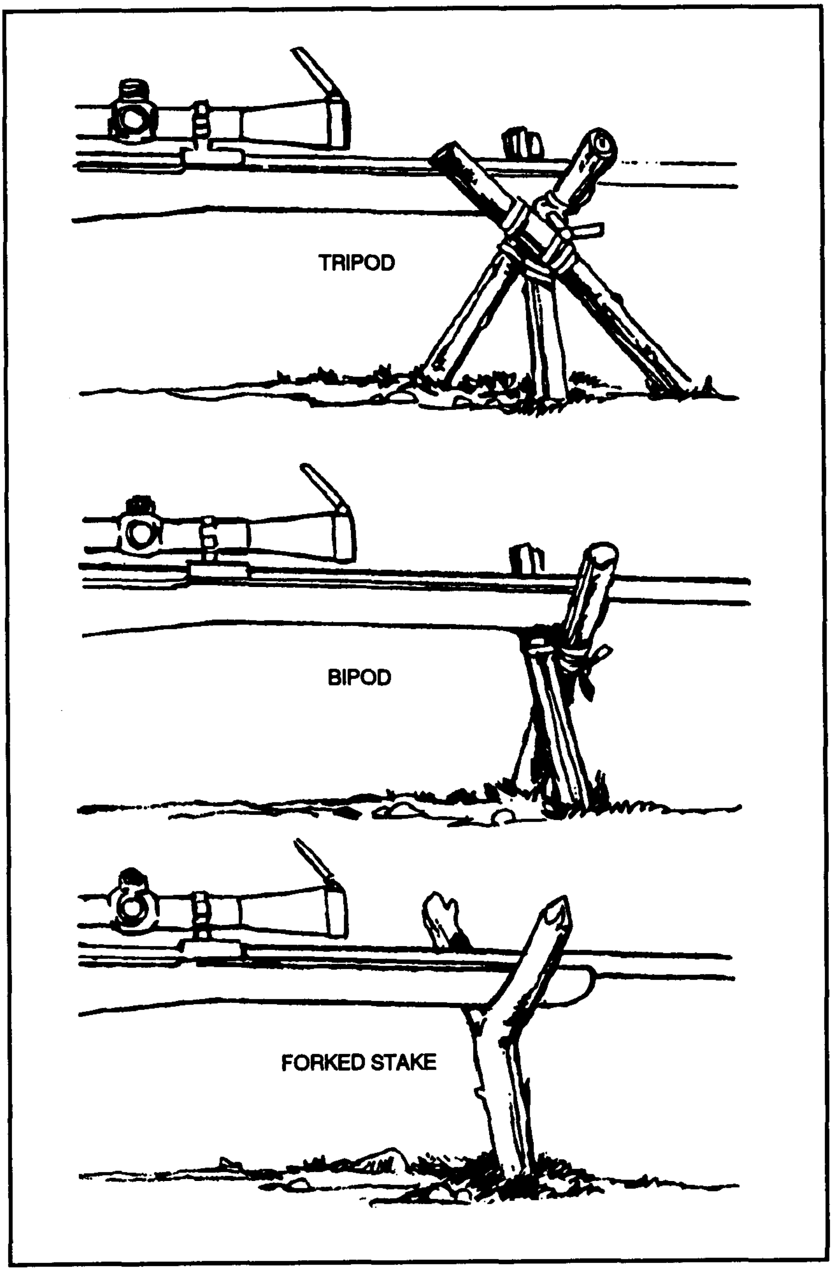

Figure 3-12. Field-expedient tripod, bipod, and forked stake.

e. **Sniper and Observer Positioning.** The sniper should find a place on the ground that allows him to build a steady, comfortable position with the best cover, concealment, and visibility of the target area. Once established, the observer should position himself out of the sniper's field of view on his firing side.

(1) The closer the observer gets his spotting telescope to the sniper's line of bore, the easier it is to follow the trace (path) of the bullet and observe the point of impact. A position at 4 to 5 o'clock (7 to 8 o'clock for left-handed firers) from the firing shoulder and close to (but not touching) the sniper is best (Figure 3-13).

NOTE: Trace is the visible trail of a bullet and is created by the shock wave of a supersonic bullet. The shockwave compresses the air along the leading edge of a bullet causing water vapor in the air to momentary condense and become visible. To the observer, located to the rear of the sniper, trace appears as a rapidly moving V-shaped vortex in the air following the trajectory of the bullet. Through close observation and practice, trace can be used to judge the bullet's trajectory relative to the aiming point, making corrections easier for a follow-up shot. Trace can best be seen if the observer's optics are directly in line with the axis of the sniper's rifle barrel. Watching the trace and the effects of the bullet's impact are the primary means by which the observer assists the sniper in calling the shot.

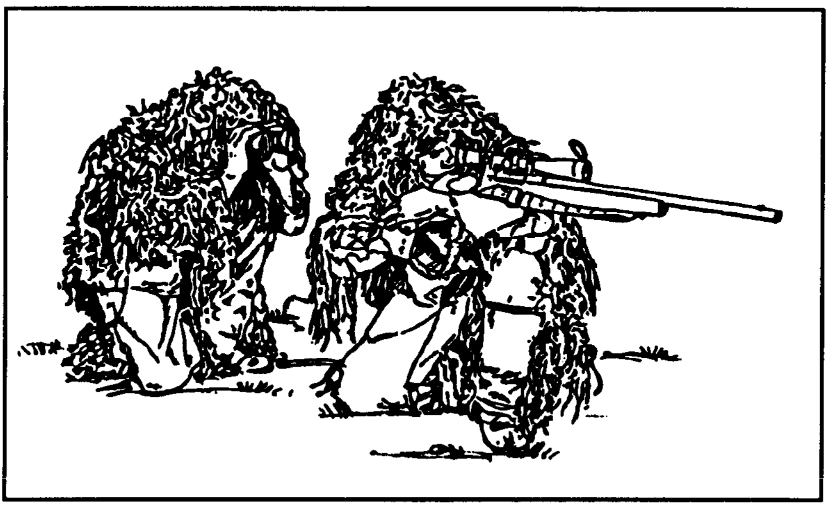

Figure 3-13. Sniper team positioning.

(2) If the sniper is without weapon support in his position, he uses the observer's body as a support (Figure 3-14). This support is not recommended since the sniper must contend with his own movement and the observer's body movement. The sniper should practice and prepare to use an observer supported position. A variety of positions can be used; however, the two most stable are when the observer is in a prone or sitting position.

(a) *Prone.* To assume the prone position, the observer lies at a 45-to 75-degree angle to the target and observes the area through his spotting telescope. The sniper assumes a a prone supported position, using the back of the observer's thigh for support. Due to the offset angle, the observer may only see the bullet impact.

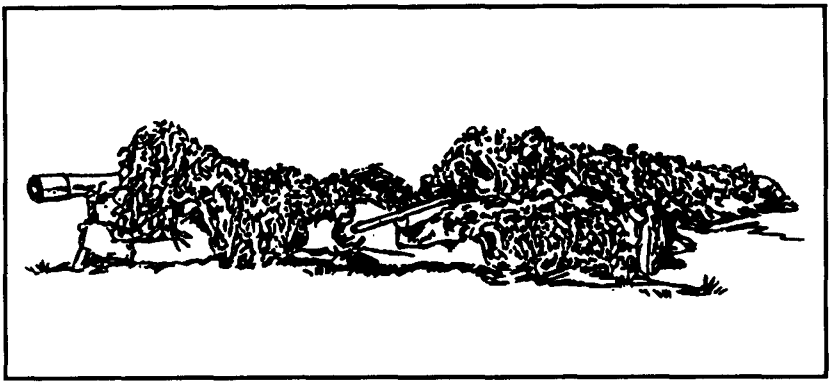

Figure 3-14. Prone observer supported position.

(b) *Sitting.* If vegetation prevents the sniper from assuming a prone position, the sniper has the observer face the target area and assume a cross-legged sitting position. The observer places his elbows on his knees to stabilize his position. For observation, the observer uses binoculars held in his hands. The spotting telescope is not recommended due to its higher magnification and the unsteadiness of this position. The sniper is behind the observer in an open-legged, cross-legged, or kneeling position, depending on the target's elevation (Figure 3-15, page 3-16). The sniper places the fore-end of the weapon across the observer's left shoulder, stabilizing the weapon with the forefinger of the nonfiring hand. When using these positions, the sniper's effective engagement of targets at extended ranges is difficult and used only as a last resort. When practicing these positions, the sniper and observer must enter respiratory pause together to eliminate movement from breathing.

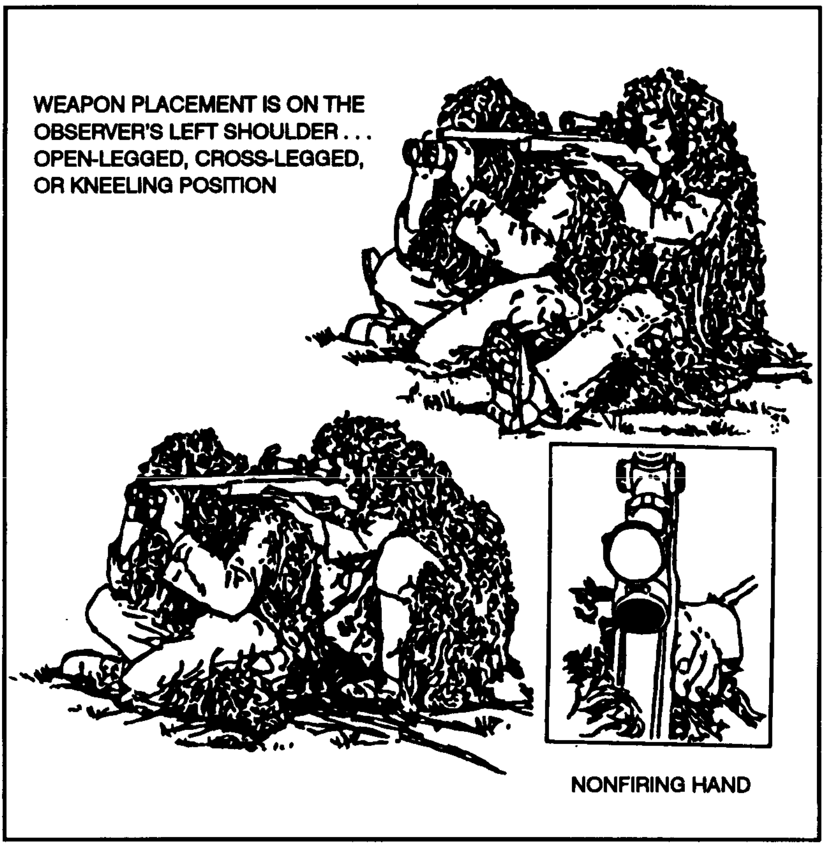

Figure 3-15. Sitting position.

