CHAPTER 4

Target Acquisition and Range Determination

On future battlefields, the tempo will be such that a light cavalry crew must be prepared to move and, when necessary, engage targets rapidly. Platoons will be operating within irregular battle lines. Depending on the tactical situation and the area of operations, threat targets will be intermixed with friendly and neutral (civilian) vehicles. The speed and mobility of the light cavalry force, coupled with battle doctrine, also increase the likelihood of opposing and allied forces becoming intermingled during combat operations. Survival depends on the crew's ability to search for, detect, locate, identify, classify, confirm, and engage threat targets effectively and rapidly. Light cavalry crews must take advantage of the tactical situation and fire first when necessary. The speed and accuracy of an engagement are dependent on crew proficiency in target acquisition, range determination, and gunnery procedures.

Section I. TARGET ACQUISITION

This section describes the target acquisition process, methods for acquiring and classifying targets, and acquisition reports, and relates target acquisition confirmation to the conduct of fire.

Target acquisition is the timely detection, location, and identification of targets in enough detail to attack accurately by either direct fire or supporting weapons. The target acquisition process is a series of progressive and interdependent actions by which the crew acquires targets. These actions are crew search, detection, location, identification, classification, and confirmation. All crew members observe continuously. Effective target acquisition for a light cavalry crew requires the combined effort of all crew members.

Crew Search

Crew search (observation) is the act of watching the area of operations carefully. Crew members use the unaided eye as well as optics to search or scan the predetermined sector to acquire targets.

SECTORS OF OBSERVATION

Sectors of observation are areas assigned to each crew member for target acquisition. To ensure all-around coverage of the battlefield is maintained, each crew member is assigned a specific sector of observation by the vehicle commander. The gunner has a 360-degree responsibility. When operating as a section, fields of observation for each vehicle will overlap with other vehicles in the section to ensure all-around coverage.

NBC OPERATIONS

Wearing the protective mask hampers acquisition; therefore, in an NBC environment, the vehicle commander's and gunner's abilities to acquire targets are significantly reduced. Their acquisition responsibilities must be adjusted to compensate for this reduction.

DISMOUNTED OBSERVER

When the vehicle is in a hide position, an observer, equipped with binoculars and communications equipment, should dismount and locate forward of the vehicle position and observe the area of operations. Depending on the area(s) of responsibility, more than one observer position may be required.

GROUND SEARCH TECHNIQUES

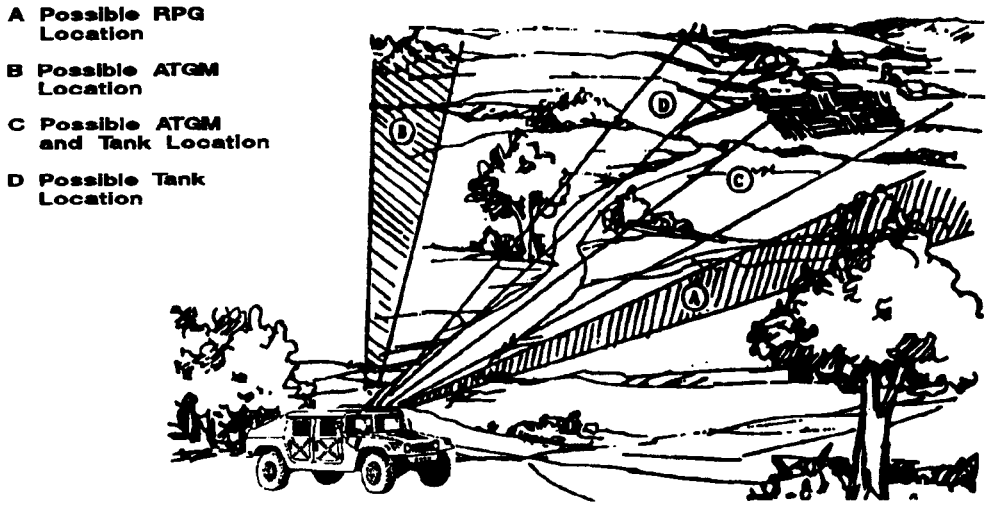
Crew members scan their areas of observation at all times to detect targets or possible target locations. There are three ground search techniques: rapid scan, slow (50-meter) scan, and detailed search. All three techniques may be used by all crew members (using the unaided eye, binoculars, or other optics) during good and limited visibility conditions. These techniques are modified at night by using the off-center vision method.

Rapid Scan

The rapid-scan method (see Figure 4-1) is used to detect obvious signs of enemy activity quickly. It is usually the first method used, whether stationary or moving. The vehicle commander may use optics or the unaided eye; the gunner may use TOW sights (day or thermal mode), if available, in low magnification, or the unaided eye.

- Start in the center of the sector and rapidly scan from the nearest to the farthest visible point.
- Then, orient left or right and conduct a rapid scan, near to far. (This sweep must overlap the center area of the previously scanned sector.)
- Once one side (from center) is completed, scan the remaining side in the same manner.

Figure 4-1. Rapid Scan.

