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FM 6-30

THE FIELD ARTILLERY OBSERVER

HEADQUARTERS
DEPARTMENT OF THE ARMY

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FM 6-30
August 1978
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FIELD MANUAL
No. 6-30

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 25 April 1980

S/S
17 June 1985

THE FIELD ARTILLERY OBSERVER

FM 6-30, 18 August 1978, is changed as follows:

1. New or changed material is indicated by a vertical bar.
2. Remove old pages and insert new pages as indicated below:

REMOVE	INSERT
i	i
1-1 and 1-2	1-1 and 1-2
2-1 and 2-2	2-1 and 2-2
3-1 and 3-2	3-1 and 3-2
3-5 and 3-6	3-5 and 3-6
4-1 through 4-8	4-1 through 4-8
4-11 through 4-13	4-11 through 4-13
5-1 through 5-10	5-1 through 5-10
5-13 through 5-20	5-13 through 5-20
6-1 and 6-2	6-1 and 6-2
6-7 through 6-14	6-7 through 6-14
6-17 and 6-18	6-17 and 6-18
6-25 through 6-28	6-25 through 6-28
7-1 and 7-2	7-1 and 7-2
	7-2.1 and 7-2.2
7-3 and 7-4	7-3 and 7-4
7-7 through 7-9	7-7 through 7-9
B-1 and B-2	B-1 and B-2
C-1 and C-2	C-1 and C-2
Index-1 and Index-2	Index-1 through Index-4

Posted
8 July 1980

3. File this change in the front of the publication for reference purposes.

The word "he" or "his" in this publication is intended to include both the masculine and feminine genders and any exception to this will be so noted.

C1, FM 6-30

25 APRIL 1980

By Order of the Secretary of the Army:

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Chief of Staff

Official:

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Washington, DC, 18 August 1978

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THE FIELD ARTILLERY OBSERVER

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*This publication supersedes Chapters 8, 9, 10, 11, 12 and 13 of FM 6-40, 28 June 1974.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Purpose

The purpose of this manual is to explain:

a. Observed fire procedures used by field artillery cannon units in combat.

b. How observed fire training is conducted in peacetime to meet combat requirements.

1-2. Scope

a. The material presented herein applies to both nuclear and nonnuclear warfare. Hereafter, when the term "artillery" is used, it relates to field artillery unless otherwise stated.

b. Laser rangefinder and FASCAM (family of scatterable mines) procedures are incorporated into this text. Future changes to FM 6-30 will support the development and operation of other field artillery systems (e.g., ground laser locator designator (GLLD) and cannon-launched guided projectile (CLGP) (Copperhead)).

c. This manual does not discuss observed fire procedures under tactical fire direction system (TACFIRE) or battery computer system (BCS).

d. This manual covers only technical observed fire procedures. The operational and organizational aspects of employing FIST are in FM 6-20, FM 6-20-1, and TC 6-20-10.

1-3. Target Audience

The target audience for this FM is the fire support team (FIST) personnel and other observers.

1-4. Changes or Corrections

Users of this manual are encouraged to submit recommended changes or comments to improve this manual. Comments should specify page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be forwarded to Commandant, US Army Field Artillery School, ATTN: ATSF-TD-TM, Fort Sill, Oklahoma 73503.

1-5. References

See appendix C for a list of references.

Section II. GUNNERY COMPONENTS/ FIELD ARTILLERY EFFECTIVENESS

1-6. The Field Artillery Gunnery Team (Fig 1-1)

The field artillery gunnery problem is solved through the coordinated efforts of the field artillery gunnery team. The gunnery team consists of the FIST, the fire direction center, and the firing battery linked by an adequate communication system. Field artillery doctrine requires team members to operate with a sense of urgency and continually strive to reduce the time required to execute an effective fire mission.

a. Observer. The observer serves as the eyes of all indirect fire systems. Personnel assigned to a fire support team (FIST) function as observers. The FIST team chief functions as an observer and as the fire support coordinator (FSCOORD) for the maneuver company commander. An observer detects and locates suitable indirect fire targets within his zone of observation. To attack a target, the observer transmits a request for indirect fires and adjusts the fires onto the target when necessary. An observer provides surveillance data of his own fires and any other fires delivered in his zone of observation. See FM 6-20 for detailed duties of the FIST chief as a fire support coordinator.

b. The fire direction center. The fire direction center (FDC) serves as the brain of the artillery system. The FDC receives the call for fire from the observer, plots the target location on the firing charts (or enters target data into FADAC), determines chart and firing data, and converts it to fire commands. The FDC transmits the fire commands to the sections designated to fire the mission. Because of the great distance between units on the battlefield and requirements for improved responsiveness, technical fire direction is normally conducted by the battery FDC. The battalion FDC provides tactical fire direction, monitors all fire nets, and provides technical fire direction assistance to battery FDCs (e.g., fire plan firing data, fire direction backup, GFT setting transfer). FDC procedures are found in FM 6-40.

c. Firing battery. The firing battery serves as the brawn of the artillery system. The firing battery consists of the firing battery

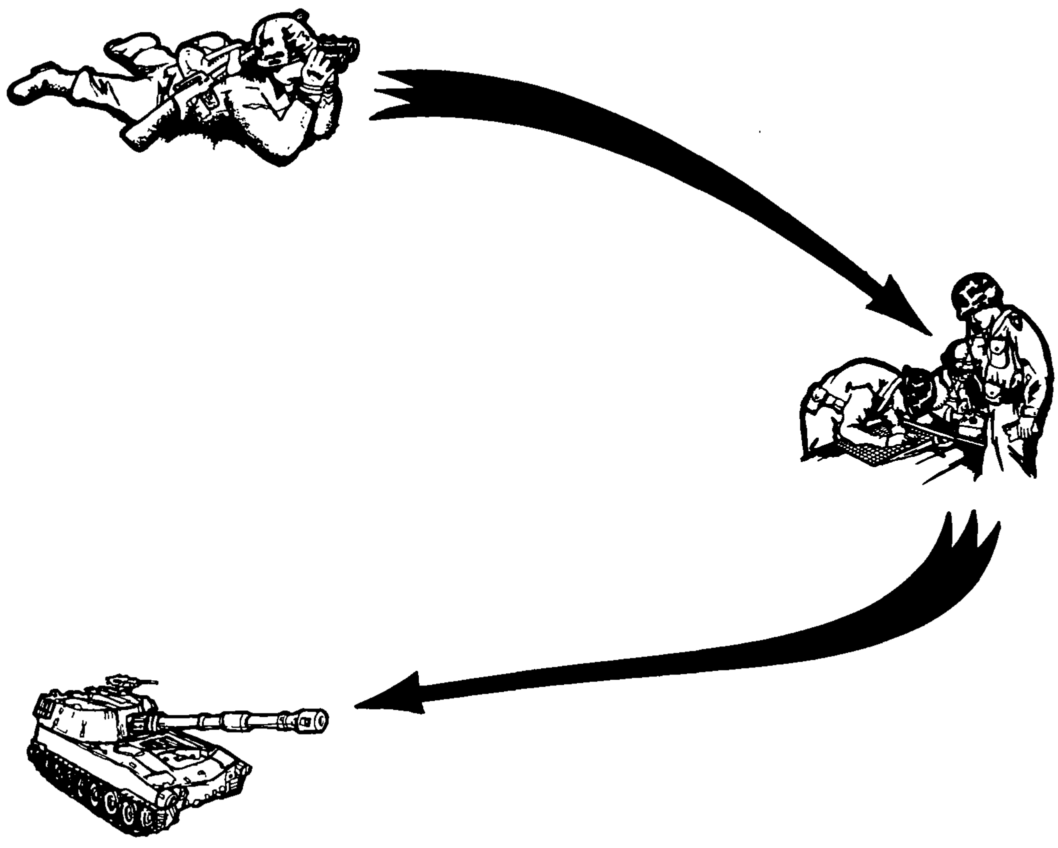


Figure 1-1. The field artillery gunnery team.

headquarters and four or six howitzer or gun sections. The normal function of the cannon section is to deliver fires as directed by the FDC. Firing battery procedures are found in FM 6-50.

1-7. Field Artillery Effectiveness

a. System responsiveness. In addition to gunnery, the FA system consists of target acquisition, weapons and munitions, and command and control. To be an effective force in the next battle, the field artillery must be responsive to the needs of our maneuver forces. To be responsive we must streamline our procedures to minimize the time lag between target acquisition and rounds on the target. Unnecessary delay can result in our missing the intended target or placing fires on our advancing forces. Responsiveness can be achieved if we accomplish the following:

(1) Plan artillery requirements ahead.

(2) Streamline the call for fire.

(3) Limit radio transmission on fire nets to time sensitive, mission essential traffic, only.

b. Effect on target. The ability of the field artillery system to place effective fires on a target will depend in part on the method of fire and type ammunition selected to attack the target. Maximum effect can be achieved through surprise and mass fires.

(1) Surprise. Accurate surprise fire inflicts the greatest number of casualties. We must strive for first round fire for effect or make a one round adjustment if adjustment is necessary. Figure 1-2 compares effect achieved to length of adjustment.

(2) Mass fires. Massing all available artillery fires normally enables us to inflict maximum effect on a target with a minimum expenditure of ammunition in addition to reducing our vulnerability to enemy target acquisition devices. Failure to mass fires will provide the enemy time to react and seek protection. Figure 1-3 compares mass fire and

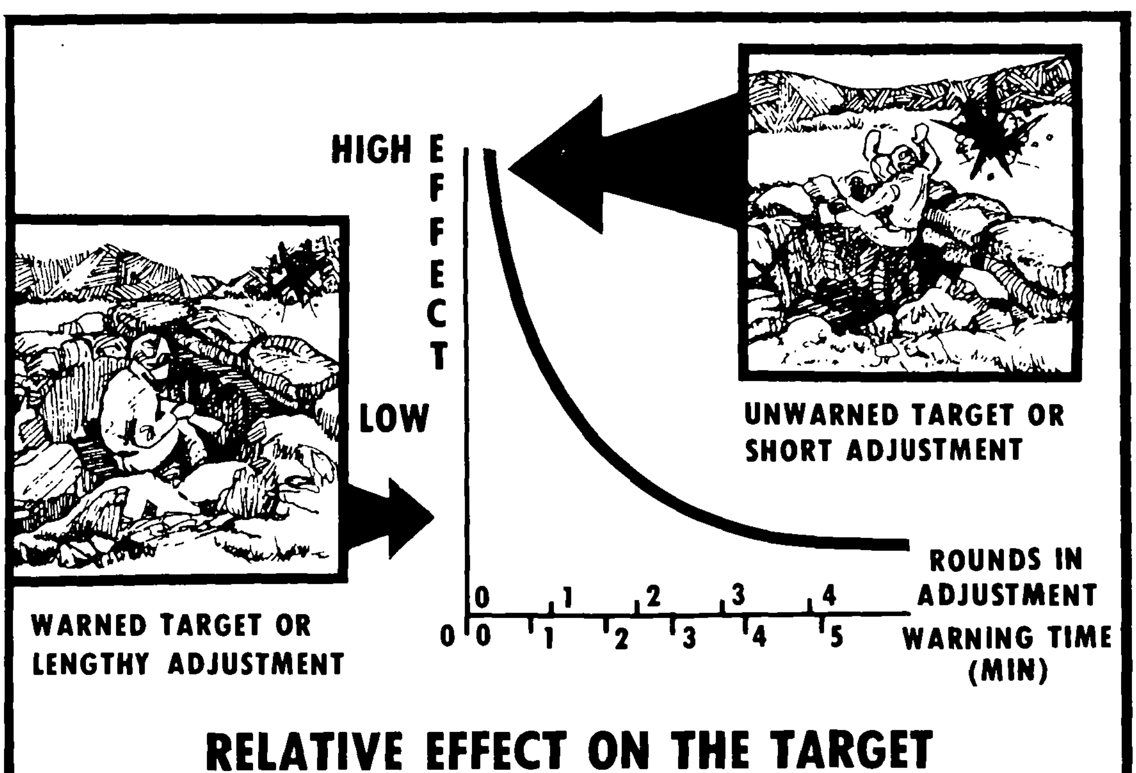


Figure 1-2. Effectiveness compared to length of adjustment.