3-2. AIMING

The sniper begins the aiming process by aligning the rifle with the target when assuming a firing position. He should point the rifle naturally at the desired point of aim. If his muscles are used to adjust the weapon onto the point of aim, they automatically relax as the rifle fires, and the rifle begins to move toward its natural point of aim. Because this movement begins just before the weapon discharge, the rifle is moving as the bullet leaves the muzzle. This causes inaccurate shots with no apparent cause (recoil disguises the movement). By adjusting the weapon and body as a single unit, rechecking, and readjusting as needed, the sniper achieves a true natural point of aim. Once the position is established, the sniper then aims the weapon at the exact point on the target. Aiming involves: eye relief, sight alignment, and sight picture.

a. **Eye Relief.** This is the distance from the sniper's firing eye to the rear sight or the rear of the scope tube. When using iron sights, the sniper ensures the distance remains consistent from shot to shot to preclude changing what he views through the rear sight. However, relief will vary from firing position to firing position and from sniper to sniper, according to the sniper's neck length, his angle of head approach to the stock, the depth of his shoulder pocket, and his firing position. This distance (Figure 3-16) is more rigidly controlled with telescopic sights than with iron sights. The sniper must take care to prevent eye injury caused by the scope tube striking his brow during recoil. Regardless of the sighting system he uses, he must place his head as upright as possible with his firing eye located directly behind the rear portion of the sighting system. This head placement also allows the muscles surrounding his eye to relax. Incorrect head placement causes the sniper to look out of the top or corner of his eye, resulting in muscular strain. Such strain leads to blurred vision and can also cause eye strain. The sniper can avoid eye strain by not staring through the telescopic or iron sights for extended periods. The best aid to consistent eye relief is maintaining the same stock weld from shot to shot.

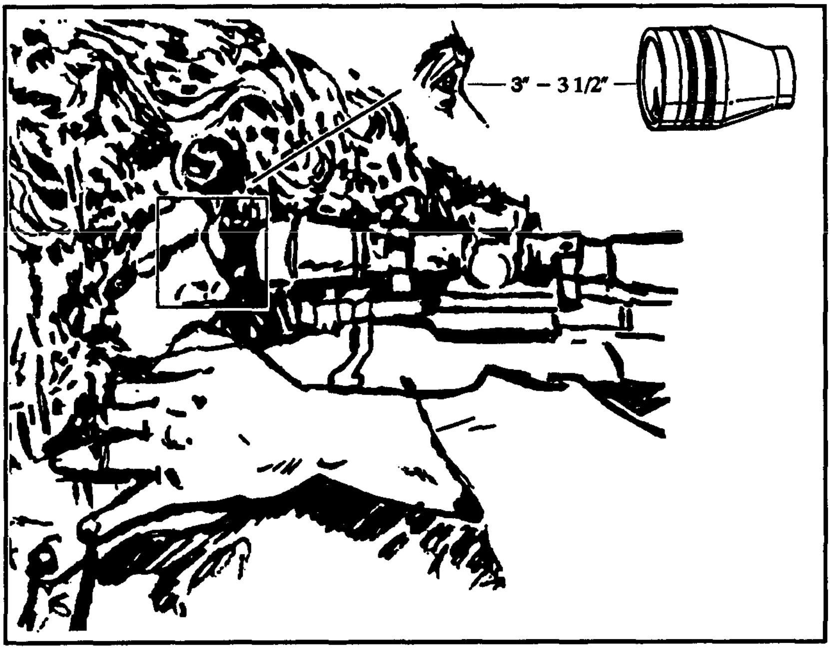

Figure 3-16. Eye relief.

b. **Sight Alignment.** With telescopic sights, sight alignment is the relationship between the cross hairs (reticle) and a full field of view as seen by the sniper. The sniper must place his head so that a full field of view fills the tube, with no dark shadows or crescents to cause inaccurate shots. He centers the reticle in a full field of view, ensuring the vertical cross hair is straight up and down so the rifle is not canted. Again, the center is easiest for the sniper to locate and allows for consistent reticle placement. With iron sights, sight alignment is the relationship between the front and rear sights as seen by the sniper (Figure 3-17). The sniper centers the top edge of the front sight blade horizontally and vertically within the rear aperture. (The center of aperture is easiest for the eye to locate and allows the sniper to be consistent in blade location.)

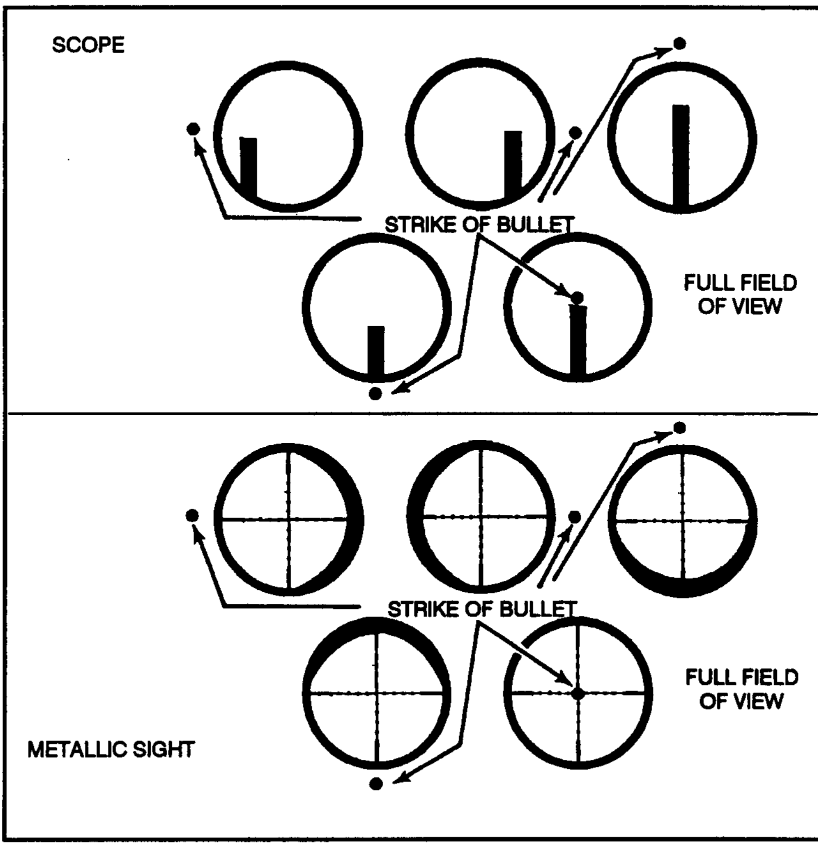

Figure 3-17. Sight alignment.

e. **Sight Picture.** With telescopic sights, the sight picture is the relationship between the reticle and full field of view and the target as seen by the sniper. The sniper centers the reticle in a full field of view. He then places the reticle center of the largest visible mass of the target (as in iron sights). The center of mass of the target is easiest for the sniper to locate, and it surrounds the intended point of impact with a maximum amount of target area. With iron sights, sight picture is the relationship between the rear aperture, the front sight blade, and the target as seen by the sniper (Figure 3-18). The sniper centers the top edge of the blade in the rear aperture. He then places the top edge of the blade in the center of the largest visible mass of the target (disregard the head and use the center of the torso).

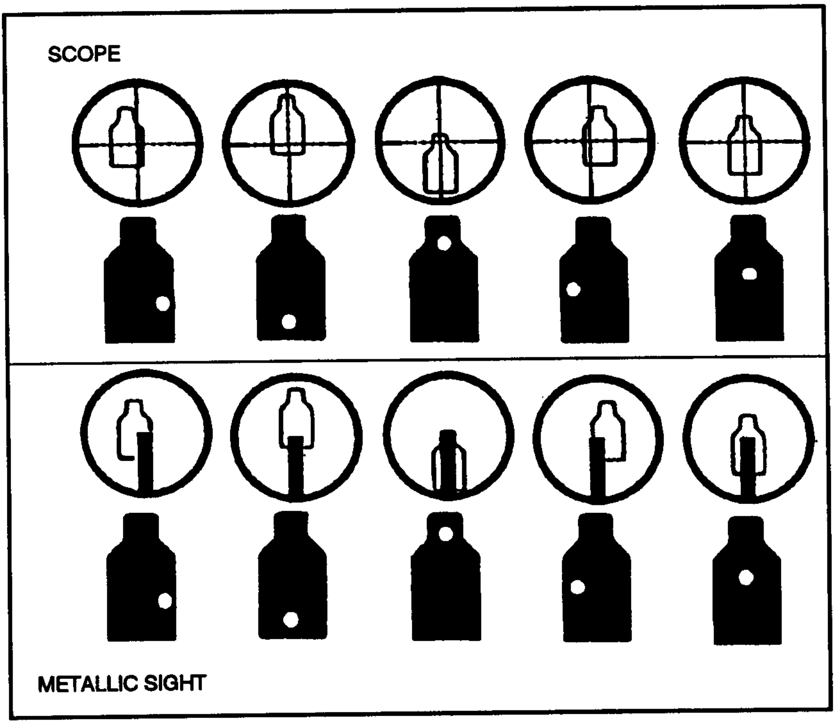

Figure 3-18. Sight picture.