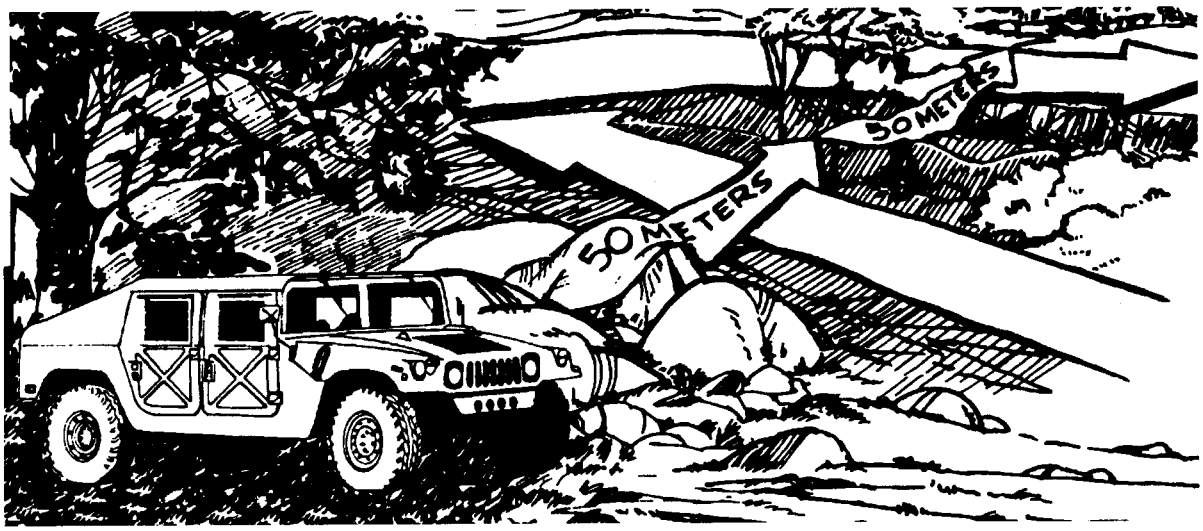


Slow (50-meter) Scan

If no obvious targets are identified in the rapid scan, crew members will conduct a more deliberate scan of the terrain by using the vehicle optics (day or thermal mode) or binoculars. The slow (50-meter) scan method (see Figure 4-2) is used for this task. The slow scan is best used by the vehicle commander or gunner when in a defensive position or from a short halt.

- Pausing at short intervals to give the eyes time to focus, search a strip of the target area 50 meters deep from right to left.
- Then, search a strip farther out from left to right overlapping the first area scanned.
- When a suspicious area or possible target signature is detected, stop and search the immediate area thoroughly, using the detailed search technique. If the AN/TAS 4(A) is being used, the gunner switches to high magnification (12X) for an intensive observation of potential targets.

Figure 4-2. Slow (50-meter) Scan.

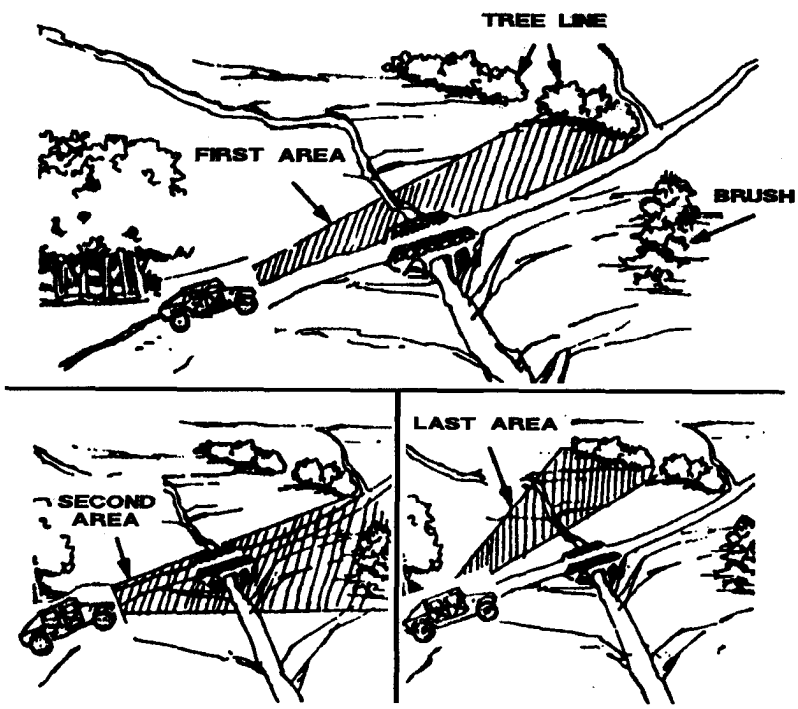


Detailed Search

If no targets are found using the rapid or slow scan techniques and time permits, crews should use the optics (day and night) to make a careful, deliberate search of specific areas in their assigned sector. This method (see Figure 4-3) is also used to search, in detail, small areas or locations with likely or suspected avenues of approach.