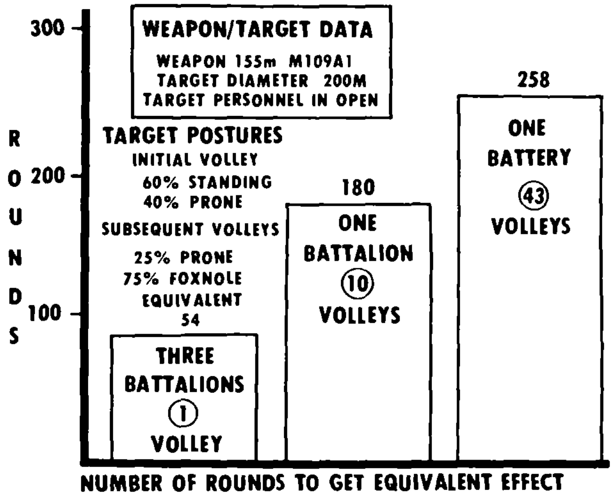


Figure 1-3. Number of rounds required for equivalent effect.

successive volley ammunition expenditures to get equivalent effect. "TOTs" are more effective against soft targets than AT MY COMMAND and WHEN READY fire missions because they minimize the time lag between volley impact. TOTs insure maximum effect when attacking targets that can easily change their posture category (e.g., a "soft" target-personnel in the open can easily become a "hard" target-personnel with overhead cover). TOTs and AT MY COMMAND fire missions do not provide increased effectiveness against hard targets because volume of fire is more critical than round impact timing. WHEN READY fire missions provide a suitable method of fire for delivering required volumes of fire against hard targets.

(3) Proper munitions. When attacking a target, the shell/fuze combination selected must be capable of producing desired results against the most vulnerable part of the target (e.g., gun crew versus the gun). Failure to select proper shell/fuze combinations will result in an excessive expenditure of critical ammunition supplies or a reduction in target effect. Figure 1-4 compares type ammunition expenditures and relative effects.

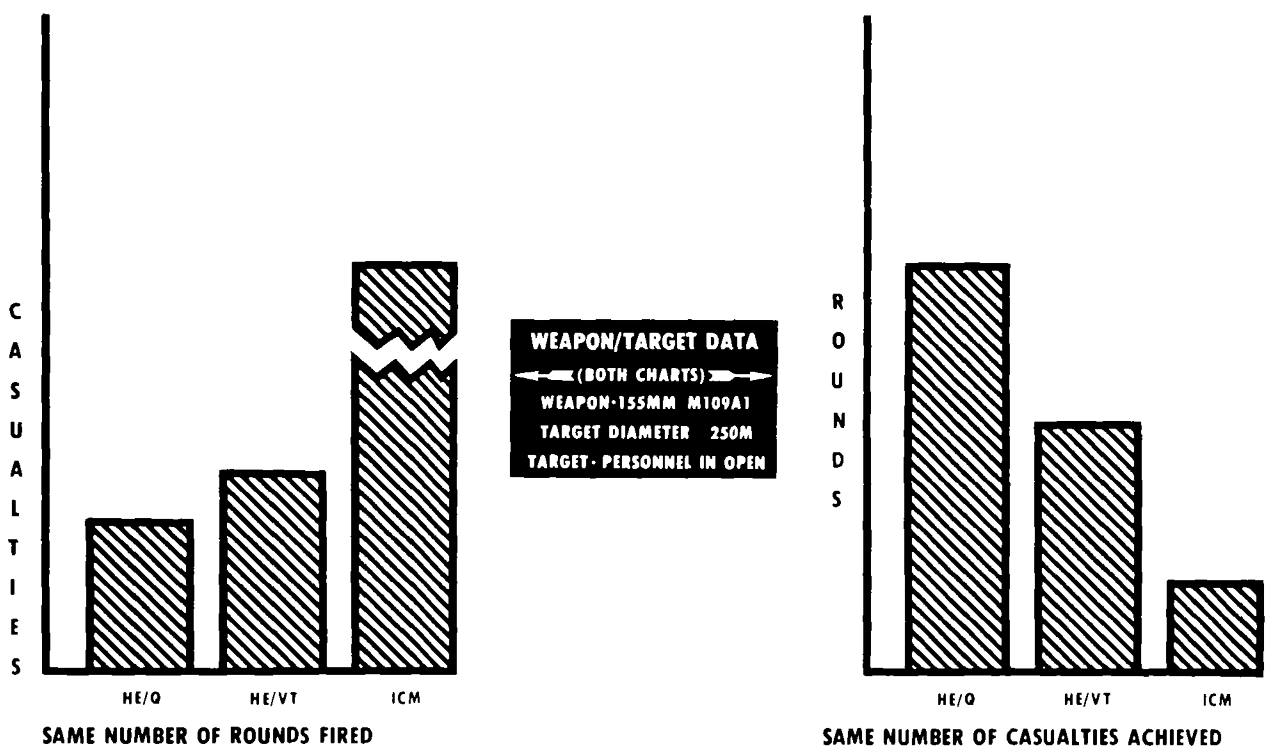


Figure 1-4. Ammunition expenditures and relative effects.

CHAPTER 2

DUTIES OF THE FIST AND RESPONSIBILITIES OF THE OBSERVER

2-1. Duties of the FIST

The "eyes" of the artillery are the fire support team (FIST). The FIST is an internal part of all maneuver units and works at company level. Each FIST consists of a headquarters that includes the FA lieutenant (FIST chief) and additional 13F personnel. In all units except the tank company, an FO per platoon is authorized. Specific organization of each FIST can be found in table 2-1. Each FIST headquarters is authorized a vehicle. Platoon FOs will either have their own vehicle or will ride with the platoon leader. Laser designators/rangefinders, digital message devices, and position determining equipment will be provided within the FIST as they become available.

a. The traditional duties of the FA forward observers and mortar observers are handled by the FIST. The FIST will locate targets, request and adjust indirect fire (mortars and artillery), and request and may adjust and control all other forms of fire support available, such as naval gunfire (NGF) and close air support (CAS). Fire support planning by the FIST will support the company commander's development of the scheme of maneuver.

b. The FIST chief is the company fire support coordinator (FSCOORD). As such he will:

(1) Advise the company commander on all fire support matters.

Table 2-1. FIST Personnel Summary

RANK / POSITION \ TYPE UNIT	MECH INF	ARMOR /CAV	INF	ABN	AIR ASSAULT
LT FIST CHIEF	1	1	1	1	1
SSG FS SERGEANT	1	1	1	1	1
SGT FORWARD OBSERVER	3	0	3	3	3
SP4 FS SPECIALIST DRIVER	1	1	1	1	1
PFC RTO (ASS'T FO)	3	2	3	3	3
TOTAL	9	5	9	9	9

(2) Resolve fire support conflicts arising during the planning and execution of operations.

(3) Attack all targets with the most suitable fire support means available.

(4) Coordinate the operations of all platoon observers. Detailed FSCOORD duties are outlined in FM 6-20 and TC 6-20-10.

c. The FIST communications and control are extremely flexible. The FIST chief may organize his team to best accomplish the mission. The platoon observers and FIST chief are capable of calling the artillery or mortars as necessary. The FIST chief must always maintain liaison with the battalion FSO.

2-2. Responsibilities of the Observer

The primary responsibility of the observer is to

LOCATE, CALL FOR, AND ADJUST INDIRECT FIRE ON TO TARGETS

The observer has several secondary responsibilities that amplify his primary responsibility. These responsibilities are knowing the terrain in his area of responsibility and maintaining surveillance of that area, knowing the tactical situation, understanding the enemy, using his communications effectively, and maintaining the security of his party. To fulfill these responsibilities, the observer must:

a. Conduct a detailed terrain-map association. The observer should constantly make a thorough analysis of the terrain and map for his zone of operation. Some techniques the observer can use are:

(1) Locate himself accurately. (He should be able to determine the six-place grid of his location at all times.)

(2) Locate all registration points and likely points of enemy activity. Use of prominent terrain features will help relate a potential target area to a grid location on a map (fig 2-1).

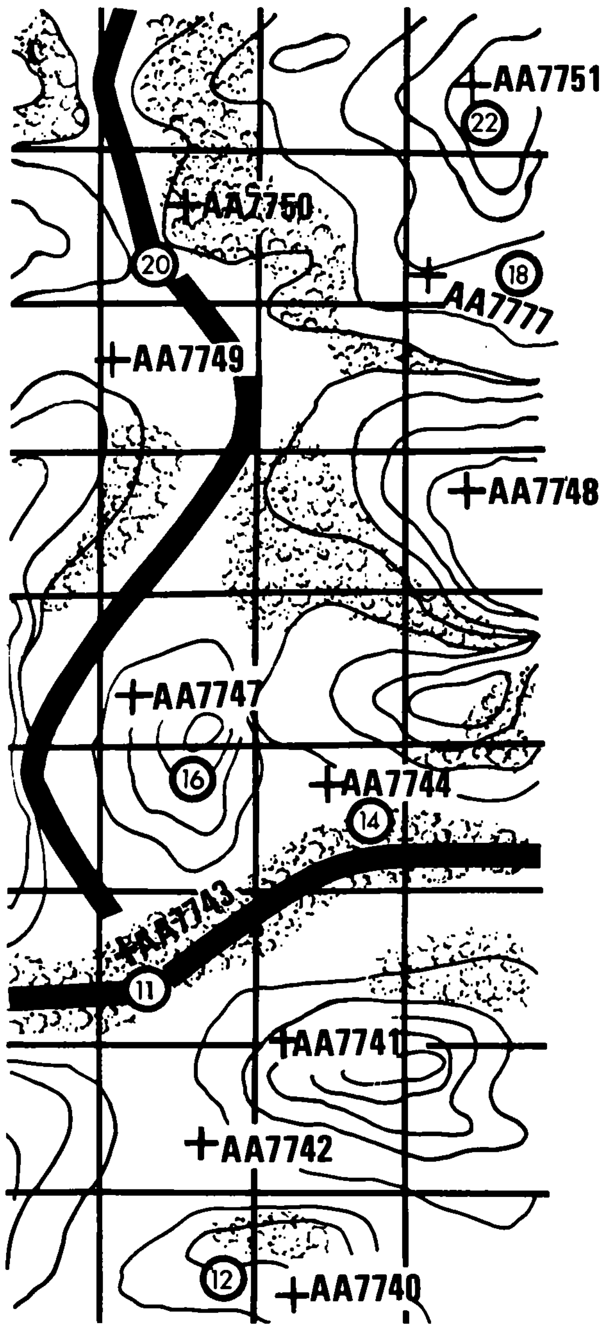


Figure 2-1. Use of prominent terrain features to locate potential targets.

(3) Make a thorough study of terrain. He should look for different colors of grass that might reveal hills and valleys, find all roads and bodies of water in the area as they are easily associated with terrain features on the map, and locate manmade objects such as buildings, dams, or trig markers that can be seen on both the terrain and the map. The observer must be thoroughly familiar with the terrain when in a defensive posture. One frequent advantage of defense is that the defender is normally more familiar with the terrain than is the attacker. The observer should make the most of this advantage by studying the terrain to the flanks and rear as well as to the front.

b. Observe the entire zone of the supported unit (fig 2-2).

(1) Conduct surveillance of areas previously fired on. Once a fire mission is completed the observer should analyze the terrain and the vicinity of the target, looking for places where the enemy might hide personnel or conceal equipment.

(2) Conduct constant surveillance of critical areas such as avenues of approach and probable assembly areas. He should monitor these areas constantly so that targets that appear can be neutralized or suppressed immediately.

(3) Whenever possible, make a terrain sketch of the area. This will help associate the terrain with the map.

(4) A thorough terrain-map analysis is the key to accurate location of targets.

AN OBSERVER CAN NEVER BE TOO FAMILIAR WITH THE TERRAIN.

c. Know the tactical situation and scheme of maneuver.

(1) To effectively plan targets, the observer must understand the scheme of maneuver. Maneuver planning and fire planning must be done jointly.

Figure 2-2. Observe the entire zone of the supported unit.

(2) The observer should be familiar with the adjacent units to facilitate fire support coordination.

d. Maintain surveillance of the battlefield and report all information about the enemy activity. Use the following format in reporting data:

S—Size	How large a unit do you see?
A—Activity	What is it doing?
L—Location	Where is it? Give a grid.
U—Unit	What type of unit is it?
T—Time	When was the activity observed?
E—Equipment	What equipment does the unit have with it?

e. Know the enemy situation. Knowledge of the enemy—his capabilities and limitations, his tactics and techniques, his equipment—will ease the fire planning process and aid in selecting the most effective fire support means.

f. Know what fire support means are available and how they should be employed.

g. Insure that all communications—with the company commander, FIST headquarters or platoon observers, and other fire support means—are maintained at all times.

h. Provide security for his party. The observer should use cover, camouflage, and concealment. He should use proper communications security procedures and avoid sending information about his location or activity in the clear.