d. **Sight Alignment Error.** When sight alignment and picture are perfect (regardless of sighting system) and all else is done correctly, the shot will hit center of mass on the target. However, with an error insight alignment, the bullet is displaced in the direction of the error. Such an error creates an angular displacement between the line of sight and the line of bore. This displacement increases as range increases; the amount of bullet displacement depends on the size of alignment error. Close targets show little or no visible error. Distant targets can show great displacement or can be missed altogether due to severe sight misalignment. An inexperienced sniper is prone to this kind of error, since he is unsure of what correctly aligned sights look like (especially telescopic sights); a sniper varies his head position (and eye relief) from shot to shot, and he is apt to make mistakes while firing.

e. **Sight Picture Error.** An error in sight picture is an error in the placement of the aiming point. This causes no displacement between the line of sight and the line of bore. The weapon is simply pointed at the wrong spot on the target. Because no displacement exists as range increases, close and far targets are hit or missed depending on where the front sight or the reticle is when the rifle fires. All snipers face this kind of error every time they shoot. This is because, regardless of firing position stability, the weapon will always be moving. A supported rifle moves much leas than an unsupported one, but both still move in what is known as a *wobble area.* The sniper must adjust his firing position so that his wobble area is as small as possible and centered on the target. With proper adjustments, the sniper should be able to fire the shot while the front sight blade or reticle is on the target at, or very near, the desired aiming point. How far the blade or reticle is from this point when the weapon fires is the amount of sight picture error all snipers face.

f. **Dominant Eye.** To determine which eye is dominant, the sniper extends one arm to the front and points the index finger skyward to select an aiming point. With both eyes open, he aligns the index finger with the aiming point, then closes one eye at a time while looking at the aiming point. One eye will make the finger appear to move off the aiming point; the other eye will stay on the aiming point. The dominant eye is the eye that does not move the finger from the aiming point. Some individuals may have difficulty aiming because of interference from their dominant eye, if this is not the eye used in the aiming process. This may require the sniper to fire from the other side of the weapon (right-handed firer will fire left-handed). Such individuals must close the dominant eye while shooting.

3-3. BREATH CONTROL

Breath control is important with respect to the aiming process. If the sniper breathes while trying to aim, the rise and fall of his chest causes the rifle to move. He must, therefore, accomplish sight alignment during breathing. To do this, he first inhales then exhales normally and stops at the moment of natural respiratory pause.

a. A respiratory cycle lasts 4 to 5 seconds. Inhalation and exhalation require only about 2 seconds. Thus, between each respiratory cycle there is a pause of 2 to 3 seconds. This pause can be extended to 10 seconds without any special effort or unpleasant sensations. The sniper should shoot during this pause when his breathing muscles relax. This avoids strain on his diaphragm.

b. A sniper should assume his firing position and breathe naturally until his hold begins to settle. Many snipers then take a slightly deeper breath, exhale, and pause, expecting to fire the shot during the pause. If the hold does not settle enough to allow the shot to be fired, the sniper resumes normal breathing and repeats the process.

c. The respiratory pause should never feel unnatural. If it is too long, the body suffers from oxygen deficiency and sends out signals to resume breathing. These signals produce involuntary movements in the diaphragm and interfere with the sniper's ability to concentrate. About 8 to 10 seconds is the maximum safe period for the respiratory pause. During multiple, rapid engagements, the breathing cycle should be forced through a rapid, shallow cycle between shots instead of trying to hold the breath or breathing. Firing should be accomplished at the forced respiratory pause.

3-4. TRIGGER CONTROL

Trigger control is the most important of the sniper marksmanship fundamentals. It is defined as causing the rifle to fire when the sight picture is at its best, without causing the rifle to move. Trigger squeeze is uniformly increasing pressure straight to the rear until the rifle fires.

a. Proper trigger control occurs when the sniper places his firing finger as low on the trigger as possible and still clears the trigger guard, thereby achieving maximum mechanical advantage and movement of the finger to the entire rifle.

b. The sniper maintains trigger control beat by assuming a stable position, adjusting on the target, and beginning a breathing cycle. As the sniper exhales the final breath toward a natural respiratory pause, he secures his finger on the trigger. As the front blade or reticle settles at the desired point of aim, and the natural respiratory pause is entered, the sniper applies initial pressure. He increases the tension on the trigger during the respiratory pause as long as the front blade or reticle remains in the area of the target that ensures a well-placed shot. If the front blade or reticle moves away from the desired point of aim on the target, and the pause is free of strain or tension, the sniper stops increasing the tension on the trigger, waits for the front blade or reticle to return to the desired point, and then continues to squeeze the trigger. If movement is too large for recovery or if the pause has become uncomfortable (extended too long), the sniper should carefully release the pressure on the trigger and begin the respiratory cycle again.

c. As the stability of a firing position decreases, the wobble area increases. The larger the wobble area, the harder it is to fire the shot without reacting to it. This reaction occurs when the sniper—

(1) ***Anticipates recoil.*** The firing shoulder begins to move forward just before the round fires.

(2) ***Jerks the trigger.*** The trigger finger moves the trigger in a quick, choppy, spasmodic attempt to fire the shot before the front blade or reticle can move away from the desired point of aim.

(3) ***Flinches.*** The sniper's entire upper body (or parts thereof) overreacts to anticipated noise or recoil. This is usually due to unfamiliarity with the weapon.

(4) ***Avoids recoil.*** The sniper tries to avoid recoil or noise by moving away from the weapon or by closing the firing eye just before the round fires. This, again, is caused by a lack of knowledge of the weapon's actions upon firing.

3-5. FOLLOW-THROUGH

Applying the fundamentals increases the odds of a well-aimed shot being fired. When mastered, additional skills can make that first-round kill even more of a certainty. One of these skills is the follow-through.

a. Follow-through is the act of continuing to apply all the sniper marksmanship fundamentals as the weapon fires as well as immediately after it fires. It consists of—

(1) Keeping the head infirm contact with the stock (stock weld).
(2) Keeping the finger on the trigger all the way to the rear.
(3) Continuing to look through the rear aperture or scope tube.
(4) Keeping muscles relaxed.
(5) Avoiding reaction to recoil and or noise.
(6) Releasing the trigger only after the recoil has stopped.

b. A good follow-through ensures the weapon is allowed to fire and recoil naturally. The sniper/rifle combination reacts as a single unit to such actions.

3-6. CALLING THE SHOT

Calling the shot is being able to tell where the round should impact on the target. Because live targets invariably move when hit, the sniper will find it almost impossible to use his scope to locate the target after the round is fired. Using iron sights, the sniper will find that searching for a downrange hit is beyond his abilities. He must be able to accurately call his shots. Proper follow-through will aid in calling the shot. The dominant factor in shot calling is knowing where the reticle or blade is located when the weapon discharges. This location is called the *final focus point*.

a. With iron sights, the final focus point should be on the top edge of the front sight blade. The blade is the only part of the sight picture that is moving (in the wobble area). Focusing on it aids in calling the shot and detecting any errors insight alignment or sight picture. Of course, lining up the sights and the target initially requires the sniper to shift his focus from the target to the blade and back until he is satisfied that he is properly aligned with the target. This shifting exposes two more facts about eye focus. The eye can instantly shift focus from near objects (the blade) to far objects (the target).

b. The final focus is easily placed with telescopic sights because of the sight's optical qualities. Properly focused, a scope should present both the field of view and the reticle in sharp detail. Final focus should then be on the target. While focusing on the target, the sniper moves his head slightly from side to side. The reticle may seem to move across the target face, even though the rifle and scope are motionless. This movement is *parallax*. Parallax is present when the target image is not correctly focused on the reticle's focal plane. Therefore, the target image and the reticle appear to be in two separate positions inside the scope, causing the effect of reticle movement across the target. The M3A scope on the M24 has a focus adjustment that eliminates parallax in the scope. The sniper should adjust the focus knob until the target's image is on the same focal plane as the reticle. To determine if the target's image appears at the ideal location, the sniper should move his head slightly left and right to see if the reticle appears to move. If it does not move, the focus is properly adjusted and no parallax will be present.

3-7. INTEGRATED ACT OF FIRING

Once the sniper has been taught the fundamentals of marksmanship, his primary concern is his ability to apply it in the performance of his mission. An effective method of applying fundamentals is through the use of the integrated act of firing one round. The integrated act is a logical, step-by-step development of fundamentals whereby the sniper can develop habits that enable him to fire each shot the same way. The integrated act of firing can be divided into four distinct phases:

a. Preparation Phase. Before departing the preparation area, the sniper ensures that—

(1) The team is mentally conditioned and knows what mission they are to accomplish.

(2) A systematic check is made of equipment for completeness and serviceability including, but not limited to—

(a) Properly cleaned and lubricated rifles.

(b) Properly mounted and torqued scopes.

(c) Zero-sighted systems and recorded data in the sniper data book.

(d) Study of the weather conditions to determine their possible effects on the team's performance of the mission.

b. **Before-Firing Phase.** On arrival at the mission site, the team exercises care in selecting positions. The sniper ensures the selected positions support the mission. During this phase, the sniper—

(1) Maintains strict adherence to the fundamentals of position. He ensures that the firing position is as relaxed as possible, making the most of available external support. He also makes sure the support is stable, conforms to the position, and allows a correct, natural point of aim for each designated area or target.

(2) Once in position, removes the scope covers and checks the field(s) of fire, making any needed corrections to ensure clear, unobstructed firing lanes.

(3) Makes dry firing and natural point of aim checks.

(4) Double-checks ammunition for serviceability and completes final magazine loading.