- Concentrate on one specific area or location and study that area intensely.
- Look for direct and indirect target signatures in a clockwise manner around the focal point (terrain feature) of the area. The following are examples of target signatures:
  - — Dust created by movement of vehicles.
  - — Tracks or tire marks.
  - — Reflections (flash) from glass or metal.
  - — Angular objects that do not conform to the surrounding area.
  - — Vegetation that appears out of place.
  - — Flash or smoke from a weapon or missile.
  - — Entrenchments or earthworks.

Figure 4-3. Detailed Search.



Off-Center Vision Method

Day and night scan techniques (rapid, slow, and detailed) are similar, with one exception: At night when using daylight optics or the unaided eye, do not look directly at an object; look a few degrees off to the side of the target object. When scanning with off-center vision, move the eye in short, abrupt, irregular movements. At each likely target area, pause a few seconds to attempt to detect a target or any movement. If an object is detected as a possible target, use off-center vision to observe it. While observing the object, frequent eye movement is necessary to prevent object fade-out. Cupping the hands around the eye will also increase night vision.

AIR SEARCH TECHNIQUES

There are two air search techniques (see Figure 4-4) used to detect aerial targets quickly: flat terrain scan and hilly terrain scan. Both of these methods are based on slow (50-meter) scan techniques. While using a ground search technique, crew members should always search near to far for possible targets; when using an air search technique, crew members should always search far to near.

Flat Terrain Scan (Air Search)

In flat terrain, search the horizon by moving the eyes in short movements from object to object.

Hilly Terrain Scan (Air Search)

In hilly terrain, search the sky beginning just below the horizon and move upward. Use prominent terrain features as points of reference to ensure overlapping areas of search.

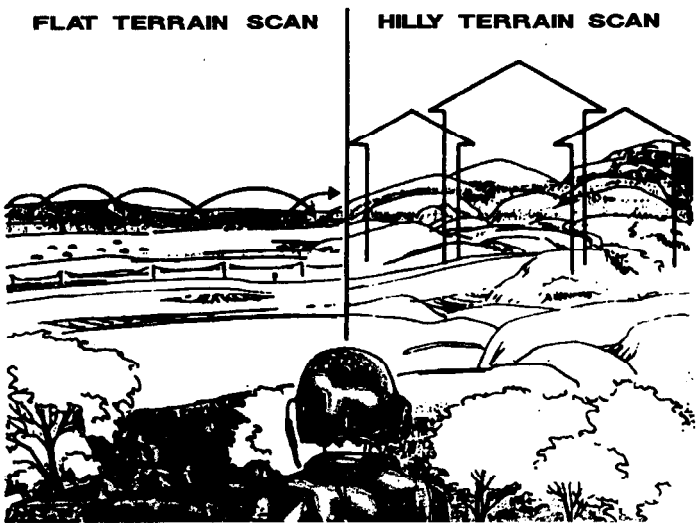
Notes. When using the air search technique, concentrate just below the tops of the trees or vegetation to detect helicopters in hide positions.

Ground and air search techniques may be combined. This allows crew members to scan for targets in the air and on the ground at the same time. Combinations used will depend on the area of operations and mission, enemy, terrain, troops, and time available (METT-T).

Air search at night is similar to searching for ground targets at night.

Threat aircraft operate in pairs. If aircraft are acquired, a second pair of aircraft should be expected, and possibly another pair. There may be one to four pairs of aircraft.

Figure 4-4. Air Search Techniques.



CREW SEARCH TIPS

All of the surveillance, target acquisition, and night observation (STANO) devices on the vehicle can be used to acquire targets. These devices include binoculars, night vision goggles, starlight scopes, AN/TAS-5, and the TOW sights in either the day or night mode.

- Initial scanning is always done without optics first, then with optics (such as binoculars or sights).
- Target search is continuous. Any target(s) missed on the first or second scan may be seen on the third or fourth scan.
- The entire crew must look for likely targets and target locations using proper scan techniques within their assigned sectors of observation.
- While on the move, the gunner should use the rapid scan technique, constantly scanning his sector limits from the right limit to the left limit.
- Targets on the edge of the peripheral field of view are harder to detect and locate.
- The field of view is greatly narrowed while the crew members are wearing protective masks; therefore, the crew's ability to acquire targets during NBC conditions is limited. The crew must scan continuously.
- Concentrate the search in areas where targets are more likely to appear (such as identified avenues of approach, woodlines, and reverse slope firing positions).

Target Detection

Target detection is the discovery of any target or object (such as personnel, vehicles, equipment) of potential military significance on the battlefield. Target detection occurs during crew search as a direct result of observation.

TARGET SIGNATURES

Target signatures are indicators or clues that aid an observer in the search to detect the presence of potential targets. Most weapons and vehicles have identifiable signatures. These signatures may be the result of the design of the equipment or the environment in which the equipment is operating. For example, firing a vehicle's main weapon system could produce blast, flash, noise, smoke, and dust. The movement of vehicles through a built-up area causes more noise than the movement of the same vehicle in an open field. Different types of aircraft have different signatures (the signature of a hovering helicopter is not the same as that of a fixed-wing aircraft). Other factors (such as visibility, temperature, and weather conditions) also affect target signatures.