CHAPTER 3

TARGET LOCATION

Section I. REQUIREMENTS FOR LOCATING TARGETS

3-1. Terrain-Map Analysis

To successfully perform his duties, an observer must be proficient in determining a target's position on the ground. The key to accurate target location is a thorough terrain-map analysis. The observer can analyze map and terrain by:

a. Locating himself within 150 meters at all times.

b. Using prominent terrain features to relate potential target areas to grid locations on the map.

c. Making a thorough study of terrain.

d. Associating the direction in which he is looking with a grid direction on the map.

3-2. Target Location Methods

Once a thorough terrain-map study has been conducted, the observer will be well prepared to locate targets. There are three methods of target location available to the observer: By grid coordinates—the observer locates the target by giving the actual grid location; by shift from a known point—the observer describes the target location in relation to a point of known location (known point); and by polar plot—the observer describes the target location in relation to himself.

a. Target location by grid coordinates. If the observer has conducted a good terrain-map study, the grid coordinate method is the most expedient. The observer's location need not be known to the FDC, and known points are not necessary. The observer normally locates targets to an accuracy of 100 meters (six-place grid). Normally, this is accomplished by visually interpolating within the appropriate map and grid square. When additional accuracy is required (e.g., registration points or planned targets), the observer can locate targets to the nearest 10 meters (eight-place grid).

b. Target location by shift from a known point. The observer may have one or more known points. These are identifiable points whose locations are known to the observer and FDC. The observer does not need a map to use this method; he only needs a known point. This method is reasonably accurate, but is the slowest of the three methods. The steps in locating a target by shift from a known point are described below:

(1) Identify the known point to be used.

(2) Determine the observer-target direction (OT dir). This direction can be:

Grid azimuth (10 mils):	DIRECTION 4360
Cardinal Direction:	DIRECTION SOUTHWEST
Gun-target line:	DIRECTION GUN TARGET

(3) Determine a lateral shift from the known point to the observer-target (OT) line. If the angular deviation from the observer-known point line to the OT line can be determined, a shift in meters can be computed by use of the following formula:

$$W = R \times m\!\!/$$

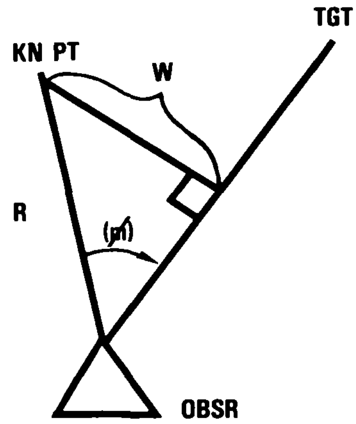


Figure 3-1. Mil relation formula.

Where W is the shift in meters, R is the observer-known point distance (expressed in number of thousands to the nearest hundred), and m̸ is the angular deviation in mils (to the nearest 1 mil). This formula is based on the assumption that the width of 1 meter will subtend an angle of 1 mil at a distance of 1000 meters. It is called the MIL RELATION FORMULA (fig 3-1).

> Example (fig 3-2).
>
> The observer knows that the distance from his location to the church is 2500 meters. He also knows the direction is 850 mils. With his binoculars, he measures an angular deviation of 62 mils from the church to the target. He calculates the lateral shift as follows:
>
> $\frac{2500}{1000} = 2.5$
>
> (2500 is already expressed to the nearest 100)
>
> W = R × m̸
>
> W = 2.5 × 62
>
> W = 155 meters ≈ 160 meters
>
> "LEFT 160"

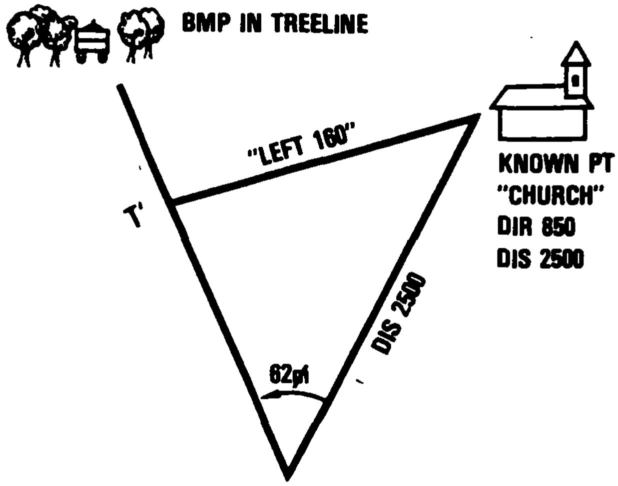


Figure 3-2. Lateral shift.

THE LATERAL SHIFT IS EXPRESSED TO THE NEAREST 10 METERS

Note. When a shift greater than 600 mils must be made, the accuracy of computing the lateral shift will decrease.

(4) Determine a range change along the OT line. The observer must determine whether the target is at a greater or lesser distance than the known point. The lateral shift gives the observer a point on the OT line (T′) the same distance from him as the known point. If the target is farther away than the known point, the observer must ADD the estimated distance from T′ to the target (fig 3-3,①). If the target is closer, the observer must DROP the estimated distance (fig 3-3,②).

THE DIFFERENCE IN DISTANCE BETWEEN THE KNOWN POINT AND THE TARGET IS EXPRESSED TO THE NEAREST 100 METERS

(5) Determine a vertical shift, if significant. If there is a significant difference in altitude between the known point and the target, the observer must include it in his target location. If the target is at a higher altitude than the known point, then the observer must go UP the difference in altitudes (fig 3-4). If the target is at a lower

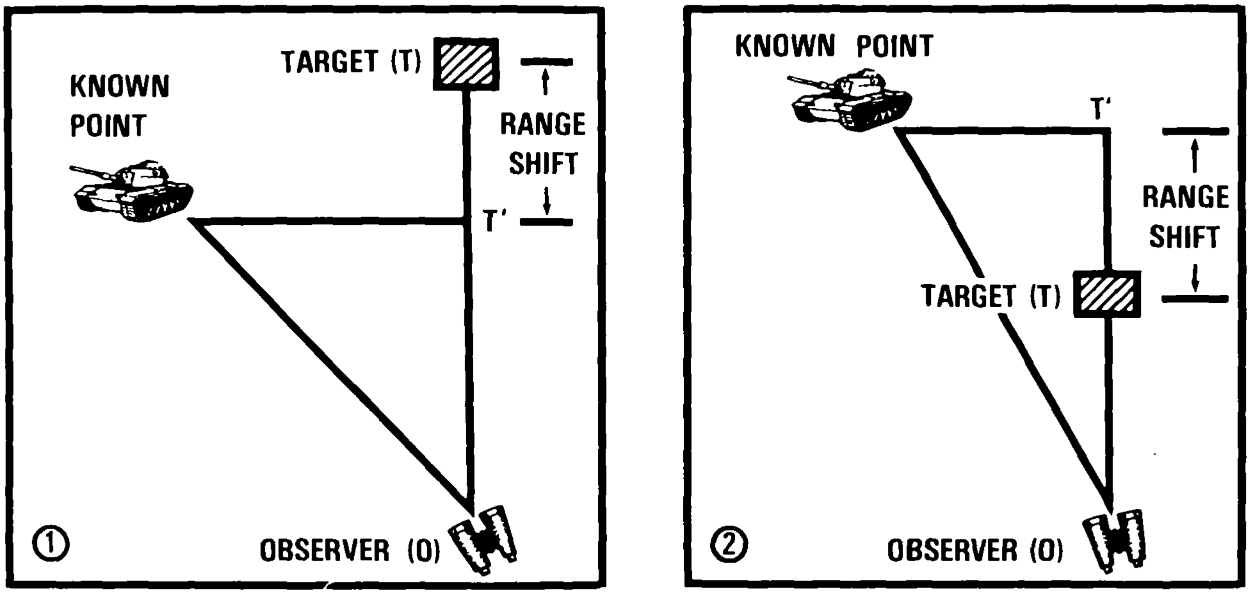


Figure 3-3. Range shift.

altitude, he must go DOWN the difference. Whether a vertical shift is sent or not depends upon several factors. Normally, if the mission is a fire-for-effect mission, a vertical shift should be sent to improve accuracy. If the observer does not have a map, vertical shifts are normally not sent. The observer should weigh the time expended on determining and sending a vertical shift against the time available. Experienced observers who can determine differences in altitude quickly should send a vertical shift when the difference in altitude is greater than 30 meters. When responsiveness is paramount, inexperienced observers should not attempt to send a vertical shift.

THE DIFFERENCE IN ALTITUDE IS EXPRESSED TO THE NEAREST 5 METERS.

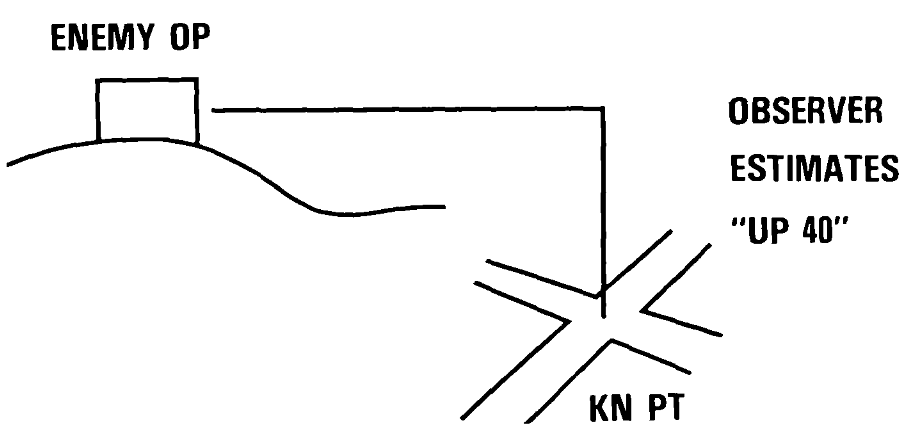


Figure 3-4. Vertical shift.

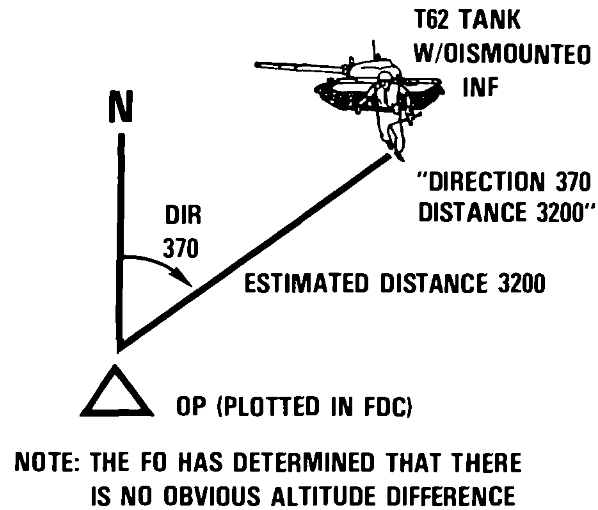


Figure 3-5. Polar plot.

c. Target location by polar plot. When the observer's location is known to the FDC, the polar plot method may be used. The observer does not need a map. This method is easy and quick; however, the observer may reveal his location to the enemy. In addition, in a mobile situation, it is difficult for the observer to always encode his location and send it to the FDC. The steps in the polar plot method are shown below (see also figure 3-5):

(1) Determine the OT direction (nearest 10 mils) as mentioned earlier.

(2) Estimate the distance to the target (nearest 100 meters). Use all information obtained from the terrain-map study to determine the OT distance.

(3) Determine a vertical shift, if significant. Just as in the shift from a known point method, determine an UP or DOWN shift if the difference between the observer altitude and the target altitude is obvious. See *b*(5) above for a further discussion of vertical shift.

3-3. Direction

Determining direction is an essential skill for the observer. Direction is an integral part of terrain-map association, adjustment of fire, and target location. There are five methods to determine direction:

a. Estimating. With a thorough terrain-map analysis of his zone of operation, the observer can estimate direction on the ground. As a minimum, the observer should be able to visualize the eight cardinal directions (N, NE, E, SE, S, SW, W, NW).

b. Scaling from a map. Using an observed fire (OF) fan (para 3-4) or protractor, the observer may scale direction from a map to an accuracy of 10 mils.

c. Using a compass. Using an M2 or lensatic compass, the observer can measure direction. Care must be taken when using a compass around radios or large concentrations of metal such as vehicles. Observers should move approximately 50 meters away from vehicles to avoid incorrect readings.

d. Measuring from a reference point. Using a reference point with known direction, the observer can measure horizontal angular deviations and apply them to the reference direction. Angular deviations may be measured with binoculars or with the hand. Measuring with the binoculars is shown in figure 3-6. Use of the hand to measure angular deviations is discussed in paragraph 3-6.

e. Using other measuring devices. When properly oriented, the aiming circle, battery commander's scope, or laser devices will provide direction to the nearest mil. The heading indicator in aircraft can be used by the aerial observer.