(5) Notifies the observer he is ready to engage targets. The observer must be constantly aware of weather conditions that may affect the accuracy of the shots. He must also stay ahead of the tactical situation.

c. **Firing Phase.** Upon detection, or if directed to a suitable target, the sniper makes appropriate sight changes, aims, and tells the observer he is ready to fire. The observer then gives the needed windage and observes the target. To fire the rifle, the sniper should remember the key word, "BRASS." Each letter is explained as follows:

(1) ***Breathe.*** The sniper inhales and exhales to the natural respiratory pause. He checks for consistent head placement and stock weld. He ensures eye relief is correct (full field of view through the scope; no shadows present). At the same time, he begins aligning the cross hairs or front blade with the target at the desired point of aim.

(2) ***Relax.*** As the sniper exhales, he relaxes as many muscles as possible, while maintaining control of the weapon and position.

(3) ***Aim.*** If the sniper has a good, natural point of aim, the rifle points at the desired target during the respiratory pause. If the aim is off, the sniper should make a slight adjustment to acquire the desired point of aim. He avoids "muscling" the weapon toward the aiming point.

(4) **Squeeze.** As long as the sight picture is satisfactory, the sniper squeezes the trigger. The pressure applied to the trigger must be straight to the rear without disturbing the lay of the rifle or the desired point of aim.

d. After-Firing Phase. The sniper must analyze his performance If the shot impacted at the desired spot (a target hit), it may be assumed the integrated act of firing one round was correctly followed. If however, the shot was off call, the sniper and observer must check for Possible errors.

(1) Failure to follow the keyword, BRASS (partial field of view, breath held incorrectly, trigger jerked, rifle muscled into position, and so on).

(2) Target improperly ranged with scope (causing high or low shots).

(3) Incorrectly compensated for wind (causing right or left shots).

(4) Possible weapon/ammunition malfunction (used only as a last resort when no other errors are detected).

Once the probable reasons for an off-call shot is determined the sniper must make note of the errors. He pays close attention to the problem areas to increase the accuracy of future shots.

Section II
BALLISTICS

As applied to sniper marksmanship, types of ballistics may be defined as the study of the firing, flight, and effect of ammunition. Proper execution of marksmanship fundamentals and a thorough knowledge of ballistics ensure the successful completion of the mission. Tables and formulas in this section should be used only as guidelines since every rifle performs differently. Maximum ballistics data eventually result in a well-kept sniper data book and knowledge gained through experience.

3-8. TYPES OF BALLISTICS

Ballistics are divided into three distinct types: internal external, and terminal.

a. Internal-the interior workings of a weapon and the functioning of its ammunition.

b. External-the flight of the bullet from the muzzle to the target.

c. Termninal-what happens to the bullet after it hits the target. (See paragraph 3-16.)

3-9. TERMINOLOGY

To fully understand ballistics, the sniper should be familiar with the following terms:

a. Muzzle Velocity-the speed of the bullet as it leaves the rifle barrel, measured in feet per second. It varies according to various factors, such as ammunition type and lot number, temperature, and humidity.

b. Line of Sight- straight line from the eye through the aiming device to the point of aim.

c. Line of Departure-the line defined by the bore of the rifle or the path the bullet would take without gravity.

d. Trajectory-the path of the bullet as it travels to the target.

e. Midrange Trajectory/Maximum Ordinate-the highest point the bullet reaches on its way to the target. This point must be known to engage a target that requires firing underneath an overhead obstacle, such as a bridge or a tree. In attention to midrange trajectory may cause the sniper to hit the obstacle instead of the target.

f. Bullet Drop—how far the bullet drops from the line of departure to the point of impact.

g. Time of Flight-the amount of time it takes for the bullet to reach the target from the time the round exits the rifle.

h. Retained Velocity-the speed of the bullet when it reaches the target. Due to drag, the velocity will be reduced.

3-10. EFFECTS ON TRAJECTORY

To be effective, the sniper must know marksmanship fundamentals and what effect gravity and drag will have on those fundamentals.

a. **Gravity.** As soon as the bullet exits the muzzle of the weapon, gravity begins to pull it down, requiring the sniper to use his elevation adjustment. At extended ranges, the sniper actually aims the muzzle of his rifle above his line of sight and lets gravity pull the bullet down into the target. Gravity is always present, and the sniper must compensate for this through elevation adjustments or hold-off techniques.

b. **Drag.** Drag is the slowing effect the atmosphere has on the bullet. This effect decreases the speed of the bullet according to the air—that is, the less dense the air, the leas drag and vice versa. Factors affecting drag/density are temperature, altitude/barometric pressure, humidity, efficiency of the bullet, and wind.

(1) ***Temperature.*** The higher the temperature, the less dense the air. (See Section III.) If the sniper zeros at 60 degrees F and he fires at 80 degrees, the air is leas dense, thereby causing an increase in muzzle velocity and higher point of impact. A 20-degree change equals a one-minute elevation change in the strike of the bullet.

(2) ***Altitude/barometric pressure.*** Since the air pressure is less at higher altitudes, the air is less dense. Thus, the bullet is more efficient and impacts higher due to less drag. (Table 3-1 shows the approximate

effect of change of the point of impact from sea level to 10,000 feet if the rifle is zeroed at sea level.) Impact will be the point of aim at sea level. For example, a rifle zeroed at sea level and fired at a range of 700 meters at an altitude of 5,000 feet will hit 1.6 minutes high.

RANGE (METERS)	2,500 FEET *(ASL)	5,000 FEET (ASL)	10,000 FEET (ASL)
100	.05	.08	.13
200	.1	.2	.34
300	.2	.4	.6
400	.4	.5	.9
500	.5	.9	1.4
600	.6	1.0	1.8
700	1.0	1.6	2.4
800	1.3	1.9	3.3
900	1.6	2.8	4.8
1,000	1.8	3.7	6.0
*ABOVE SEA LEVEL			

Table 3-1. Point of impact rises as altitude increases (data are in MOA).

(3) ***Humidity.*** Humidity varies along with the altitude and temperature. Figure 3-19 considers the changes in altitudes. Problems can occur if extreme humidity changes exist in the area of operations. That is, when humidity goes up, impact goes down; when humidity goes down, impact goes up. Since impact is affected by humidity, a 20 percent change in humidity equals about one minute as a rule of thumb. Keeping a good sniper data book during training and acquiring experience are the best teachers.

(4) ***Efficiency of the bullet.*** This is called a *bullet's ballistic coefficient.* The imaginary perfect bullet is rated as being 1.00. Match bullets range

from .500 to about .600. The 7.62-mm special ball (M118) is rated at .530 (Table 3-2).

(5) ***Wind.*** Wind is discussed in Section III.

RANGE (METERS)	(A)	(B)	(C)	(D)
100	2,407	.7	NA	.1
200	2,233	3.0	1.5	.2
300	2,066	7.3	3.0	.4
400	1,904	14.0	3.5	.5
500	1,750	24.0	4.0	.7
600	1,603	37.6	4.5	.9
700	1,466	56.2	5.0	1.0
800	1,339	80.6	5.0	1.3
900	1,222	112.5	6.0	1.5
1,000	1,118	153.5	7.0	1.8

(A) RETAINED VELOCITY (FEET PER SECOND).
(B) MIDRANGE TRAJECTORY (INCHES).
(C) BULLET DROP IN 100-METER INCREMENTS (MINUTES).
(D) TIME OF FLIGHT (SECONDS).

Table 3-2. Muzzle velocity data for 7.62-mm special ball (M118).

3-11. ANGLE FIRING

Most practice firing conducted by the sniper team involves the use of military range facilities, which are relatively flat. However, as a sniper being deployed to other regions of the world, the chance exists for operating in a mountainous or urban environment. This requires target engagements at higher and lower elevations. Unless the sniper takes corrective action, bullet impact will be above the point of aim. How high the bullet hits is determined by the range and angle to the target (Table 3-3). The amount of elevation change applied to the telescope of the rifle for angle firing is known as *slope dope.*

RANGE (METERS)	SLANT DEGREES 5	10	15	20	25	30	35	40	45	50	55	60
100	.01	.04	.09	.16	.25	.36	.49	.63	.79	.97	1.2	1.4
200	.03	.09	.2	.34	.53	.76	1.	1.3	1.7	2.	2.4	2.9
300	.03	.1	.3	.5	.9	1.2	1.6	2.1	2.7	3.2	3.9	4.5
400	.05	.19	.43	.76	1.2	1.7	2.3	2.9	3.7	4.5	5.4	6.3
500	.06	.26	.57	1.	1.6	2.3	3.	3.9	4.9	6.	7.2	8.4
600	.08	.31	.73	1.3	2.	2.9	3.9	5.	6.3	7.7	9.2	10.7
700	.1	.4	.9	1.6	2.5	3.6	4.9	6.3	7.9	9.6	11.5	13.4
800	.13	.5	1.	2.	3.	4.4	5.9	7.7	9.6	11.7	14.	16.4
900	.15	.6	1.3	2.4	3.7	5.3	7.2	9.3	11.6	14.1	16.9	19.8
1,000	.2	.7	1.6	2.8	4.5	6.4	8.6	11.	13.9	16.9	20.2	23.7

*RANGE GIVEN IS SLANT RANGE (METERS), NOT MAP DISTANCE.

Table 3-3. Bullet rise at given angle and range in minutes.

Section III
EFFECTS OF WEATHER

For the highly trained sniper, the effects of weather are the main causes of error in the strike of the bullet. Wind, mirage, light, temperature, and humidity affect the bullet, the sniper, or both. Some effects are minor; however, sniping is often done in extremes of weather and all effects must be considered.