Look for targets where they are most likely to be employed. Tracked vehicle signatures are most likely to be detected in open areas and rolling terrain. For threat antitank positions, visually cover primary avenues of approach where tanks and armored personnel carriers (APC) are likely to be used. Look for helicopters on the backside of woodlines, ridgelines, and significant folds in the terrain.

Crews must be familiar with these as well as other possibilities. Sight, hearing, and smell can all assist in detecting signatures that will lead to target location and identification. Target signatures include—

- Soldier signatures:
  - — Foxholes.
  - — Broken vegetation.
  - — Footprints.
  - — New and old fires.
  - — Noise.
  - — Trash.

- Tracked vehicle signatures:
  - — Vehicle tracks on the ground.
  - — Engine noise.
  - — Exhaust smoke.
  - — Dust clouds from movement.
  - — Weapon firing report and smoke.
  - — Bright white flash at night.

Note. Normally, when weather conditions permit, a tracked vehicle is more visible than the surrounding area and readily visible through passive and thermal sights.

- Antitank signatures:
  - — Missile launch “swish” sound.
  - — Long, thin wires from fired ATGMs.
  - — Sharp crack of the ATGM being fired.
  - — Destroyed armored vehicles.

- Artillery signatures:
  - — Loud, dull sound.
  - — Grayish-white smoke cloud.
  - — Bright, orange flash and black smoke from air bursts.
  - — Rushing noise several seconds before round impacts.

Notes. Towed artillery signatures vary according to the towing vehicle.

Self-propelled artillery has the same thermal infrared signature as tracked vehicles.

- Aircraft signatures:
  - — Glare of sun reflecting off aircraft canopies, wings, and fuselages of freed-wing aircraft and windows and rotor blades of helicopters.
  - — Aircraft noise.
  - — Vapor trails from engine exhaust and fired missiles.
  - — Dust and movement of foliage from hovering helicopters.
- Obstacles and mine signatures:
  - — Loose or disturbed dirt in a regular pattern.
  - — Destroyed or disabled vehicle that appears to have struck a mine.

DETECTION CHALLENGES

Some targets are more difficult to detect than others. Increased crew sustainment training and greater concentration are needed to detect and locate targets. Some examples of these more difficult targets and challenges are—

- Peripheral targets (targets on the edge of the field of view).
- Targets that are camouflaged or in shadows.
- Targets that can be heard but not seen.
- Targets under less than ideal indirect fire illumination. (If the illumination is in front of the target, the resulting shadow will be darker than the target. If the illumination is behind the target [and not in position to "wash out" the crew's optics], the target should stand out distinctly from the background.). Always keep one eye closed during illumination search, and never look directly into the illumination source.
- Small, single targets such as lone, dismounted ATGM or rocket-propelled grenade (RPG) positions.
- Natural obstacles (weather and terrain).
- Man-made obstacles (smoke and battlefield clutter).

Note. Behavioral or physical deficiencies (fatigue, eye reaction to gun flashes) also make target detection more difficult.

REDUCED VISIBILITY CONDITIONS

In winter, about 12 hours are spent in the dark. The threat makes the most of these conditions by moving his forces in the dark. The threat also digs in or continues the attack during the night. Even during the day, the threat uses every means possible to cover his intentions. Camouflaged targets in woodlines or behind buildings are difficult to acquire with day optics. These targets can sometimes be detected more easily with thermal sights or other night vision equipment (see Table 4-1). For example, a vehicle in a woodline will be seen as an irregular shape compared to surrounding vegetation. A vehicle behind a building with its engine running may give off a heat plume from the exhaust, thus alerting the crew to the target. The gunner must be able to use thermal sights, if available, to acquire targets during limited visibility and during daylight. Thermal sights operate by sensing heat radiation or temperature changes. Any source of heat that is at least one degree above the surrounding temperature can be sensed by thermal sights. The following primary heat sources may be detected by thermal sights.

- Solar heat. Energy from the sun is absorbed by the exterior surface of an object. The heat radiated from that object is then sensed by the thermal sight. During daylight, targets are hotter and easier to detect. It is necessary, as the sun goes down and the temperature drops, to note how the object form changes.
- Fuel combustion. Heat is created through the operation of a vehicle engine. Most vehicles will show one or more image(s). Vehicles will show a plume of heat from the exhaust and another around the engine compartment.
- Friction. Moving parts of a vehicle will cause friction. These areas will then a pear as images in the sight: tracks, road wheels, drive sprockets, and support rollers. (Vehicles driving through mud or snow will not show as sharp an image.)
- Thermal reflections. Glossy, smooth surfaces (such as the windshield of a vehicle) may reflect radiated heat.
- Body heat. Body heat is also sensed by the thermal sight.

Table 4-1.Thermal Sights and Night Vision Equipment.