The target is 40 mils to the LEFT of the reference point. The direction to the target is 2060 mils (2100m - 40m = 2060m).

The horizontal scale is divided into increments of 10 mils.

The vertical scale on the right of the lens is not used by the FO in determining data for his call for fire. It is used primarily by the infantry for sighting automatic weapons.

The vertical scale on the left of the lens is divided into increments of 5 mils and is used in HOB adjustments.

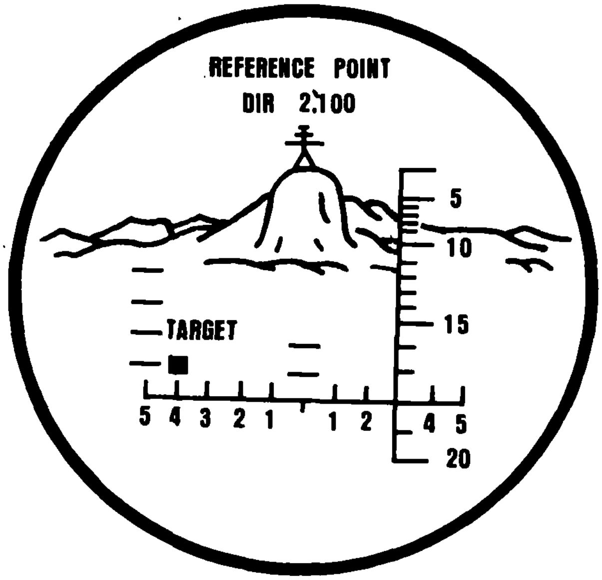


Figure 3-6. Measuring angular deviations with binoculars.

Section II. AIDS TO TARGET LOCATION

There are many techniques that should be used to aid the observer in target location. The following paragraphs discuss only several of the more common ones.

3-4. Observed Fire Fan

a. The observed fire fan (fig 3-7) allows the observer to identify on the map, the terrain he sees on the ground. The OF fan is a transparent protractor that can be used to show OT direction and distance on the map. OT direction is shown by the use of radial lines that are 100 mils apart and cover a total of 1600 mils. OT distance is shown by use of arcs marked on the fan every 500 meters starting at 1000 and extending to 6000 meters.

b. To prepare the OF fan:

(1) Place the vertex of the fan over the observer's location.

(2) Place the center radial in the direction of the center of the observer's sector of responsibility.

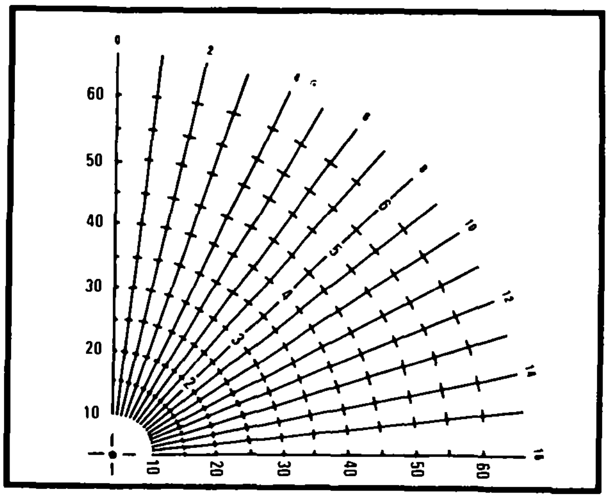


Figure 3-7. Observed fire (OF) fan.

(3) Move the fan slightly until one radial line is parallel to a grid line. The direction of that radial is the same as the grid line.

(4) With a grease pencil, number the radial of known direction by dropping the

last two zeros (1600 would be 16). Then label every second radial with the appropriate direction (labeling each radial is unnecessary and makes the fan too cluttered).

c. To determine target location, the observer first must determine a polar plot location by quick use of the compass or other means of determining direction, and estimate the OT distance. He then plots the data on the OF fan by finding the two radials between which the OT direction falls and visually interpolating between the two to determine the OT direction. The observer then moves out along this interpolated radial until he has moved the estimated distance. He then marks this point. The observer then compares the terrain near the target with the terrain of his estimated point on the map. If they agree, he can use the polar plot location or read the grid from the map. If they do not agree, he can search along the radial until he finds terrain that matches (see figure 3-8).

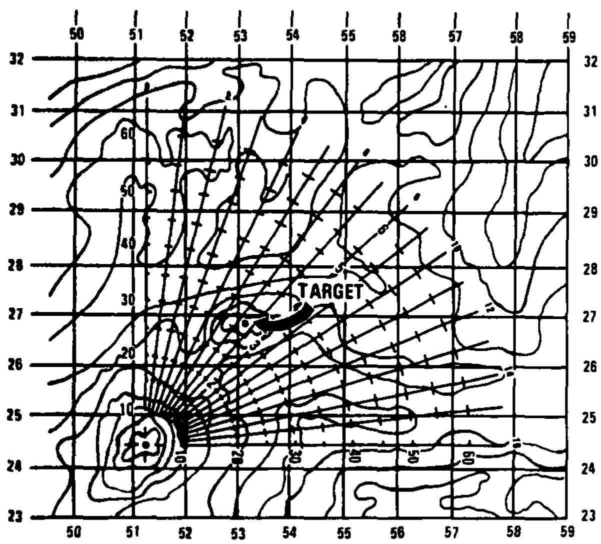


Figure 3-8. Target location using OF fan.

Note. In the figure above the target is located approximately 3000 meters from the observer in a direction of approximately 680 mils. The grid location is approximately 531 269.

d. When the FO is rapidly changing position, he can orient his OF fan over the next prominent terrain or manmade feature he will cross and note the direction to a known point or feature in the target area. In this manner he can maintain the relative orientation of his OF fan to aid in determining direction and target location.

3-5. Terrain Sketch

Another aid in target location is the terrain sketch (fig 3-9). This is a rough panoramic sketch of the terrain as seen by the observer. It should include valleys, hill masses, streams, woods, and roads. Other features such as manmade objects, reference points, and targets should be shown in their approximate positions. Directions and distances, when known, should also be included to help determine target locations.

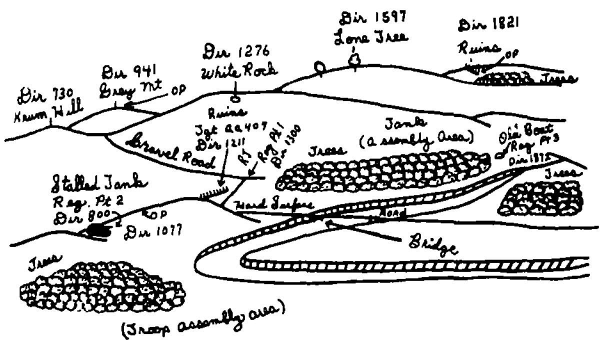


Figure 3-9. Terrain sketch.

3-6. Hand Measurement of Angular Deviation

a. When it is necessary to measure angles to determine direction quickly, the observer may use his hand and fingers as a measuring device (fig 3-10).

b. Every observer should calibrate his hand and fingers to determine the values of the angles for the various combinations of finger and hand positions shown.

c. When calculating and using his hand or fingers in measuring angles, the observer should fully extend his arm so that his hand and fingers will always be at the same distance from his eyes.

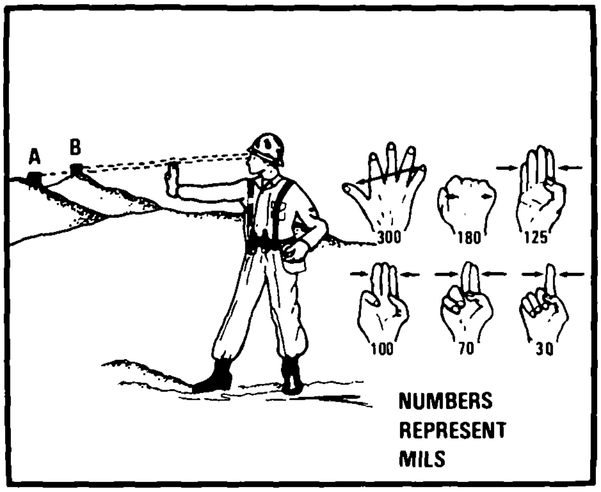


Figure 3-10. Hand measurement of angular deviation.

3-7. Flash-to-Bang Time

When it is necessary to verify observer-target distance, the flash-to-bang technique is helpful. Sound travels at a speed of 350 meters per second. Use the equation:

ELAPSED TIME BETWEEN IMPACT AND SOUND × 350 DISTANCE

When the round first impacts, the number of seconds between round detonation (flash) and when the sound reaches the observer (bang) is multiplied by 350 meters. The answer is the number of meters between observer and the round. This procedure can also be used to determine the distance to enemy weapon muzzle flashes.

CHAPTER 4

CALL FOR FIRE

Section I. ELEMENTS OF THE CALL FOR FIRE

4-1. Introduction

a. A call for fire is a concise message prepared by the observer and containing all information needed by the FDC to determine the method of target attack. The call for fire must be sent rapidly but with enough clarity that it can be understood, recorded, and read back without error by the FDC radio-telephone operator (RATELO). The observer should tell his RATELO that he has seen a target so his RATELO can start the call for fire while the target location is being determined. Information is sent as it is determined rather than waiting until a complete call for fire is prepared.

b. Regardless of the method of target location used, the normal call for fire will be transmitted in a maximum of three parts, with a break and readback after each part. The three parts are:

(1) Observer identification and warning order.

(2) Target location.

(3) Description of target, method of engagement, and method of fire and control.

c. The six elements of the call for fire are listed below in the sequence in which they are transmitted and are discussed in paragraphs 4-2 through 4-7.

(1) Observer identification.

(2) Warning order.

(3) Target location.

(4) Target description.

(5) Method of engagement.

(6) Method of fire and control.

4-2. Observer Identification

This element of the call for fire lets the FDC know who is calling for fire and clears the net for the fire mission.

4-3. Warning Order

The warning order informs the FDC of the type of mission and the type of target location that will be used. The warning order consists of the type of mission, the size of the element to fire for effect, and the method of target location.

a. Type of mission.

(1) Adjust fire (AF). When the observer feels that an adjustment must be conducted (due to questionable target location or lack of registration corrections), he announces ADJUST FIRE.

(2) Fire for effect (FFE). The observer should *always* strive for first round FFE. The accuracy required to fire for effect depends on the target and the ammunition being used. When the observer is certain that the target location is accurate and the first volley would have effect on the target so that little or no adjustment is required, he announced FIRE FOR EFFECT.

(3) Suppress (S). To rapidly bring fire on an on-call target (that is not currently active), the observer announces SUPPRESS (followed by the target identification).

(4) Immediate suppression (IS). When engaging a planned target or target of opportunity that has taken friendly maneuver or aerial elements under fire, the observer announces IMMEDIATE SUPPRESSION (followed by target identification).

b. Size of element to fire for effect. The observer may request the size of the unit to fire for effect; e.g., BATTALION. When the observer says nothing about the size of the element to fire, it is assumed to be a battery.

c. Method of target location.

(1) Polar plot. If the target is located using the polar plot method of target location, the observer announces POLAR; e.g., ADJUST FIRE, POLAR.

(2) Shift from a known point. If the target is located using the shift from a known point method of target location, the observer announces SHIFT (followed by the known point); e.g., ADJUST FIRE, SHIFT AA7730.

(3) Grid. If neither POLAR nor SHIFT is announced, the observer indicates that the grid method of target location is being used. The word "grid" is not announced.

Examples.

(1) *Adjust fire mission.*

GRID:

A57, THIS IS A71, ADJUST FIRE, OVER.

(2) *Fire-for-effect mission.*

POLAR PLOT:

A57, THIS IS A71, FIRE FOR EFFECT, BATTALION, POLAR, OVER.

SHIFT FROM A KNOWN POINT:

A57, THIS IS A71, FIRE FOR EFFECT, SHIFT AA7750, OVER.

(3) *Suppression mission.*

THIS IS F72, SUPPRESS CHECKPOINT 10, OVER.

(4) *Immediate suppression mission.*

THIS IS F72, IMMEDIATE SUPPRESSION, AA7750 OVER.