3-12. WIND CLASSIFICATION

Wind poses the biggest problem for the sniper. The effect that wind has on the bullet increases with range. This is due mainly to the slowing of the bullet's velocity combined with a longer flight time. This allows the wind to have a greater effect on the round as distances increase. The result is a loss of stability.

a. Wind also has a considerable effect on the sniper. The stronger the wind, the more difficult it is for him to hold the rifle steady. This can be partly offset by training, conditioning and the use of supported positions.

b. Since the sniper must know how much effect the wind will have on the bullet, he must be able to classify the wind. The best method is to use the clock system (Figure 3-19). With the sniper at the center of the clock and the target at 12 o'clock, the wind is assigned three values: full, half, and no value. Full value means that the force of the wind will have a full effect on the flight of the bullet. These winds come from 3 and 9 o'clock. Half value means that a wind at the same speed, but from 1,2,4,5,7,8, 10, and 11 o'clock, will move the bullet only half as much as a full-value wind. No value means that a wind from 6 or 12 o'clock will have little or no effect on the flight of the bullet.

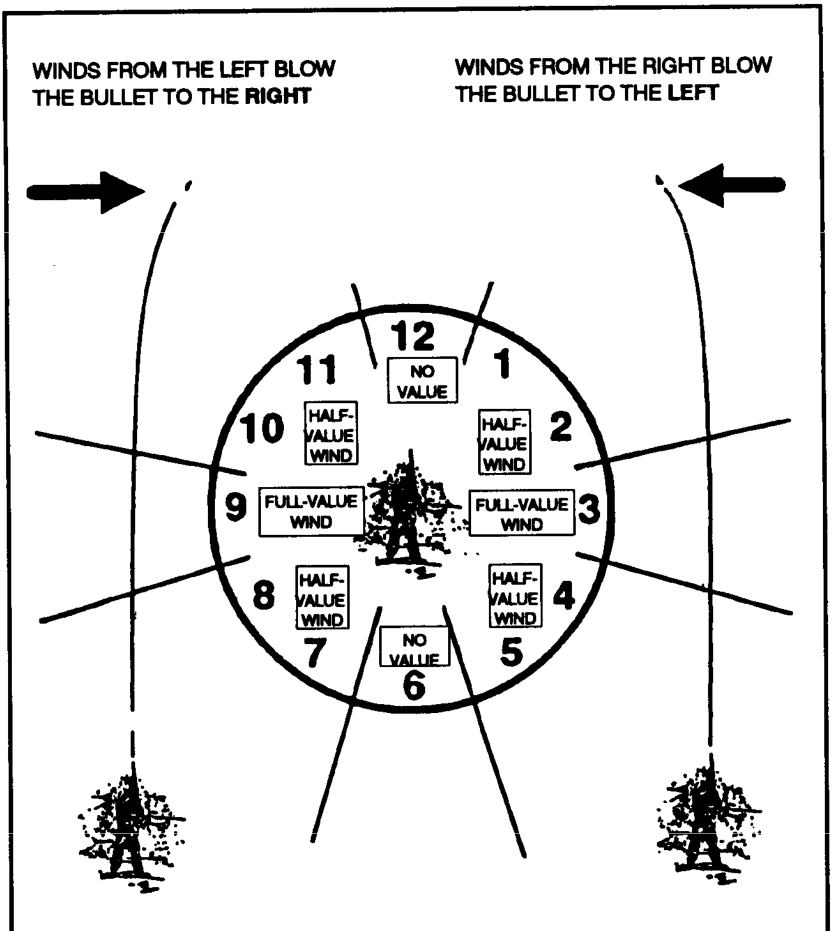

Figure 3-19. Clock system.

3-13. WIND VELOCITY

Before adjusting the sight to compensate for wind, the sniper must determine wind direction and velocity. He may use certain indicators to accomplish this. These are range flags, smoke, trees, grass, rain, and the sense of feel. However, the preferred method of determining wind direction and velocity is reading mirage (see paragraph d below). In most cases, wind direction can be determined simply by observing the indicators.

a. A common method of estimating the velocity of the wind during training is to watch the range flag (Figure 3-20). The sniper determines the angle between the flag and pole, in degrees, then divides by the constant number 4. The result gives the approximate velocity in miles per hour.

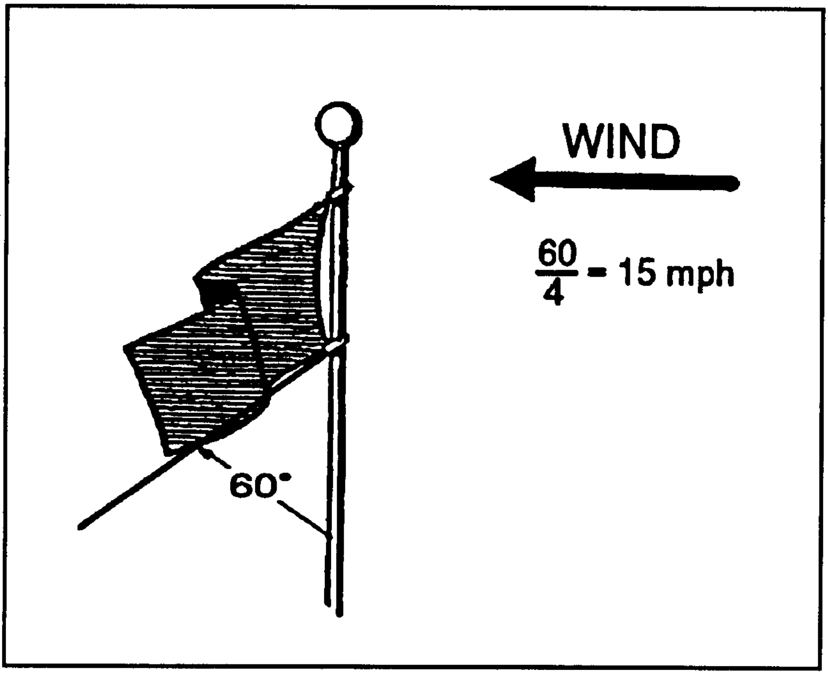

Figure 3-20. The Flag method.

b. If no flag is visible, the sniper holds a piece of paper, grass, cotton, or some other light material at shoulder level, then drops it. He then points directly at the spot where it lands and divides the angle between his body and arm by the constant number 4. This gives him the approximate wind velocity in miles per hour.

c. If these methods cannot be used, the following information is helpful in determining velocity. Winds under 3 miles per hour can barely be felt, although smoke will drift. A3- to 5-mile-per-hourwind can barely be felt on the face. With a 5- to 8-mile-per-hour wind, the leaves in the trees are in constant motion, and with a 12- to 15-mile-per-hour wind, small trees begin to sway.

d. A mirage is a reflection of the heat through layers of air at different temperatures and density as seen on a warm day (Figure 3-21). With the telescope, the sniper can see a mirage as long as there is a difference in ground and air temperatures. Proper reading of the mirage enables the sniper to estimate wind speed and direction with a high degree of accuracy. The sniper uses the M49 observation telescope to read the mirage. Since the wind nearest to midrange has the greatest effect on the bullet, he tries to determine velocity at that point. He can do this in one of two ways:

(1) He focuses on an object at midrange, then places the scope back onto the target without readjusting the focus.

(2) He can also focus on the target, then back off the focus one-quarter turn counterclockwise. This makes the target appear fuzzy, but the mirage will be clear.

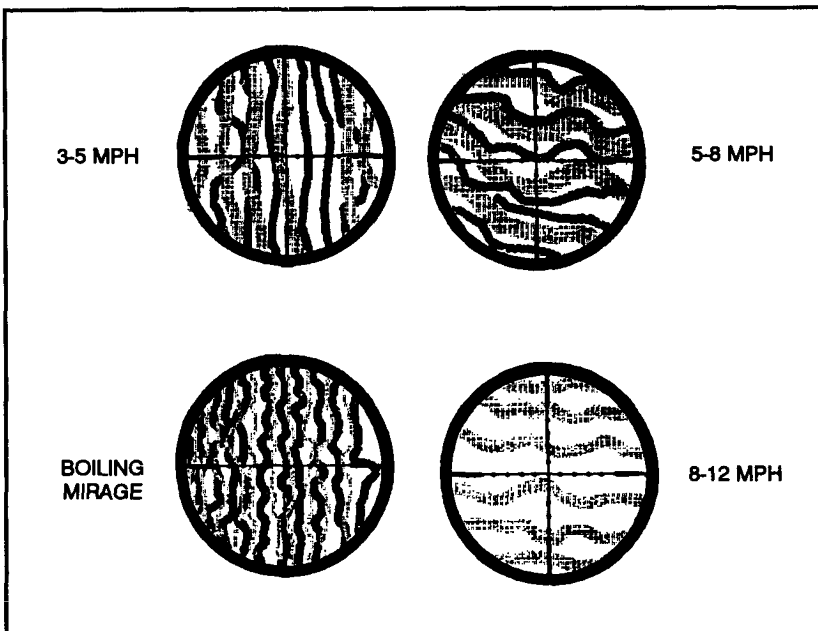

Figure 3-21. Types of mirages.

e. As observed through the telescope, the mirage appears to move with the same velocity as the wind, except when blowing straight into or away from the scope. Then, the mirage gives the appearance of moving straight upward with no lateral movement. This is called a *boiling mirage*. A boiling mirage may also be seen when the wind is constantly changing direction. For example, a full-value wind blowing from 9 o'clock to 3 o'clock suddenly changes direction. The mirage will appear to stop moving from left to right and present a boiling appearance. When this occurs, the inexperienced observer directs the sniper to fire with the "0" wind. As the sniper fires, the wind begins blowing from 3 o'clock to 9 o'clock, causing the bullet to miss the target therefore, firing in a "boil" can hamper shot placement. Unless there is a no-value wind, the sniper must wait until the boil disappears. In general, changes in the velocity of the wind, up to about 12 miles per hour, can be readily determined by observing the mirage. Beyond that speed, the movement of the mirage is too fast for detection of minor changes.

3-14. CONVERSION OF WIND VELOCITY TO MINUTES OF ANGLE

All telescopic sights have windage adjustments that are graduated in minutes of angle or fractions thereof. A minute of angle is l/60th of a degree (Figure 3-22, page 3-34). This equals about 1 inch (1.145 inches) for every 100 meters.