Equipment	Weight (pounds)	Range (meters) Starlight/Moonlight	Battery	Field of view (degrees)
PVS-7A/B Goggles	1.5	150/300	BA 5567 (1 ea) or AA (2 ea)	40
PVS-4 Individual Sight	3.5	400/600	BA 5567 (2 ea)	15
PAS-13 Thermal (Projected)	4.13 to 4.85	Equal to, or greater than, weapon	BA 6847 (2 ea)	15 15/9 9/3
TVS-5 Crew Sight	7.5	1,000/1,200	BA 5567 (2 ea)	9
GVS-5 Range Finder	5.0	200 to 9,900	BA 6515 or BB 516	7
PVS-6 Range Finder	3.5	50 to 10.000	BA 6515 or BB 516	7

Note. There are three versions of the PAS-13 which will replace the PVS-4 and TVS-5 beginning in FY 96:
- Light-4.13 pounds.
- Medium-4.33 pounds.
- Heavy-4.85 pounds.

Target Location

Target location is the determination of where a potential target is on the battlefield. A target is located as a result of observation and detection during crew search. Once a target is located by a crew member, the target location must be communicated to all other personnel. Target location methods used to announce a target depend on the individual's specific position, unit SOP, and time available. Descriptions of the four most common target location methods follow.

CLOCK METHOD

The clock method is commonly used to get the vehicle commander or gunner on target. Twelve o'clock is based on the direction of vehicle movement while traveling, and the front of the vehicle when stationary. The vehicle commander or gunner can use the vehicle front direction to assist in accurately announcing target location. (Example: BMP—NINE O'CLOCK.)

SECTOR METHOD

The sector method is similar to the clock method; it is quick and easy to use. It is best used to indicate a direction from the direction of movement (moving) or vehicle orientation (stationary) using the terms center, left, right, and rear. Center sector is always to the direct front. (Example: THREE TANKS-LEFT REAR.)

REFERENCE POINT METHOD

The reference point method is used in conjunction with optics. The vehicle commander uses optics to determine the mil value from a terrain feature or known position. He then announces the mil value to the gunner. The gunner uses the mil reticle relationship to traverse onto the target. The key to this location method is the vehicle commander's and gunner's knowledge of the mil sight relationship. (Example: ATGM—TRP ONE FOUR—RIGHT FIVE MILS.)

The quick reference point method is used by all personnel to hand over targets near a target reference point (TRP). (Example: TWO PCs—TRP ONE FOUR.)

The precise reference point method is used to locate targets accurately in relation to a known reference point.

GRID METHOD

The grid method is the least desired technique because of the length of time it takes to bring the gunner on target. The vehicle commander receives the location of a target by map grid (usually from an observation post). He then uses his map to orient the vehicle toward the target area for the gunner.

Target Identification

Target identification is the recognition of a potential military target as being a particular target (such as a specific vehicle by type).

As a minimum, identification must determine the target as friendly or threat (friend, foe, or neutral). Crews must know what to engage and what not to engage. The crew's only method of positive vehicle identification is visual. The crew's ability to visually identify targets greatly decreases as engagement ranges increase, camouflage techniques become more effective, and battlefield obscuration increases.

Target identification training is an essential part of any weapon system proficiency training program. Crews must be able to identify targets quickly to have the advantage of engaging first when necessary and destroying the threat at the weapon system's maximum engagement range; therefore, crews must be continuous y trained and evaluated on target identification. (See the unit S2 for more information on identifying specific or additional vehicles, aircraft, and equipment likely to appear on the battlefield.)

Note. Keep in mind that, in many parts of the world, our allies and the threat employ both allied- and threat-made vehicles.

Target Classification

Target classification is categorizing potential targets by the level of danger they represent. To defeat multiple targets on the battlefield, the *most dangerous* targets must be engaged first. This requires a quick determination of which target is the *most dangerous.* All crew members must know the engagement priorities of their unit and be able to classify priority targets; however, the vehicle commander is responsible for classifying targets and deciding what and when to shoot. Targets are classified by the level of danger based on the following criteria.

MOST DANGEROUS

When the crew observes a threat target with HMMWV-defeating capabilities that appears to be preparing to engage them, the target is classified as *most dangerous.* This type of target is the greatest threat and must be engaged immediately. When faced with multiple *most dangerous* targets, the vehicle commander must further classify the targets based on which one of the *most dangerous* targets is the greatest immediate threat.

Generally, helicopters, tanks, and BMPs within their effective ranges have a greater kill probability against HMMWVs than handheld high-explosive antitank (HEAT) weapons (for example, RPGs).

Stationary targets can fire more accurately (and are therefore more dangerous) than moving targets. If two or more targets are of equal threat, engage the closest one first. When engaging more than two *most dangerous* targets from a stationary (weapons-down) position, the crew should use an alternate firing position. Smoke (indirect fire or on-board) may also be used to keep the enemy from observing the vehicle. Minimizing the number of rounds fired from any one position (primary, alternate) aids in confusing the enemy and avoiding detection caused by a firing signature.

DANGEROUS

When the crew sees a target with HMMWV-defeating capabilities but the target is not preparing to engage them, the target is classified as dangerous. This type of target should be engaged after all *most dangerous* targets have been destroyed, unless otherwise specified by the priority of engagements. Multiple *dangerous* targets are engaged in the same manner as *most dangerous* targets—engage the target that presents the greatest threat; if the targets are of equal threat, engage the closest one first.