4-4. Target Location

This element enables the FDC to plot the location of the target in order to determine firing data.

a. In a grid mission, six-place grids normally are sent. Eightplace grids should be sent for registration points or other points for which greater accuracy is required. The OT direction normally will be sent after the entire call for fire is completed, since the FDC does not need it to locate the target.

b. In a shift from a known point mission, the point from which the shift will be made is sent in the warning order. The point must be known to both the observer and the FDC. The observer then sends the OT direction (normally direction to the target will be sent to the nearest 10 mils; however, FDCs will be able to handle mils, degrees, or cardinal directions, whichever is specified by the observer). The lateral shift (how far LEFT or RIGHT the target is from the known point to the nearest 10 meters), the range shift (how much further (ADD) or closer (DROP) the target is in relation to the known point to the nearest 100 meters), and the vertical shift (how much the target is above (UP) or below (DOWN) the altitude of the known point to the nearest 5 meters) are sent next. Unless there is an obvious difference, the vertical shift is ignored (fig 4-1).

c. In a polar plot mission, the word POLAR in the warning order alerts the FDC that the target will be located with respect to the observer's position, which must be known in the FDC. The observer then sends the DIRECTION (to the nearest 10 mils) and DISTANCE (to the nearest 100 meters). A vertical shift to the nearest 5 meters tells the FDC how far the target is located above (UP) or below (DOWN) the observer's location. Vertical shift may also be given in mils.

4-5. Target Description

The observer must describe the target in sufficient detail so the FDC can determine the amount and type of ammunition to use. The FDC would use different ammunition for different types of targets. The observer

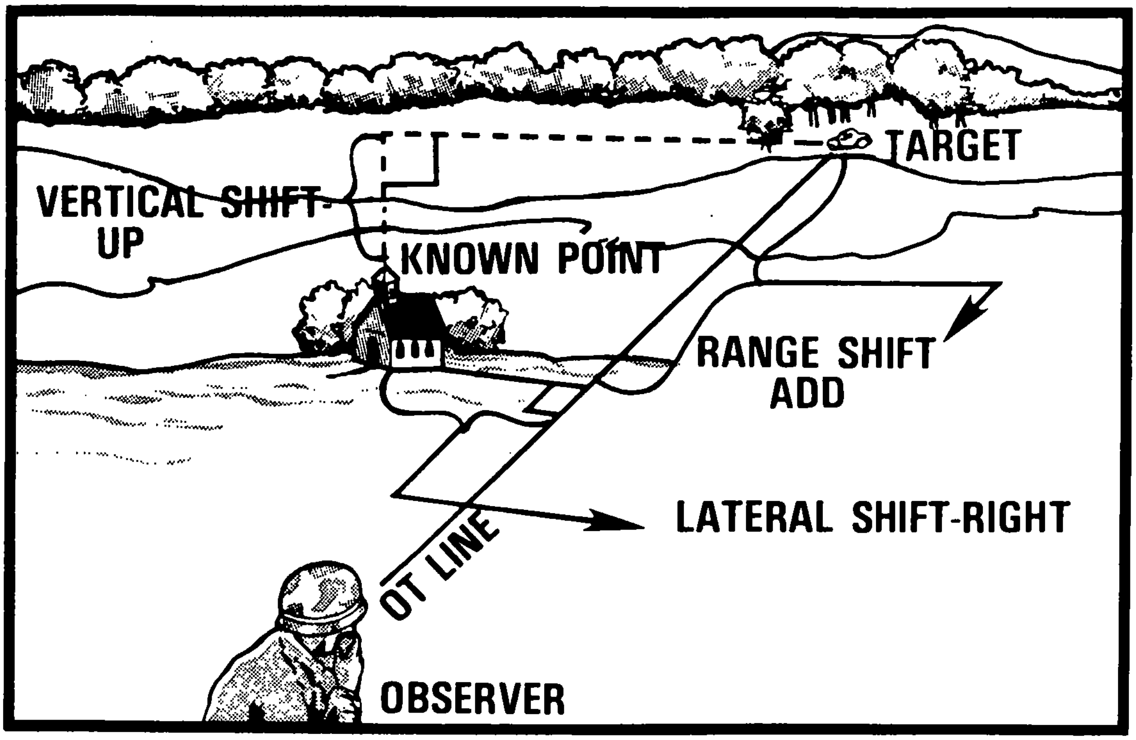


Figure 4-1. Shift from a known point.

should be brief but accurate. The description should contain the following:

a. What the target is (troops, equipment, supply dump, trucks, etc.).

b. What the target is doing (digging in, in an assembly area, etc.).

c. The number of elements in the target (squad, platoon, three trucks, six tanks, etc.).

d. The degree of protection (in open, in foxholes, in bunkers with overhead protection, etc.).

e. The target size and shape if these are significant. When the target is rectangular, the length and width in meters and the attitude (azimuth of the long axis) to the nearest 50 mils should be given (e.g., 400 BY 200, ATTITUDE 2850). When the target is circular, the radius should be given (e.g., RADIUS 200). Linear targets may be described by two or more grids or by grid, length, and attitude.

4-6. Method of Engagement

The observer must indicate how he wants to attack the target. This element consists of the type of engagement, trajectory, ammunition, and distribution. These are discussed below.

a. Type of engagement. Two types of adjustment may be employed—precision or area. Unless precision fire is specified, area fire will be used.

(1) Precision fire is conducted with one piece on a point target. It is used to either obtain registration corrections or destroy a target. When the mission is a registration, it is initiated with a message to observer. If the target is to be destroyed, the observer announces DESTRUCTION.

(2) Area fire is used to attack an area target. Since many area targets are capable of movement, the adjustment should be as rapid as possible, consistent with accuracy, to prevent the target from escaping. A well-defined point at or near the center of the area

to be attacked should be selected and used as an aiming point. This point is called the adjusting point. To achieve surprise, fire may be adjusted on an auxiliary adjusting point, and, after adjustment is completed, shifted to the actual target area. Normally, adjustment on an area target is conducted with one adjusting piece. Two pieces fire when the height of burst for fuze time is being adjusted.

b. The term DANGER CLOSE will be included in the method of engagement when the predicted impact of a round or shell will be within 600 meters of friendly troops for artillery and mortars, 750 meters for naval guns 5-inch and smaller, and 1000 meters for naval guns larger than 5-inch.

c. The term MARK is included in the method of engagement to indicate that the observer is going to call for rounds either:

(1) To orient himself in his zone of observation, or

(2) To indicate targets to ground troops, aircraft, or fire support.

d. Trajectory. If high angle fire is desired, it is requested immediately after the type of engagement. If high angle is not specified, low angle will be used.

e. Ammunition. If the type of ammunition is not specified in the call for fire, shell HE with fuze quick will be fired during the adjustment and fire-for-effect phases. If a different type of ammunition or fuze action is desired during either the adjustment or the fire-for-effect phase, the observer requests it. (See section II.)

(1) Projectile. Examples of requests for other than HE projectile are ILLUMINATION, ICM, and SMOKE.

(2) Fuze. Most missions are fired with fuze quick during the adjustment phase. When requesting a projectile that has only one fuze, the fuze is not indicated. Illumination, ICM, and smoke projectiles are fuzed with time fuzes; therefore, when the observer requests ILLUMINATION, ICM, or SMOKE, he does not announce TIME.

(3) Volume of fire. The observer may request the number of rounds to be fired by the weapons firing in effect; e.g., 3 ROUNDS indicates a battery 3 volleys.

f. Distribution. The observer may control the pattern of bursts in the target area. This pattern of bursts is called a sheaf. Unless otherwise requested, the battery will fire a parallel sheaf, all guns will fire the same data, and the pattern of bursts will resemble the position of the guns in the battery area. A converged sheaf places all rounds on a specific point and is used for small, hard targets. Special sheafs of any length may be requested; e.g., SHEAF 150 METERS. An open sheaf separates the bursts by the maximum effective burst width of the shell fired.

4-7. Method of Fire and Control

The method of fire and control element indicates the desired manner of attacking the target, whether or not the observer desires to control the time of delivery of fire, and whether or not he can observe the target. Methods of fire and control are announced by the observer by use of the terms below.

a. Method of fire. In area fire, the adjustment normally is conducted with one of the center platoon howitzers or center section mortars. If for any reason the observer determines that PLATOON RIGHT (LEFT) will be more appropriate, he may request it. The normal interval of time between rounds fired by a platoon or battery right (left) is 5 seconds. If the observer wants some other interval, he may so specify.

b. Method of control.

(1) At my command. If the observer wishes to control the time of delivery of fire, he includes AT MY COMMAND in the method of control. When the pieces are ready to fire, the FDC announces:

BATTERY (BATTALION) IS READY, OVER.

The observer announces FIRE when he is ready for the pieces to fire. AT MY COMMAND remains in effect throughout the mission until the observer announces:

CANCEL AT MY COMMAND, OVER.

(2) Cannot observe. CANNOT OBSERVE indicates that the observer cannot see the target (because of vegetation, terrain, weather, or smoke); however, he has reason

to believe that a target exists at the given location and that it is of sufficient importance to justify firing on it without adjustment.

(3) Time on target. The observer may tell the FDC when he wants the rounds to impact around the target by requesting:

TIME ON TARGET ________ MINUTES FROM . . . NOW, OVER.

or

TIME ON TARGET 0859, OVER.

The FO must insure 0859 on his watch is 0859 on the FDC's watch by conducting a time check.

(4) Fire when ready. If nothing is specified regarding method of control, each cannon section will fire when ready.

(5) Continuous illumination. If no interval is given by the observer, the FDC/CP will determine the interval by the burning time of the illuminating ammunition in use. If any other interval is required, it will be indicated in seconds.

(6) Coordinated illumination. The observer may order the interval between illuminating and HE shells in seconds to achieve a time of arrival of the HE coincident with optimum illumination, or he may use normal AT MY COMMAND procedures.

(7) Cease loading. The command CEASE LOADING is used during firing of two or more rounds to indicate the suspension of inserting rounds into the gun(s).

(8) Check firing. This command is used to cause a temporary halt in firing.

(9) Continuous fire. In field artillery and naval gunfire, this means loading and firing as rapidly as possible consistent with accuracy within the prescribed rate of fire for the equipment. Firing will continue until temporarily suspended by the command CEASE LOADING or CHECK FIRING.

(10) Followed by .... This is part of a term used to indicate a change in the rate of fire, in the type of ammunition, or in another order for fire for effect.

(11) Repeat.

(a) During adjustment. Fire another round(s) at the last data, adjust for any change in ammunition if necessary.

(b) During fire for effect. Fire the same number of rounds at the same method of fire for effect as last ordered. Alterations to the number of guns, the gun data, the interval, or the ammunition may be ordered.

4-8. Corrections of Errors

a. Errors are sometimes made in transmitting data or by the FDC personnel in reading back the data. If the observer realizes that he has made an error in his transmission or that the FDC has made an error in the readback, he announces CORRECTION and transmits the correct data.

Example.

The observer has transmitted:

SHIFT REGISTRATION POINT 2, OVER, DIRECTION 4680 . . .

He immediately realizes that he should have sent DIRECTION 5680. He announces:

CORRECTION, DIRECTION 5680.

After receiving the correct readback, he may continue to send the remainder of the call for fire.

b. When an error has been made in a subelement and the correction of that subelement will affect other transmitted data, the word CORRECTION is announced and then the correct subelement and all affected data are transmitted in the proper sequence.

Example.

The observer transmitted:

LEFT 200, ADD 400, UP 40, OVER.

He then realizes that he should have sent DROP 400. To correct this element, he sends:

CORRECTION LEFT 200, DROP 400, UP 40, OVER

because the LEFT 200 and UP 40 will be canceled if they are not included in the corrected transmission.

4-9. Calls for Fire From Headquarters Higher Than Battalion

Calls for fire from higher headquarters and calls for fire from the observer are similar in format. The call for fire from higher headquarters may specify the unit to fire for effect; however, the observers call for fire can only request the fire unit. An example of a call for fire from higher headquarters is as follows:

Warning order	FIRE FOR EFFECT, BATTALION, OVER.
Target location	TARGET AA7731 (or GRID 432789, ALTITUDE 520)
Method of engagement	VT, 3 ROUNDS
Control	TIME ON TARGET IS 10 MINUTES FROM...NOW, OVER.

4-10. Message to Observer (MTO)

a. After the FDC receives the call for fire, it will determine how the target will be attacked. That decision is announced to the observer in the form of a message to observer. The message to observer consists of three items:

(1) Unit(s) to fire—the battery or batteries that will fire the mission. If the battalion is firing in effect with one battery adjusting, the FDC will designate the fire-for-effect unit (battalion) and the adjusting unit (BRAVO).

Example.

ALFA . . . or BATTALION, BRAVO . . .