EXAMPLE

1 MOA = 2 inches at 200 meters
1 MOA = 5 inches at 500 meters

a. Snipers use minutes of angle (Figure 3-22, page 3-34) to determine and adjust the elevation and windage needed on the weapon's scope. After finding the wind direction and velocity in miles per hour, the sniper must then convert it into minutes of angle, using the wind formula as a rule of thumb only. The wind formula is—

$$\frac{\text{RANGE (hundreds) divided by 100 VELOCITY (mph)}}{\text{CONSTANT}} = \text{Minutes full-value wind}$$

The constant depends on the target's range.

100 to 500	"C" = 15
600	"C" = 14
700 to 800	"C" = 13
900	"C" = 12
1,000	"C" = 11

If the target is 700 meters away and the wind velocity is 10 mph, the formula is—

$$\frac{7 \times 10}{13} = 5.38 \text{ minutes or } 5\ 1/2 \text{ minutes}$$

This determines the number of minutes for a full-value wind. For a half-value wind, the 5.38 would be divided in half.

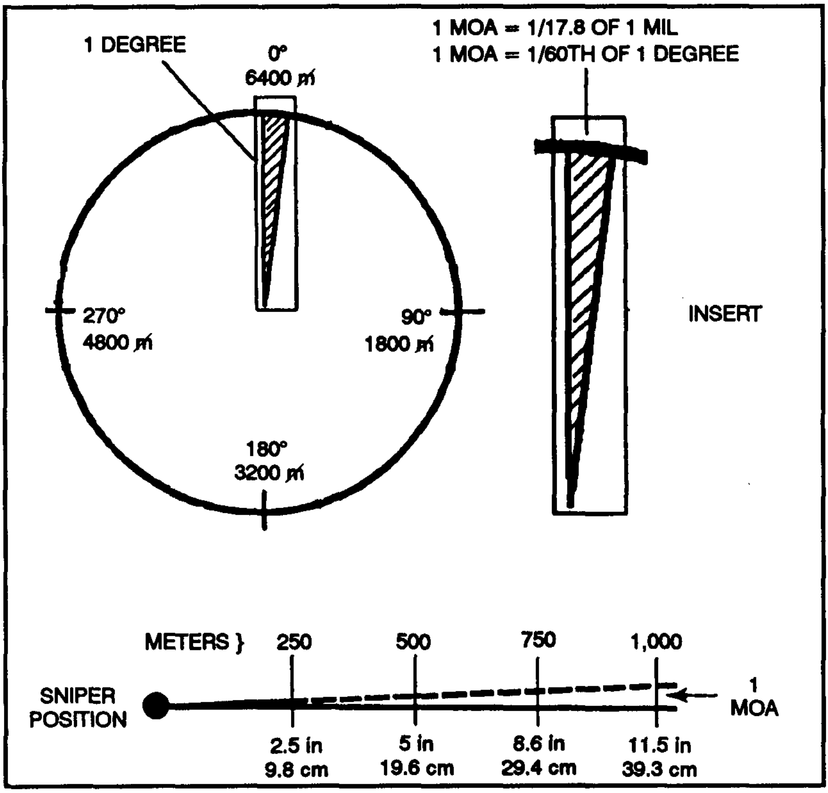

Figure 3-22. Minutes of angle.

b. The observer makes his own adjustment estimations, then compares them to the wind conversion table, which can be a valuable training tool. He must not rely on this table; if it is lost, his ability to perform the mission could be severely hampered. Until the observer gains skill in estimating wind speed and computing sight changes, he may refer to Table 3-4.

RANGE (METERS)	WIND VALUE	3 MPH MIN	3 MPH IN	5 MPH MIN	5 MPH IN	7 MPH MIN	7 MPH IN	10 MPH MIN	10 MPH IN
200	HALF	0.0	0.4	0.5	0.6	0.5	0.8	0.5	1.2
	FULL	0.5	0.8	0.5	1.2	1.0	1.7	1.0	2.4
300	HALF	0.5	0.9	0.5	1.3	0.5	1.9	1.0	2.7
	FULL	0.5	1.7	1.0	2.7	1.0	3.8	1.5	5.4
400	HALF	0.5	1.4	0.5	2.4	1.0	3.3	1.0	4.8
	FULL	0.5	2.9	1.0	4.8	1.5	6.7	2.0	9.6
500	HALF	0.5	2.3	0.5	3.8	1.0	5.3	1.5	7.5
	FULL	1.0	4.5	1.5	7.5	2.0	10.5	2.5	15.0
600	HALF	0.5	3.0	1.0	5.0	1.0	8.0	1.5	11.0
	FULL	1.0	7.0	1.5	11.0	2.5	15.0	3.5	21.0
700	HALF	0.5	4.0	'1.0	7.0	1.5	10.0	2.0	15.0
	FULL	1.0	9.0	2.0	15.0	2.5	21.0	4.0	29.0
800	HALF	0.5	6.0	1.0	10.0	1.5	13.0	2.0	19.0
	FULL	1.5	11.0	2.0	19.0	3.0	27.0	4.5	38.0
900	HALF	0.5	7.0	1.0	12.0	1.5	17.0	2.5	24.0
	FULL	3.5	15.0	2.5	24.0	3.5	34.0	5.0	49.0
1000	HALF	1.0	9.0	1.5	15.0	2.0	21.0	2.5	3.00
	FULL	1.5	18.0	2.5	30.0	4.0	42.0	5.5	60.0

RANGE (METERS)	WIND VALUE	12 MPH MIN	12 MPH IN	15 MPH MIN	15 MPH IN	18 MPH MIN	18 MPH IN	20 MPH MIN	20 MPH IN
200	HALF	0.5	1.3	1.0	1.8	1.0	2.2	1.0	2.4
	FULL	1.5	2.9	1.5	3.6	2.0	4.3	2.0	4.8
300	HALF	1.0	3.3	1.0	4.0	1.5	4.9	1.5	5.4
	FULL	2.0	6.5	2.5	8.1	3.0	9.8	3.5	10.9
400	HALF	1.5	5.8	1.5	7.2	2.0	8.6	2.0	9.6
	FULL	2.5	11.5	3.5	14.4	4.0	17.3	4.5	19.2
500	HALF	1.5	9.0	2.0	11.3	2.5	13.5	2.5	15.0
	FULL	3.5	18.0	4.0	22.6	5.0	27.0	5.5	30.0
600	HALF	1.5	13.0	2.5	16.0	3.0	19.0	3.5	22.0
	FULL	4.0	26.0	5.0	32.0	6.0	39.0	6.5	43.0
700	HALF	2.5	18.0	3.0	22.0	3.5	26.0	4.0	29.0
	FULL	4.5	35.0	6.0	44.0	7.0	53.0	7.5	59.0
800	HALF	2.5	23.0	3.5	29.0	4.0	35.0	4.5	38.0
	FULL	5.5	46.0	6.5	57.0	8.0	69.0	9.0	77.0
900	HALF	3.0	29.0	3.5	36.0	4.5	44.0	5.0	49.0
	FULL	6.0	58.0	7.5	73.0	9.0	97.0	10.0	97.0
1000	HALF	3.5	36.0	4.0	45.0	5.0	54.0	5.5	60.0
	FULL	6.5	72.0	8.0	90.0	10.0	103.0	11.5	120.0

Table 3-4. Wind conversion table.

3-15. EFFECTS OF LIGHT

Light does not affect the trajectory of the bullet; however, it does affect the way the sniper sees the target through the scope. This effect can be compared to the refraction (bending) of light through a medium, such as a prism or a fish bowl. The same effect, although not as drastic, can be observed on a day with high humidity and with sunlight from high angles. The only way the sniper can adjust for this effect is to refer to past firing recorded in the sniper data book. He can then compare different light and humidity conditions and their effect on marksmanship. Light may also affect firing on unknown distance ranges since it affects range determination capabilities.

3-16. EFFECTS OF TEMPERATURE

Temperature affects the firer, ammunition, and density of the air. When ammunition sits in direct sunlight, the bum rate of powder is increased, resulting in greater muzzle velocity and higher impact. The greatest effect is on the density of the air. As the temperature rises, the air density is lowered. Since there is leas resistance, velocity increases and once again the point of impact rises. This is in relation to the temperature at which the rifle was zeroed, If the sniper zeros at 50 degrees and he is now firing at 90 degrees, the point of impact rises considerably. How high it rises is best determined once again by past firing recorded in the sniper data book. The general role, however, is that when the rifle is zeroed, a 20-degree increase in temperature will raise the point of impact by one minute; conversely, a 20-degree decrease will drop the point of impact by one minute.

3-17. EFFECTS OF HUMIDITY

Humidity varies along with the altitude and temperature. The sniper can encounter problems if drastic humidity changes occur in his area of operation. Remember, if humidity goes up, impact goes down; if humidity goes down, impact goes up. As a rule of thumb, a 20-percent change will equal about one minute, affecting the point of impact. The sniper should keep a good sniper data book during training and refer to his own record.

Section IV
SNIPER DATA BOOK

The sniper data book contains a collection of data cards. The sniper uses the data cards to record firing results and all elements that had an effect on firing the weapon. This can vary from information about weather conditions to the attitude of the firer on that particular day. The sniper can refer to this information later to understand his weapon, the weather effects, and his shooting ability on a given day. One of the most important items of information he will record is the cold barrel zero of his weapon. A cold barrel zero refers to the first round fired from the weapon at a given range. It is critical that the sniper shoots the first round daily at different ranges. For example, Monday, 400 meters; Tuesday, 500 meters; Wednesday, 600 meters. When the barrel warms up, later shots begin to group one or two minutes higher or lower, depending on specific rifle characteristics. Information is recorded on DA Form 5785-R (Sniper's Data Card) (Figure 3-23). (A blank copy of this form is located in the back of this publication for local reproduction.)