LEAST DANGEROUS

A target that does not have a weapon system capable of defeating a HMMWV is classified as a *least dangerous* target. Engage this type of target after all most *dangerous* and *dangerous* targets have been destroyed, unless it has a higher priority of engagement.

ENGAGEMENT PRIORITIES

Engagement priorities are also used to classify targets. Unit operation orders (OPORD) or SOPS will designate certain types of targets as priority targets for destruction, regardless of their threat to the light cavalry.

- Classify special targets. Targets are selected based on their impact on the total threat force (command and control vehicles, engineer vehicles, reconnaissance vehicles, and artillery). Destroying these targets breaks up the combined arms capability of the threat force.

- Establish a specific type target priority for specific friendly vehicles (friendly tanks and improved TOW vehicles [ITV] might classify tanks as *most dangerous,* while light cavalry classifies threat BRDMs and other infantry carriers as *most dangerous).*

- Establish a specific type target priority for specific elements in the unit (one light cavalry unit might prioritize enemy BRDMs while another prioritizes BMPs).

Information to assist light cavalry crews in classifying targets includes—

- The most likely threat vehicles to be engaged by light cavalry.

- Threat vehicle primary and secondary armament capability of penetrating HMMWVS.

- The armor penetration data, with no angle of slope at 1,000 meters (except where noted as 500 meters).

Target Confirmation

Target confirmation is the rapid verification of the initial identification and classification of the target. It is the final step in the target acquisition process and is completed during conduct of fire. Confirmation takes place after the vehicle commander has issued all elements, except the execution element, of the fire command and as the gunner is completing his lay. (Gunners also go through a confirmation step. As he makes his final lay, the gunner assures himself that the target is hostile.)

The vehicle commander completes his evaluation of the nature of the target based on the target's appearance and his knowledge of the tactical situation. If the vehicle commander determines that the target is hostile, he continues the engagement. If he determines the target is friendly or neutral, he commands "CEASE FIRE. " If he cannot confirm the nature of the target, he continues to observe until he can confirm the target.

If the gunner confirms the target is hostile, he completes his final lay and engages the target, on order. If the gunner determines the target is friendly or neutral, he announces his confirmation to the vehicle commander ("CONFIRMATION FRIENDLY" or "CONFIRMATION NEUTRAL"). If he cannot determine the nature of the target, he announces "CONFIRMATION DOUBTFUL." The vehicle commander then determines whether to continue or terminate the engagement. (Crew duties during conduct of fire are discussed in Chapter 5.)

It is vital that the vehicle commander is kept informed on the tactical situation so he can assist in target confirmation. For example, he must be aware of friendly element movement within or between battle positions, the forward passage of lines, status of the withdrawal of any covering force, or the movement of civilian vehicle traffic in the area of operations.