(2) Changes to the call for fire—any changes to what the observer requested in the call for fire.

Example.

The observer requested ICM in effect and the FDO decides to fire VT in effect:

ALFA, VT IN EFFECT . . .

(3) Number of rounds—the number of rounds per tube in fire for effect.

Example.

Continuing the above example, the FDO will fire a battery 4 rounds:

ALFA, VT IN EFFECT, 4 ROUNDS

b. The additional information shown below will normally be transmitted separately from the message to the observer.

(1) Probable error in range (PE_R). If PE_R is greater than or equal to 38 meters during a normal mission, the FDC will inform the observer. If PE_R is greater than or equal to 25 meters in a precision registration, the FDC will inform the observer.

(2) Angle T. Angle T is sent to the observer when it is greater than or equal to 500 mils or when requested.

(3) Time of flight. Time of flight is sent to an air observer during a moving target mission, during an aerial observer mission, or when requested.

c. A target number will not be assigned to a target of opportunity unless the observer so requests and FDO agrees or the FDO or the FSO directs that it be recorded as a target. The target number will be sent to the observer at the completion of the mission.

Note. Normally, target numbers are assigned to artillery units by higher authority for fire planning purposes.

Observer:	LEFT 10, ADD 10, RECORD AS TARGET, END OF MISSION, ESTIMATE 6 CASUALTIES, OVER.
FDO:	LEFT 10, ADD 10, RECORD AS TARGET, END OF MISSION, ESTIMATE 6 CASUALTIES, TARGET AA7732, OVER.
Observer:	TARGET AA7732, OUT.

Note. THE FDC WILL SEND THE REPLOT GRID AS SOON AS IT IS AVAILABLE.

d. Messages to observers for registrations are shown in chapter 5 of FM 6-40.

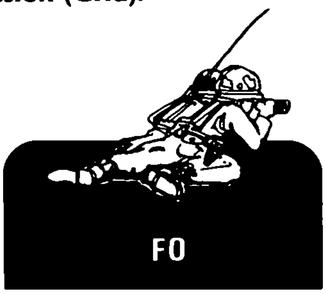
4-11. Authentication

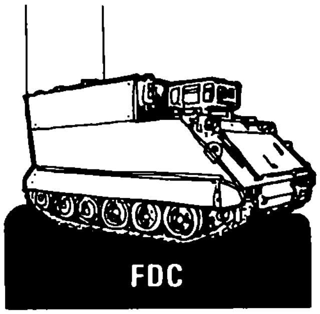
Excluding unique FA support operations (e.g., dedicated battery, suppressive fires posture), challenge and authentication is considered a *normal* element of initial requests for artillery fire. The FDC inserts the challenge in the last readback of the fire request (see examples in para 4-12). The FO transmits the correct authentication reply to the FDC immediately following the challenge. Authentication replies exceeding 15-20 seconds are automatically suspect and a basis for rechallenge. Subsequent adjustment of fire or immediate engagement of additional targets by the FO originating the initial fire request normally would not require continued challenge by the FDC.

4-12. Sample Missions

The following are sample calls for fire and FDC responses for various type missions:

Fire Mission (Grid).





Initial Fire Request

FO: Z57, THIS IS Z71, ADJUST FIRE, OVER.

FDC: Z71, THIS IS Z57, ADJUST FIRE, OUT.

FO: GRID 180513, OVER.

FDC: GRID 180513, OUT.

FO: INFANTRY PLATOON IN THE OPEN, VT IN EFFECT, OVER.

FDC: INFANTRY PLATOON IN THE OPEN, VT IN EFFECT, AUTHENTICATE PAPA BRAVO, OVER.

FO: I AUTHENTICATE CHARLIE, OUT.

Message to Observer

FDC: BRAVO, 2 ROUNDS, OVER.

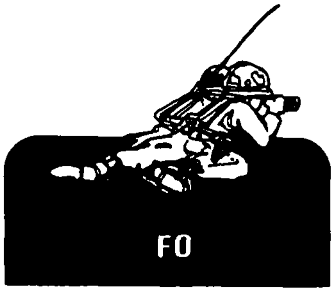
FO: BRAVO, 2 ROUNDS, OUT.

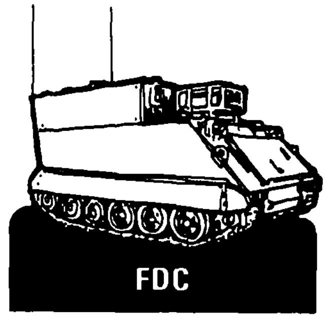
Direction (must be sent before or with first correction)

FO: DIRECTION 1650, OVER.

FDC: DIRECTION 1650, OUT.

Fire Mission (Shift From a Known Point).





Initial Fire Request

H66,THIS IS H44, ADJUST FIRE, SHIFT AA7733, OVER.

THIS IS H66, ADJUST FIRE, SHIFT AA7733, OUT.

DIRECTION 5210, LEFT 380, ADD 400, DOWN 25, OVER.

DIRECTION 5210, LEFT 380, ADD 400, DOWN 25, OUT.

COMBAT OP IN OPEN, ICM IN EFFECT, OVER.

COMBAT OP IN OPEN, ICM, AUTHENTICATE LIMA FOXTROT, OVER.

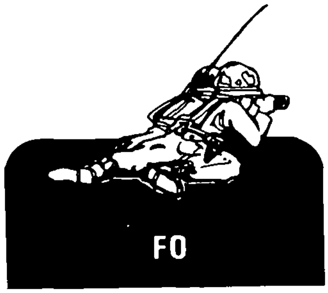
I AUTHENTICATE PAPA, OUT.

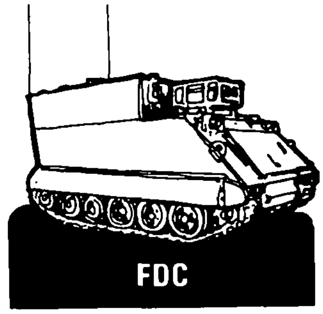
Message to Observer

CHARLIE, 1 ROUND, OVER.

CHARLIE, 1 ROUND, OUT.

Fire Mission (Polar Plot).





Initial Fire Request

Z56, THIS IS Z31, FIRE FOR EFFECT, POLAR, OVER.

Z31, THIS IS Z56, FIRE FOR EFFECT, POLAR, OUT.

DIRECTION 4520, DISTANCE 2300, DOWN 35, OVER.

DIRECTION 4520, DISTANCE 2300, DOWN 35, OUT.

INFANTRY COMPANY IN OPEN, ICM, OVER.

INFANTRY COMPANY IN OPEN, ICM, AUTHENTICATE TANGO FOXTROT, OVER.

I AUTHENTICATE ECHO, OUT.

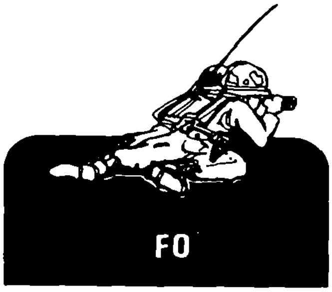
Message to Observer

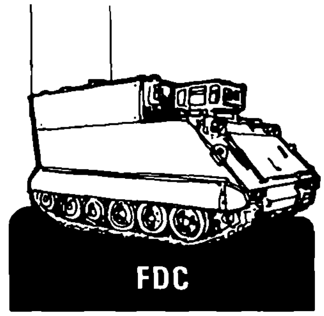
BATTALION*, VT**, 3 ROUNDS, OVER.

BATTALION, VT, 3 ROUNDS, OUT.

*Bn FDO directed a battalion mass mission.
**FDO changed shell to HE/VT.

FIRE MISSION (Suppression).

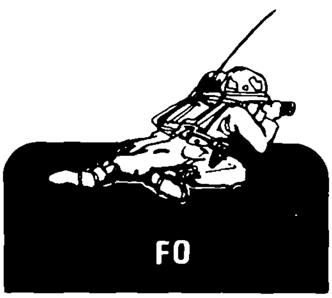


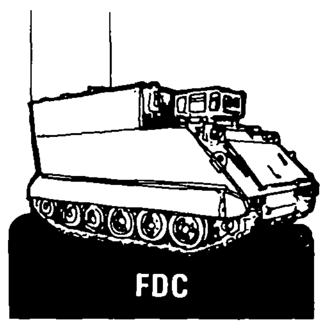


H18, THIS IS H24, SUPPRESS 31, OVER.

THIS IS H18, SUPPRESS 31, OUT.

FIRE MISSION (Immediate Suppression).





THIS IS H24, IMMEDIATE SUPPRESSION, GRID 211432, OVER.

THIS IS H69, IMMEDIATE SUPPRESSION, GRID 211432, OUT.

Section II. SHELL/FUZE COMBINATIONS

4-13. Desired Effects

Once the observer has located a target, he must decide how he wants to attack the target to get maximum effect. A thorough knowledge of the ammunition available to him will allow a rapid selection of the correct type of shell and fuze to use against the target. If not specified by commander's guidance, the first decision the observer must make is what type of effect he desires. He has three choices: destruction, neutralization, or suppression.

a. Destruction puts a target out of action permanently. Thirty percent or more casualties will normally render a unit combat ineffective. Direct hits with HE or CP shells are required to destroy hard material targets. Destruction usually requires large expenditures of ammunition and is not considered an economical mission.

b. Neutralization knocks a target out of action temporarily. Ten percent or more casualties will neutralize a unit. Neutralization can be achieved using any type shell/fuze combination suitable for attacking a particular type target. Neutralization does not require an extensive expenditure of ammunition and is the most practical type mission.

THE MAJORITY OF ALL MISSIONS WILL BE NEUTRALIZATION FIRE

c. Suppression of a target limits the ability of the enemy personnel in the target area to perform their jobs. Firing HE/VT or smoke creates apprehension and confuses the enemy. The effect of suppressive fires usually lasts only as long as the fires are continued. Suppression requires a low expenditure of ammunition; however, its inability to place lasting effect on a target makes it an unsuitable type mission for most targets.

d. To decide whether to use impact fuze action (produces ground bursts) or time fuze action (produces airbursts), the observer should consider:

(1) The nature of the target.

(2) The cover available to the enemy.

(3) The mobility of the target.

(4) Whether or not adjustment is required.

e. See appendix A for a thorough discussion of munitions effects and examples of optimum shell/fuze combinations for particular targets.

4-14. Shell HE and Fuzes

Shell HE (high explosive) is the standard shell used by the observer. Shell HE can be used with impact, time, or proximity (VT) fuzes for various effects.

a. Shell HE, fuze quick. Shell HE, fuze quick bursts on impact. It is used against

Personnel standing
Personnel prone on the ground
Unarmored vehicles
Light materiel

Shell HE, fuze quick loses its effect if troops are in trenches, on uneven ground, in frame buildings, or on earthworks.

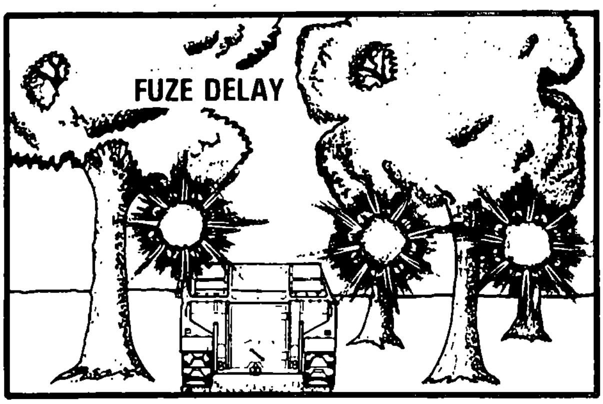


Figure 4-2. Fuze delay.

b. Shell HE, fuze delay (fig 4-2). A 0.05-second delay can be set on the quick fuze to allow either ricochet fire or penetration. If the observer is firing into dense woods, against light earthworks or buildings, or against unarmored vehicles, he should use fuze delay for penetration. If a very high charge is fired at a small angle of impact on a very hard surface, a ricochet may occur. These limitations restrict the use of ricochet fire.

c. Shell HE, fuze time. Shell HE, fuze time bursts in the air at a given time along the trajectory. Its fragmentation pattern is shown in figure 4-3. It is used against:

[illegible] in trenches Troops in deep foxholes

Fuze time must be adjusted to the proper height of burst. Therefore, consideration should be given to another shell/fuze combination if time is critical and airbursts are desired. Fuze time should not be used for high angle missions.

d. Shell HE, fuze VT. The VT fuze (or proximity fuze) is a radio activated fuze that detonates at a predetermined height of burst. A VT fuze provides the same effect as fuze time but does not have to be adjusted. Therefore, it is excellent to fire with shell HE for surprise and unobserved fires. Also, it is very effective in high angle fires. It is used against:

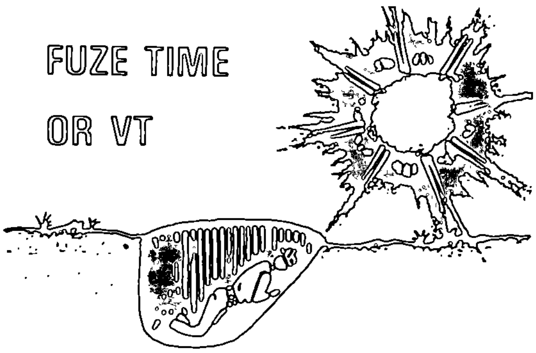


Figure 4-3. Fuze time or VT.