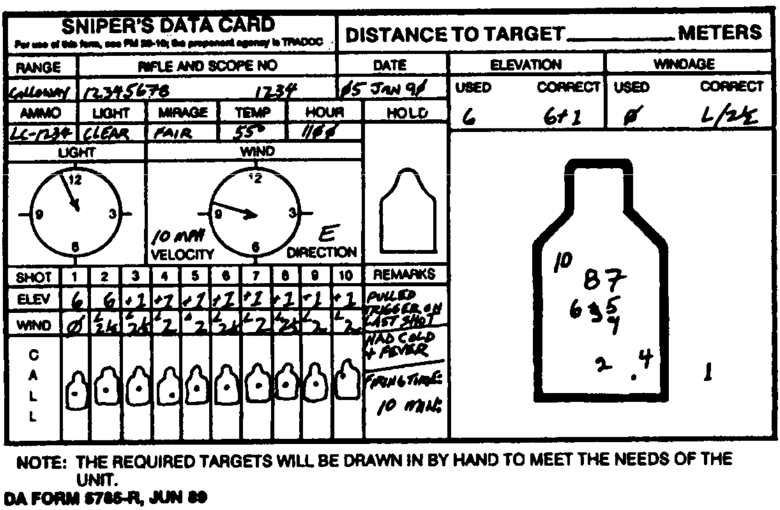

Figure 3-23. Example of completed DA Form 5785-R.

3-18. ENTRIES

Three phases in writing information on the data card (Figure 3-23) are *before firing, during firing,* and *after firing.*

a. **Before Firing.** Information that is written before firing is—

(1) ***Range.*** The distance to the target.

(2) ***Rifle and scope number.*** The serial numbers of the rifle and scope.

(3) ***Date.*** Date of firing.

(4) ***Ammunition.*** Type and lot number of ammunition.

(5) ***Light.*** Amount of light (overcast, clear, and so forth).

(6) ***Mirage.*** Whether a mirage can be seem or not (good, bad, fair, and so forth).

(7) ***Temperature.*** Temperature on the range.

(8) ***Hour.*** Time of firing.

(9) ***Light (diagram).*** Draw an arrow in the direction the light is shining.

(10) ***Wind.*** Draw an arrow in the direction the wind is blowing, and record its average velocity and cardinal direction (N, NE, S, SW, and so forth).

b. **During Firing.** Information that is written while firing is—

(1) ***Elevation.*** Elevation setting used and any correction needed. For example: The target distance is 600 meters; the sniper sets the elevation dial to 6. The sniper fires and the round hits the target 6 inches low of center. He then adds one minute (one click) of elevation (+1).

(2) ***Windage.*** Windage setting used and any correction needed. For example The sniper fires at a 600-meter target with windage setting on 0; the round impacts 15 inches right of center. He will then add 2 1/2 minutes left to the windage dial (L/2 1/2).

(3) ***Shot.*** The column of information about a particular shot. For example: Column 1 is for the first round; column 10 is for the tenth round.

(4) ***Elevation.*** Elevation used (6 +1, 6,6 –1, and so on).

(5) ***Wind.*** Windage used (L/2 1/2, O, R/l/2, and so on).

(6) ***Call.*** Where the aiming point was when the weapon fired.

(7) ***Large silhouette.*** Used to record the exact impact of the round on the target. This is recorded by writing the shot's number on the large silhouette in the same place it hit the target.

c. **After Firing.** After firing, the sniper records any comments about firing in the remarks section. This can be comments about the weapon, firing conditions (time allowed for fire), or his condition (nervous, felt bad, felt good, and so forth).

3-19. ANALYSIS

When the sniper leaves the firing line, he compares weather conditions to the information needed to hit the point of aim/point of impact. Since he fires in all types of weather conditions, he must be aware of temperature, light, mirage, and wind. The sniper must consider other major points or tasks to complete

a. Compare sight settings with previous firing sessions. If the sniper always has to fine-tune for windage or elevation, there is a chance he needs a sight change (slip a scale).

b. Compare ammunition by lot number for best rifle and ammunition combination.

c. Compare all groups fired under each condition. Check the low and high shots as well as those to the left and the right of the main group—the less dispersion, the better. If groups are tight, they are easily moved to the center of the target; if loose, there is a problem. Check the scope focus and make sure the rifle is cleaned correctly. Remarks in the sniper data book will also help.

d. Make corrections. Record corrections in the sniper data book, such as position and sight adjustment information, to ensure retention.

e. Analyze a group on a target. This is important for marksmanship training. The firer may not notice errors during firing, but errors become apparent when analyzing a group. This can only be done if the sniper data book has been used correctly. A checklist that will aid in shot group/performance analysis follows:

(1) Group tends to be low and right.

- Left hand not positioned properly.
- Right elbow slipping.
- Improper trigger control.

(2) Group scattered about the target.

- Incorrect eye relief or sight picture.
- Concentration on the target (iron sights).
- Stock weld changed.
- Unstable firing position.

(3) Good group but with several erratic shots.

- *Flinching.* Shots may be anywhere.
- *Bucking.* Shots from 7 to 10 o'clock.
- *Jerking.* Shots may be anywhere.

(4) Group strung up and down through the target.

- Breathing while firing.
- Improper vertical alignment of cross hairs.
- Stock weld changed.

(5) Compact group out of the target.

- Incorrect zero.
- Failure to compensate for wind.
- Bad natural point of aim.
- Scope shadow.

(6) Group center of the target out the bottom.

- Scope shadow.
- Position of the rifle changed in the shoulder.

(7) Horizontal group across the target.

- Scope shadow.
- Canted weapon.
- Bad natural point of aim.

Section V
HOLDOFF

Holdoff is shifting the point of aim to achieve a desired point of impact. Certain situations, such as multiple targets at varying ranges and rapidly changing winds, do not allow proper windage and elevation adjustments. Therefore, familiarization and practice of elevation and windage holdoff techniques prepare the sniper to meet these situations.

3-20. ELEVATION

This technique is used only when the sniper does not have time to change his sight setting. The sniper rarely achieves pinpoint accuracy when holding off, since a minor error in range determination or a lack of a precise aiming point might cause the bullet to miss the desired point. He uses holdoff with the sniperscope only if several targets appear at various ranges, and time does not permit adjusting the scope for each target.

a. The sniper uses holdoff to hit a target at ranges other than the range for which the rifle is presently adjusted. When the sniper aims directly at a target at ranges greater than the set range, his bullet will hit below the point of aim. At lesser ranges, his bullet will hit higher than the point of aim. If the sniper understands this and knows about trajectory and bullet drop, he will be able to hit the target at ranges other than that for which the rifle was adjusted. For example, the sniper adjusts the rifle for a target located 500 meters downrange and another target appears at a range of 600 meters. The holdoff would be 25 inches, that is, the sniper should hold off 25 inches above the center of visible mass in order to hit the center of mass of that particular target (Figure 3-24). If another target were to appear at 400 meters, the sniper would aim 14 inches below the ureter of visible mass in order to hit the center of mass (Figure 3-25).

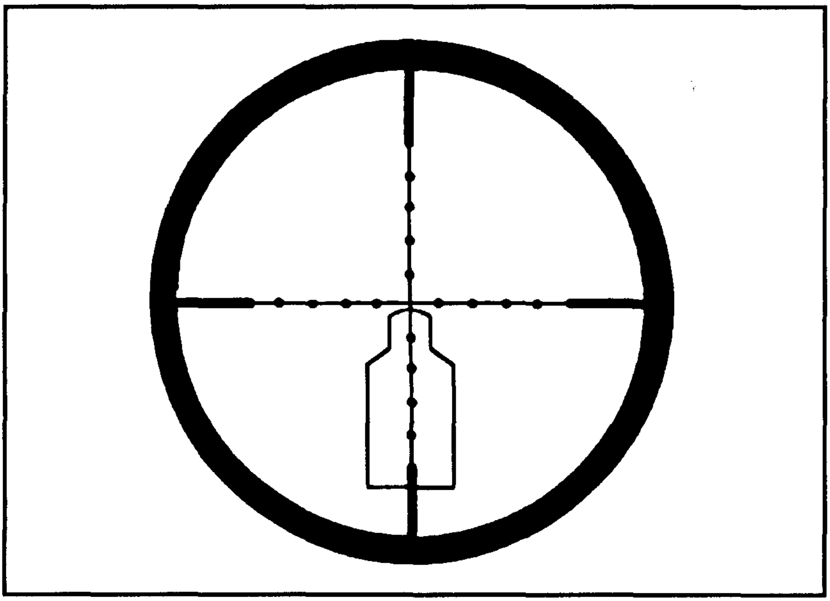

Figure 3-24. Elevation.

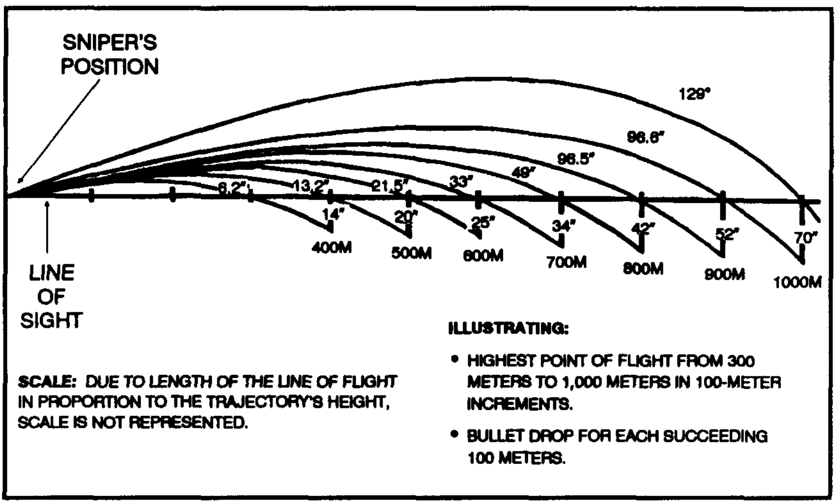

Figure 3-25. Trajectory chart.

b. The vertical mil dots on the M3A scope's reticle can be used as aiming points when using elevation holdoffs. For example, if the sniper has to engage a target at 500 meters and the scope is set at 400 meters, he would place the first mil dot 5 inches below the vertical line on the target's center mass. This gives the sniper a 15-inch holdoff at 500 meters.