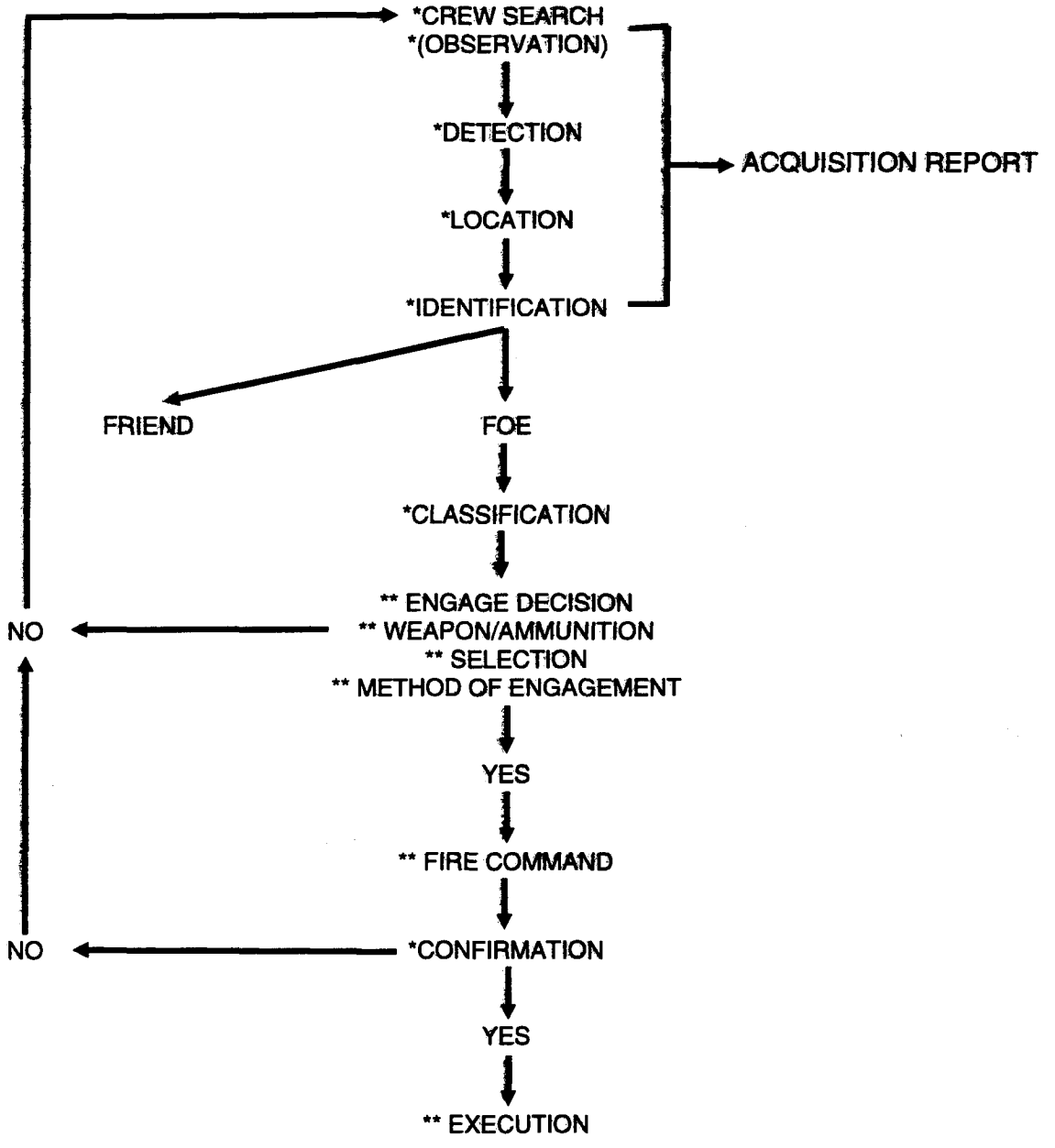
Acquisition Reports

Targets acquired by a crew member must be reported to the vehicle commander immediately by crew acquisition report. This target handover technique must take place before the classification step of the target acquisition process continues. An acquisition report consists of three elements: alert (optional), description, and location (for example, "DRIVER REPORT—TWO MOVING PCs—LEFT FLANK'). The acquisition report is given internally between the crew members who can identify each other by voice recognition. Therefore, the description element of the report usually serves as the alert element also (for example, "TWO MOVING PCs—ELEVEN O'CLOCK").

Target Acquisition and Conduct of Fire

Light cavalry crews must be proficient in the techniques and procedures of both target acquisition and conduct of fire to engage the enemy successfully in combat. (Figure 4-5 on page 4-14 shows the relationship between the steps in target acquisition and conduct of fire.)

Figure 4-5. Target Acquisition Process.



LEGEND: * TARGET ACQUISITION ELEMENT
** DIRECT FIRE ELEMENT

Section II. RANGE DETERMINATION

Range determination significantly affects target engagement accuracy. Errors in range determination will cause more first round misses than an error in deflection. Range errors causing the first round to go over the target are particularly serious because of the difficulty of observing and adjusting from a round that goes high.

When the vehicle commander chooses the precision engagement, he must rapidly and accurately determine the range to the target. The vehicle commander is primarily responsible for determining range. He has more options for determining range and a better knowledge of the terrain and tactical situation; therefore, in most cases, he can more easily and more quickly make a range determination. The gunner and driver have limited means of determining range.

This section details range determination methods available to each crew member.

Vehicle Commander

The vehicle commander is responsible for navigation, command, and control. He uses his knowledge of the terrain, the tactical situation, the friendly control measures on his map and on the ground, and his experience to determine range. He may determine range using the naked eye, the assisted method, a map, or one of the other methods of range determination; these methods can be used separately or in combination.

NAKED EYE

The vehicle commander, with practice, can estimate distances out to about 1,000 meters. This is particularly useful in close-in, immediate engagement situations where no time is available for using sights, binoculars, or maps. A technique for accomplishing this is the football field method. The vehicle commander counts 100-meter increments, estimating the number of football fields that could fit between him and the target.

The vehicle commander must be aware that light, weather, and terrain conditions can make a target look nearer or farther than it is. Conditions that make a target appear to be nearer are—

- Bright, clear day.
- Sun in front of the target.
- High elevations.
- Large targets.
- Bright colors (white, red, yellow).
- Contrast.
- Looking across ravines, hollows, rivers, depressions.

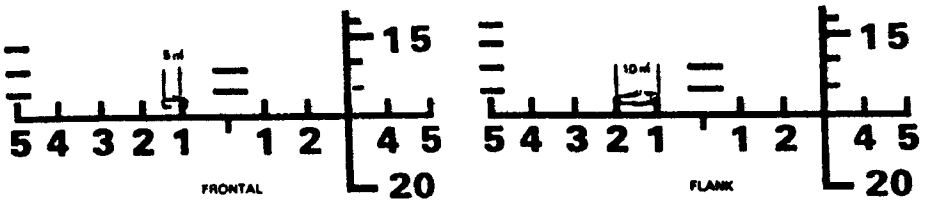
Conditions that make a target appear to be farther are—

- Fog, rain, haze, smoke, dusk, and dawn.
- sun behind the target
- Low elevations.
- Small targets.
- Dark target colors (brown, black, green).
- Camouflaged targets (paint, netting).