Note. VT fuzes M513 and M514 series should not be used in the rain or on targets that are on water, snow, or ice. The M728 VT fuze is not sensitive to water, snow, ice, or rain and may be used. Model M728 VT fuze detonates at approximately 7 meters height of burst (HOB) and can easily be misspotted as a graze burst. M513 and M514 model fuzes detonate at approximately 20 meters HOB.

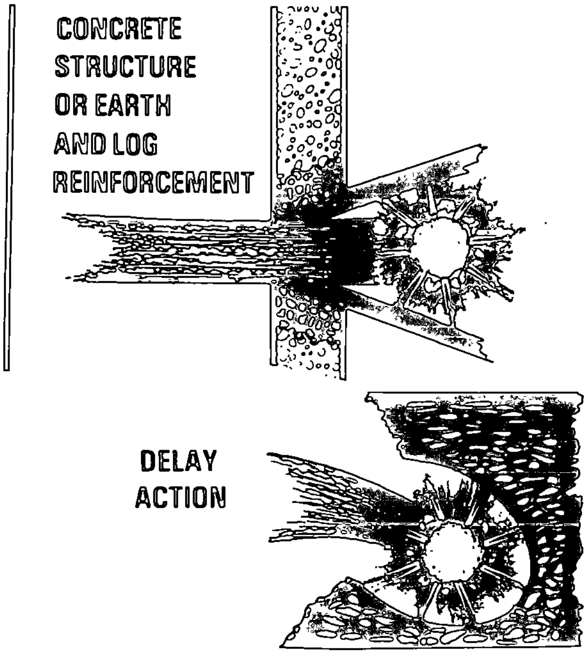


Figure 4-4. Fuze concrete piercing.

e. Shell HE, fuze concrete piercing (CP). The CP fuzes are used with shell HE against concrete structures or earth and log reinforced emplacements. There are two types of CP fuzes: a nondelay (used primarily for spotting, or for clearing rubble and shattering concrete) and a delay (used to destroy the concrete target) (fig 4-4).

4-15. Improved Conventional Munitions (ICM)

Shell ICM is a high explosive, base-ejection projectile that consists of a mechanical time fuze and a body assembly containing grenades. When the fuze functions, the grenades are dispersed and cover a large area. The dual purpose ICM (DPICM) round is used against personnel and also has a shaped charge that is effective against lightly armored vehicles. The DPICM may also be used in a registration mode. Because of the large area covered, limited use is recommended close to unprotected friendly troops. It is used against TROOPS AND LIGHT VEHICLES IN THE OPEN.

4-16. Shell WP, Fuze Quick

Shell WP (white phosphorus) has three uses: incendiary, marking, and screening. It can be used to destroy the enemy's equipment or to obscure his vision. It is used against:

[redacted]

Also, shell WP can be used as an aid in target location and navigation.

[redacted]

4-17. Shell Smoke

Shell smoke is a base-ejection projectile that is filled with canisters containing smoke. It is more effective than white phosphorus as a screening agent because it lasts longer and has less tendency to pillar. The direction of the wind must be considered in the employment of any smoke shell (WP or canister). Further employment considerations can be found in chapter 6.

4-18. Shell Illumination

The illumination shell is a base-ejection projectile containing a flare attached to a parachute. Shell illumination is normally employed to illuminate areas of known or suspected enemy activity, or to adjust artillery fire at night. Depending on caliber, an illumination shell can provide light for up to 2 minutes and illuminate an area of up to 1000 meters in diameter (see chapter 6).

4-19. Shell FASCAM

a. The family of scatterable mine (FASCAM) shells are used to deliver antipersonnel or antitank mines by a 155-mm artillery weapon against an enemy force to deny access to a particular area, delay the attacking force, or canalize them.

b. This all-weather, day-or-night mine emplacement system can be used in offensive, defensive, or retrograde operations. ANTITANK MINES ARE USED TO CREATE ANTITANK OR ANTI-VEHICLE OBSTACLES. Antipersonnel mines are used in conjunction with antitank mines to create antitank obstacles difficult for dismounted personnel to breach.

c. Antipersonnel mines can also be employed alone TO CREATE ANTI-PERSONNEL OBSTACLES, TO DISRUPT DISMOUNTED PERSONNEL OPERATIONS, TO RESTRICT ENEMY USE OF TERRAIN, AND IN COUNTERFIRE.

d. All of these mines have a short or long self-destruct time, depending upon the type of shell fired to the target area.

CHAPTER 5

ADJUSTMENT OF FIRE

Section I. SUBSEQUENT CORRECTIONS

An observer's prime concern is the placement of accurate surprise fires on targets presented to him. If an observer can locate the target accurately, he will request FIRE FOR EFFECT (FFE) in his call for fire. Failure to locate the target accurately may result from poor visibility, deceptive terrain, poor maps, or difficulty on the part of the observer in pinpointing the target. When the observer cannot locate the target with sufficient accuracy to warrant FFE, he must conduct an adjustment. Even with an accurate target location, if current firing data corrections are not available, the fire direction officer (FDO) may direct that an adjustment be conducted. Normally, one gun is used in adjustment. Special situations where more than one gun is used are so noted throughout the text.

When it is necessary for the observer to adjust fire, he must select an adjusting point. In the conduct of a registration or destruction mission (precision fire), the adjusting point is the target itself. In area missions, the observer must select a well-defined point near the center of the target area on which to adjust the fire. The point selected is called an adjusting point (fig 5-1) and the location of this point is included in the target location element of the call for fire in an area fire mission.

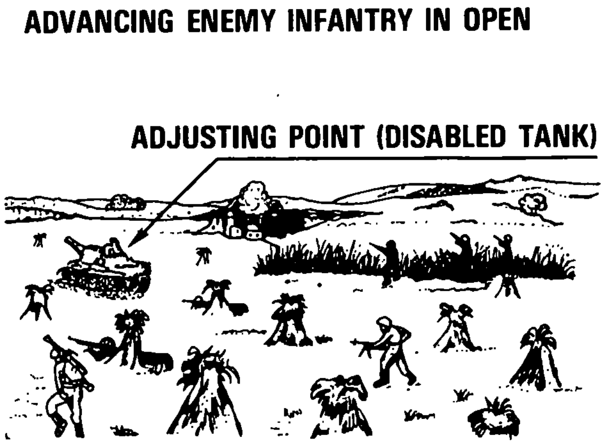


Figure 5-1. Adjusting point in an area fire mission.

5-1. Spottings

A spotting is the observer's determination of the location (or the mean point of impact of a group of bursts) with respect to the adjusting point as observed along the observer-target (OT) line. Spottings are made for deviation (i.e., the number of mils right or left of the OT line), for range (i.e., whether the burst occurred beyond or short of the target), and, in time fire, for the height of burst (HOB) (i.e., the number of mils the burst is above the target). Spottings must be made by the observer the instant the bursts occur, except when the spottings are delayed deliberately to take advantage of drifting smoke or dust. The observer is usually required to announce his spottings during his early training; in combat, he makes spottings mentally. The observer should consider spottings in the order that gives the most difficult spotting first. The sequence and accuracies of spottings are HOB to the nearest 1 mil, range over or short, and deviation to the nearest 5 mils.

a. HOB spottings.

(1) *AIR.* A round or group of rounds that bursts in the air is spotted as AIR and the number of mils above the target.

(2) *GRAZE.* A round or group of rounds that bursts on impact is spotted as GRAZE.

(3) *MIXED.* When an equal number of airbursts and graze bursts are obtained in the same group of rounds, the HOB spotting for the group is MIXED.

(4) *MIXED AIR.* A group of rounds resulting in both airbursts and graze bursts is spotted as MIXED AIR when the majority of the bursts are airbursts.

(5) *MIXED GRAZE.* A group of rounds resulting in both airbursts and graze bursts is spotted as MIXED GRAZE when the majority of the bursts are graze bursts.

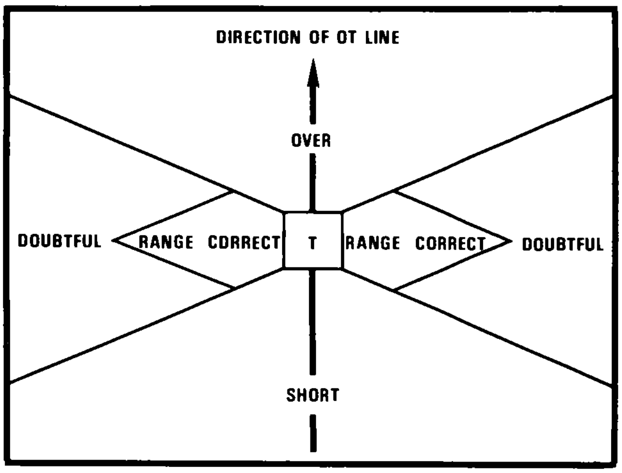


Figure 5-2. Range spottings.

b. Range spottings. Definite range spottings are required to make a proper range adjustment. Any range spotting other than DOUBTFUL or LOST (UNOBSERVED) is definite. Normally, a burst on or near the OT line gives a definite range spotting. Figure 5-2 is a guide showing approximate areas for various range spottings. An observer may make a definite range spotting when the burst is not on or near the OT line by using his knowledge of the terrain, drifting smoke, shadows, and wind. However, even experienced observers must use caution and good judgment when making such spottings. Possible range spottings are as follows:

(1) *OVER.* A burst that appears beyond the adjusting point is spotted as OVER for range.

(2) *SHORT.* A burst that appears between the observer and the adjusting point is spotted as SHORT for range.

(3) *TARGET.* An impact burst that hits the target is spotted as TARGET. This spotting is used only in precision fire (registration or destruction missions).

(4) *RANGE CORRECT.* A burst that appears to be at the correct range is spotted as RANGE CORRECT.

(5) *DOUBTFUL.* A burst that can be observed but cannot be spotted as OVER, SHORT, TARGET, or RANGE CORRECT is spotted as DOUBTFUL.

(6) *LOST.* Burst location cannot be determined by sight or sound.

(7) *UNOBSERVED.* Burst not observed but known to have impacted.

(8) *UNOBSERVED OVER (SHORT).* Burst not observed but known to have impacted over or short.

c. Deviation spottings. A deviation spotting is the angular amount and direction of the deviation as seen from the observer's position. During the conduct of a fire mission, the observer measures the deviation, in mils, with an angle-measuring instrument, usually his binoculars. Possible deviation spottings are LINE when the burst is on the OT line or (so many mils) RIGHT or LEFT. For example, an observer sees a burst to the right of the OT line. He measures the angular deviation as 20 mils. His deviation spotting is 20 RIGHT. Deviation measurements are taken from the center of a single burst, or, in the case of platoon or battery fire, from the center of the group of bursts and should be measured to the nearest 5 mils. During precision registration, deviation is measured to the nearest mil.

Note. Deviation corrections should be made as accurately as possible to assist in obtaining definite range spottings. If a definite range spotting can be made, minor deviation corrections need not be made until FFE.

> Example (fig 5-3).
>
> If the adjusting point is at the center of the binocular reticle pattern, the observer would spot this round for deviation as 20 LEFT.

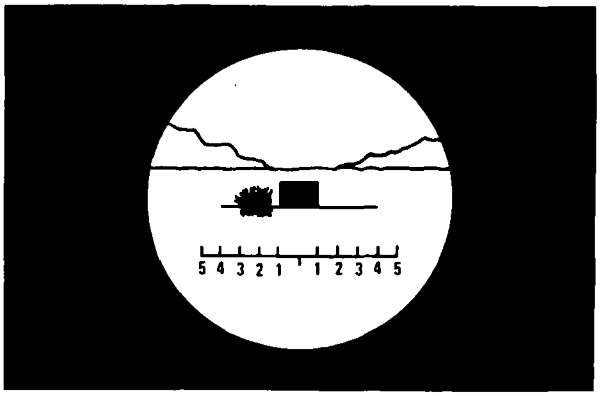


Figure 5-3. Deviation spotting 20 LEFT.