3-21. WINDAGE

The sniper can use holdoff in three ways to compensate for the effect of wind.

a. When using the M3A scope, the sniper uses the horizontal mil dots on the reticle to hold off for wind. For example, if the sniper has a target at 500 meters that requires a 10-inch holdoff, he would place the target's center mass halfway between the cross hair and the first mil dot (1/2 mil) (Figure 3-26).

b. When holding off, the sniper aims into the wind. If the wind is moving from the right to left, his point of aim is to the right. If the wind is moving from left to right, his point of aim is to the left.

c. Constant practice in wind estimation can bring about proficiency in making sight adjustments or learning to apply holdoff correctly. If the sniper misses the target and the point of impact of the round is observed, he notes the lateral distance of his error and refires, holding off that distance in the opposite direction.

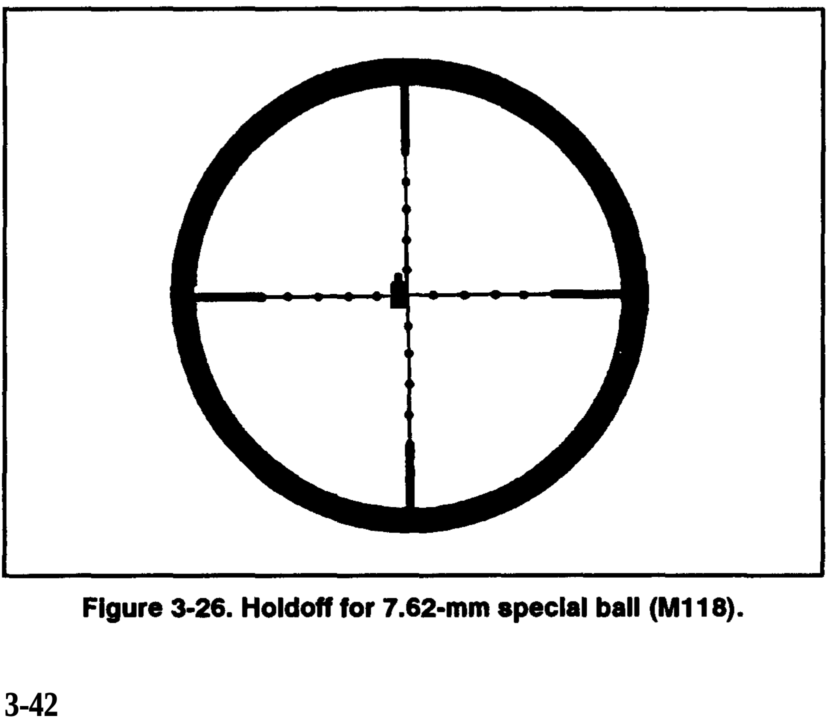

Figure 3-26. Holdoff for 7.62-mm special ball (M118).

Section VI
ENGAGEMENT OF MOVING TARGETS

Engaging moving targets not only requires the sniper to determine the target distance and wind effects on the round, but he must also consider the lateral and speed angle of the target, the round's time of flight, and the placement of a proper lead to compensate for both. These added variables increase the chance of a miss. Therefore, the sniper should engage moving targets when it is the only option.

3-22. TECHNIQUES

To engage moving targets, the sniper employs the following techniques:

- Leading.
- Tracking.
- Trapping or ambushing.
- Tracking and holding.
- Firing a snap shot.

a. **Leading.** Engaging moving targets requires the sniper to place the cross hairs ahead of the target's movement. The distance the cross hairs are placed in front of the target's movement is called a *lead.* There are four factors in determining leads:

(1) ***Speed of the target.*** As a target moves faster, it will move a greater distance during the bullet's flight. Therefore, the lead increases as the target's speed increases.

(2) ***Angle of movement.*** A target moving perpendicular to the bullet's flight path moves a greater lateral distance than a target moving at an angle away from or toward the bullet's path. Therefore, a target moving at a 45-degree angle covers less ground than a target moving at a 90-degree angle.

(3) ***Range to the target.*** The farther away a target is, the longer it takes for the bullet to reach it. Therefore, the lead must be increased as the distance to the target increases.

(4) ***Wind effects.*** The sniper must consider how the wind will affect the trajectory of the round. A wind blowing against the target's direction of movement requires less of a lead than a wind blowing in the same direction as the target's movement.

b. Tracking. hacking requires the sniper to establish an aiming point ahead of the target's movement and to maintain it as the weapon is fired. This requires the weapon and body position to be moved while following the target and firing.

c. **Trapping or Ambushing.** Trapping or ambushing is the sniper's preferred method of engaging moving targets. The sniper must establish an aiming point ahead of the target and pull the trigger when the target reaches it. This method allows the sniper's weapon and body position to remain motionless. With practice, a sniper can determine exact leads and aiming points using the horizontal stadia lines in the mil dots in the M3A.

d. **Tracking and Holding.** The sniper uses this technique to engage an erratically moving target. That is, while the target is moving, the sniper keeps his cross hairs centered as much as possible and adjusts his position with the target. When the target stops, the sniper quickly perfects his hold and fires. This technique requires concentration and discipline to keep from firing before the target comes to a complete halt.

e. **Firing a Snap Shot.** A sniper may often attempt to engage a target that only presents itself briefly, then resumes cover. Once he establishes a pattern, he can aim in the vicinity of the target's expected appearance and fire a snap shot at the moment of exposure.

3-23. COMMON ERRORS

When engaging moving targets, the sniper makes common errors because he is under greater stress than with a stationary target. There are more considerations, such as retaining a steady position and the correct aiming point, how fast the target is moving, and how far away it is. The more practice a sniper has shooting moving targets, the better he will become. Some common mistakes are as follows:

a. The sniper has a tendency to watch his target instead of his aiming point. He must force himself to watch his lead point.

b. The sniper may jerk or flinch at the moment his weapon fires because he thinks he must fire NOW. This can be overcome through practice on a live-fire range.

c. The sniper may hurry and thus forget to apply wind as needed. Windage must be calculated for moving targets just as for stationary targets. Failure to do this when squiring a lead will result in a miss.

3-24. CALCULATION OF LEADS

Once the required lead has been determined, the sniper should use the mil scale in the scope for precise holdoff. The mil scale can be mentally sectioned into l/4-mil increments for leads. The chosen point on the mil scale becomes the sniper's point of concentration just as the cross hairs are for stationary targets. The sniper concentrates on the lead point and fires the weapon when the target is at this point. The following formulas are used to determine moving target leads:

TIME OF FLIGHT X TARGET SPEED = LEAD.

Time of flight= flight time of the round in seconds.

Target speed = speed the target is moving in fps.

Lead = distance aiming point must be placed ahead of movement in feet.

Average speed of a man during—

Slow patrol = 1 fps/0.8 mph

Fast patrol = 2 fps/1.3 mph

Slow walk = 4 fps/2.5 mph

Fast walk = 6 fps/3.7 mph

To convert leads in feet to meters:

LEAD IN FEET X 0,3048 = METERS

To convert leads in meters to mils:

$$\frac{\text{LEAD IN METERS} \times 1{,}000}{\text{RANGE TO TARGET}} = \text{MIL LEAD}$$

Section VII
NUCLEAR, BIOLOGICAL CHEMICAL

Performance of long-range precision fire is difficult at best. Enemy NBC warfare creates new problems for the sniper. Not only must the sniper properly execute the fundamentals of marksmanship and contend with the forces of nature, he must overcome obstacles presented by protective equipment. Testing conducted by the US Army Sniper School, Fort Benning, GA during 1989 to 1990 uncovered several problem areas. Evaluation of this testing discovered ways to help the sniper overcome these problems while firing in an NBC environment.

3-25. PROTECTIVE MASK

The greatest problem while firing the M24 with the M17-series protective mask was that of recoil breaking the seal of the mask. Also, due to filter elements and hard eye lenses, the sniper could not gain and maintain proper stock weld and eye relief. Additionally, the observer could not gain the required eye relief for observation through his M49 observation telescope. However, testing of the M25-series protective mask provided the following results:

a. Because of its separate filtering canister, the stock weld was gained and maintained with minimal effort.

b. Its flexible face shield allowed for excellent observation. This also allowed the sniper and observer to achieve proper eye relief, which was needed for observation with their respective telescopes.

3-26. MISSION-ORIENTED PROTECTION POSTURE

Firing while in MOPP has a significant effect on the ability to deliver precision fire. The following problems and solutions have been identified

a. **Eye Relief.** Special emphasis must be made in maintaining proper eye relief and the absence of scope shadow. Maintaining consistent stock weld is a must.

b. **Trigger Control.** Problems encountered with trigger control consist of the sense of touch and stock drag.

(1) ***Sense of touch.*** When gloves are worn, the sniper cannot determine the amount of pressure he is applying to the trigger. This is of particular importance if the sniper has the trigger adjusted for a light pull. 'Raining with a glove will be beneficial; however, the trigger should be adjusted to allow the sniper to feel the trigger without accidental discharge.

(2) ***Stock drag.*** While training, the sniper should have his observer watch his trigger finger to ensure that the finger and glove are not touching any part of the rifle but the trigger. The glove or finger resting on the trigger guard moves the rifle as the trigger is pulled to the rear. The sniper must wear a well-fitted glove.

c. **Vertical Sight Picture.** The sniper naturally cants the rifle into the cheek of the face while firing with a protective mask.

d. **Sniper/Observer Communications.** The absence of a voice emitter on the M2S-series protective mask creates an obstacle in relaying information. The team either speaks louder or uses written messages. A system of foot taps, finger taps, or hand signals may be devised. Communication is a must; training should include the development and practice of communications at different MOPP levels.