ASSISTED METHOD (Binoculars With Mil-Relation Formula)

The binoculars and mil relation are used in the assisted method of range determination. To use this method, the width or height of the target must be known. Using the known threat vehicle width or height with the binocular mil scale, substitute the mil relation and compute the range. When measuring the frontal width, measure only the vehicle front slope (from left front corner to right front corner). When measuring flank width, measure the entire vehicle. Accuracy of this method depends on the target dimensions and the vehicle commander's ability to make precise measurements with the binoculars (see Figure 4-6).

Figure 4-6. Target Measurement Using Binocular Reticle.



Note. The distance between tick marks on the horizontal scale is 10 mils.

The mil is a unit of angular measurement equal to 1/6400 of a circle. There are 18 mils in one degree. One mil equals the width (or height) of 1 meter at a range of 1,000 meters. This relation is constant as the angle increases from one mil to two roils, and the range increases from 1,000 meters to 2,000 meters. Because the mil relation is constant, other units of measurement (such as yards, feet, or inches) can be substituted to express width or range; however, both width and range must be expressed in the same unit of measurement. For example, if the sides of a one-roil angle are extended to 1,000 yards, the width between the ends of the sides is 1 yard.

Since the relationship of the target width in roils ($\frac{W}{R}$) to the target width (W) in meters is constant at varying distances, accurate range determination is possible. The mil relation holds true whether the W factor is length, width, or height; therefore, the range can be determined if the target dimensions are known.

To determine the range (R), the mil and W factors must be known.

The mil comes from reading the target width (height or length) on the mil scale in the binoculars. The W comes from Table 4-2 or other vehicle identification aid (GTA 17-2-13 or FM 23- 1), and is expressed in meters.

The known target width (W) is then divided by the mil (mil) width; this equals the range (R) factor. Multiply R by 1,000 to determine the target range:

For example, a BMP is 6.75 meters long (W). Using binoculars, the vehicle commander determines that a BMP measures 5 roils in length:

$$\frac{W}{mil} = R$$

Substitute the two known values for W and mil and round to the nearest tenth:

$$\frac{6.75}{5} = 1.35 = 1.4$$

Since R is expressed in thousands of meters, multiply by 1,000:

1.4 X 1,000 = 1,400 meters, the range to the BMP.

Table 4-2 shows the results of that computation for threat vehicles at various ranges. Determine the width of the target in mils. The range to the target is listed in the column below the mil measurement. Make sure to use the correct range, depending on whether the vehicle is viewed from the front or flank.

Table 4-2. Mil Relation for Various Targets.

Note. This table is a quick reference for determining the range to threat vehicles. Threat vehicles have been grouped and the sizes of the vehicles have been averaged.

Group 1 (BMP, Tank, BTR, ZSU, OT, MT-LB, and TAB)

TARGET WIDTH (Mils)	5	4.5	4	3.5	3	2.5	2	1.5	1
FLANK 6.75 METERS	1,400	1,600	1,800	2,000	2,300	2,800	3,400	4,600	6,900
FRONT 3.0 METERS	600	700	800	900	1,000	1,200	1,600	2,000	3,000

Group 2 (BMD and BRDM)

TARGET WIDTH (Mils)	5	4.5	4	3.5	3	2.5	2	1.5	1
FLANK 5.5 METERS	1,200	1,300	1,400	1,600	1,800	2,200	2,800	3,800	5,500
FRONT 2.35 METERS	400	500	600	700	800	1,000	1,200	1,600	2,400

Group 3 (HIND-D Helicopter)

TARGET WIDTH (Mils)	22.5	20	17.5	15	12.5	10	7.5	5	2.5
FLANK 17.255 METERS	800	900	1,000	1,200	1,400	1,800	2,400	3,600	7,000
TARGET WIDTH (Mils)	5	4.5	4	3.5	3	2.5	2	1.5	1
FRONT 6.9 METERS	1,400	1,600	1,800	2,000	2,400	2,800	3,600	4,600	6,900

MAPS

The vehicle commander must have a map to navigate. He may also use the map to determine range. In both offense and defense, the vehicle commander must continuously assess the likely enemy locations, engagement areas, and engagement ranges. He must constantly know where he is and where he is going. This information gives the vehicle commander the capability to determine rapidly the best battlesight setting for the terrain and enemy situation, and to adjust the battlesight when the situation changes.

OTHER METHODS

- Target reference points. TRPs are used as fire control measures for both direct and indirect fire and entered in the sector sketch to help the vehicle commander determine range and control his fires.

- Range cards. The primary use of the range card is to assist the crew in engaging targets during limited visibility. The vehicle commander may also use the range card to determine range, since ranging data is recorded on the range card.

- Laser range finder (AN/GVS-5). Using the laser range finder, the vehicle commander can quickly and accurately determine and announce the range.

Gunner and Driver (Naked Eye)

Like the vehicle commander, the driver and gunner can use the football field method to determine ranges quickly to close-in targets, especially those within M60 and M249 range (900 meters).