> Example (fig 5-4).
>
> The observer would spot this round for deviation as LINE.

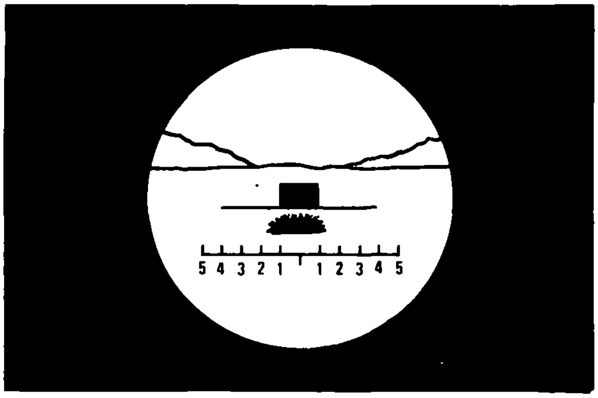


Figure 5-4. Deviation spotting, LINE.

d. Unobserved/lost spottings. Under certain conditions, the observer may be able to make a spotting even though he is unable to see the burst. For example, if the observer hears but does not see a burst and the only possible place the burst could occur and not be visible to the observer is in a ravine beyond the adjusting point, then he should assume that the burst is beyond the adjusting point and is UNOBSERVED (OVER).

(1) If visibility is temporarily impaired (e.g., if the FO has to take cover from incoming enemy fire or if target area visibility is obstructed by smoke, dirt, etc.), or if the observer is unable to obtain an accurate spotting (e.g., if the FO cannot determine which burst among several is his), he reports UNOBSERVED, REPEAT.

(2) If the observer is unable to identify the burst, the round is spotted as LOST.

(3) A round may be lost for various reasons: it may be a dud, resulting in no visual or audible identification; the terrain may prevent the observer from sighting the round or its smoke; the weather may prevent the observer from hearing or seeing it; the FO may simply have failed to spot the round; and errors by the observers, FDC, or the firing piece may cause the round to be lost.

(4) When dealing with a lost round, the FO must consider his own experience, the level of FDC/cannon section training, and the location of friendly elements with respect to the target. The observer should take corrective action based on his confidence in the target location, the accuracy of fire on previous missions, whether the lost round is an initial round or a subsequent round, and the urgency of the mission.

(5) When a round is lost, positive action must be taken. The observer can initiate a number of corrective procedures, such as one or more of the following:

(a) Initiate a data check throughout the system starting with his target location data and his call for fire.

(b) Request WP round, smoke round, or a 200-meter airburst with HE on the next round.

(c) Repeat.

(d) End the mission and initiate a new mission.

(e) Make a bold shift. The observer should exercise caution before making a bold range or deviation change when the target plots in the vicinity of friendly troops.

5-2. Types of Corrections

After a spotting determination has been made, the observer will send corrections, in meters, to the FDC to move the burst of the round. The corrections are sent to the FDC in reverse of the order used in making spottings (i.e., deviation, range, HOB).

a. Deviation corrections.

(1) The distance in meters that the burst is to be moved is determined by multiplying the observer deviation in mils (the deviation spotting) by the OT distance in thousands of meters (the OT factor). Deviation corrections are expressed to the nearest 10 meters. A deviation correction of 20 meters or less is considered a minor deviation and will be ignored during any area fire mission, except when providing final refinement data.

(2) For determining the OT factor when the OT distance is greater than 1000 meters, the distance is rounded to the nearest thousand and expressed in thousands.

Example.
OT distance = 4200 meters
OT factor = 4

For an OT distance less than 1000 meters, the distance is rounded to the nearest 100 meters and expressed in thousands.

Example.
OT distance = 800 meters
OT factor = .8

(3) The computed deviation correction is announced to the fire direction center as LEFT (RIGHT) (so much), the direction of the correction being opposite that of the spotting.

(4) Determination of deviation corrections is illustrated in figure 5-5.

(5) When the angle between the OT line and GT line (angle T, fig 5-6) is 500 mils or greater, the fire direction center will notify the observer of this fact. When the observer has been told that angle T is 500 mils or greater, his initial action is to continue to use his OT factor to make his deviation corrections. However, if he observes that he is getting much more of a correction than he asked for, he should consider cutting his corrections proportionately and continuing the mission.

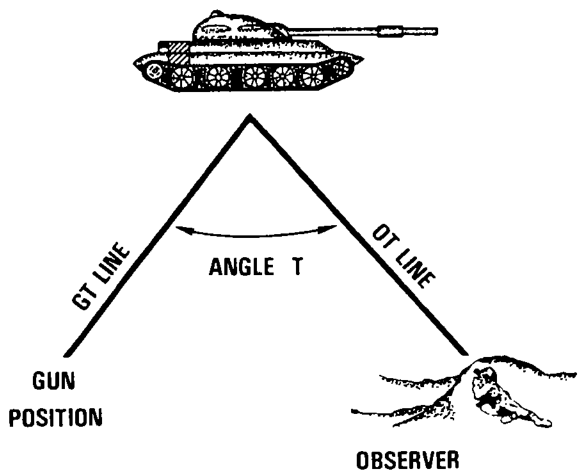


Figure 5-6. Angle T.

b. Range corrections.

(1) In conducting an adjustment on a target, the observer should establish a range bracket as early in the adjustment as

EXAMPLE	OT DISTANCE (METERS)	OT FACTOR	SPOTTING	DEVIATION CORRECTION
1	4,000	4	40R	LEFT 160
2	2,500	2	100L	RIGHT 200
3	3,400	3	50L	RIGHT 150
4	1,500	2	20R	LEFT 40
5	800	0.8	40L	RIGHT 30

Figure 5-5. Determination of deviation corrections.

possible. When the first definite range spotting is made, the observer should make a range correction that will cause the next round to be spotted opposite that of the previous round. For example, if the first definite range spotting is SHORT, the observer should ADD a sufficient amount to obtain an OVER spotting on the next round. Likewise, if the spotting is OVER, he should DROP a sufficient amount to obtain a SHORT on the next round. The observer then cuts each range correction in half, successively moving each round closer to the target (figs 5-10 through 5-13).

(2) For inexperienced observers, range changes should be made in multiples of even 100 meters (200, 400, 800, etc.) to facilitate establishing and splitting range brackets. In the final analysis, the observer must base his corrections on his estimation of the location of the bursts. After establishing a range bracket, the observer splits the existing bracket until fire for effect is appropriate. The observer normally enters fire for effect when splitting a 100-meter bracket, or when he obtains a spotting of RANGE CORRECT.

(3) Throughout the adjustment phase, it is essential that the observer exercise good judgment rather than automatically split the range bracket. For example, the observer adds 800 meters after an initial range spotting of SHORT. The second range spotting is OVER, but the burst is much closer to the adjusting point than the initial burst. A range change of DROP 200 rather than DROP 400 would be appropriate. The observer must be aggressive in his conduct of the adjustment phase of an adjust fire mission and must use every opportunity to shorten that phase. He should make every effort to correct the initial round onto the target and enter fire for effect as soon as possible. Successive bracketing procedures should be used only when time is not critical.

c. HOB corrections (fig 5-7).

(1) Two guns are used when adjusting time fuze. When firing fuze time, the HOB is adjusted (after a 100-meter bracket has been established using fuze quick) by the observer to obtain a 20-meter HOB in fire for effect. He

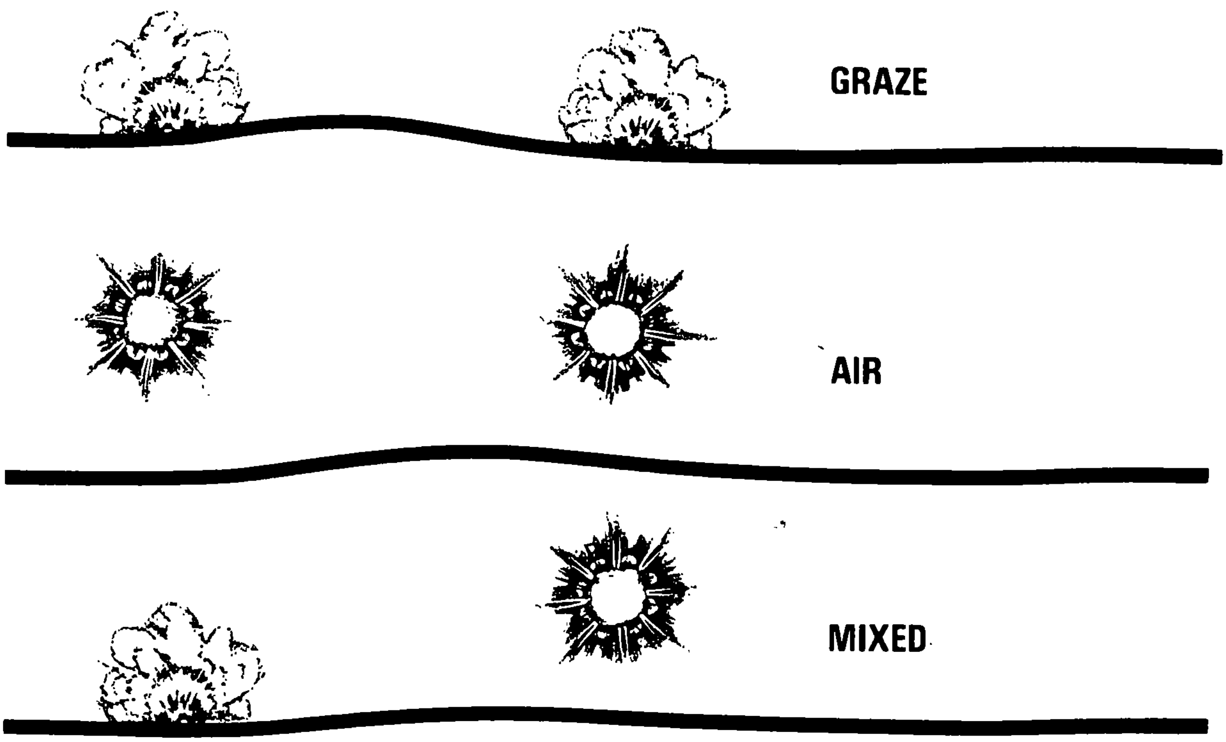


Figure 5-7. Height of burst spottings.

does this by announcing a correction of UP (DOWN) (so much).

(2) When the spotting of the initial rounds is GRAZE, an automatic correction of UP 40 is given. When the initial rounds are spotted as MIXED, an automatic correction of UP 20 is given. When the rounds are all airbursts, the mean HOB of the rounds (in meters) is computed (observed vertical angular deviation in mils above the adjusting point multiplied by the OT factor). The appropriate HOB correction is given (to the nearest 5 meters) to obtain the desired HOB.

(3) Fire for effect is entered only when a correct HOB (i.e., 20 meters) is assured. Therefore, fire for effect is never begun when the last bursts observed resulted in all graze bursts. When the last rounds before entry into fire for effect are spotted as MIXED, the correction of UP 20 will be given when requesting fire for effect. If the initial rounds in fire for effect are spotted as MIXED (50 percent airbursts and 50 percent graze bursts), the subsequent surveillance report will normally include the correction UP 20.

(4) The procedures described above are the normal procedures; however, because of dispersion, terrain, and errors, departures from these procedures based on judgment may be appropriate.

5-3. Sequence of Subsequent Corrections

a. After the initial burst(s) appears, the observer transmits subsequent corrections until the mission is completed. These corrections include appropriate changes in elements previously transmitted and the necessary corrections for deviation, range, and HOB. Elements that may require correcting and the order in which corrections are announced are as follows:

(1) Observer-target direction.

(2) Danger close.

(3) Trajectory.

(4) Method of fire.

(5) Distribution.

(6) Projectile.

(7) Fuze.

(8) Volume.

(9) Deviation.

(10) Range.

(11) Height of burst.

*(12) Control.

(13) Splash.

(14) Repeat.

* Note. Target description is sent before control correction during immediate suppression missions and when attacking a new target without sending a new call for fire.

b. Any element for which a change or correction is not desired is omitted.

c. The following guidelines are given for subsequent corrections:

(1) Change in observer-target direction. A change in the observer-target direction is made when it deviates from the announced direction by more than 100 mils. For example, an observer began an adjustment on several self-propelled guns, using a tree at direction 5620 as the adjusting point. During the adjustment, the self-propelled guns moved to a new position an appreciable distance from the initial adjusting point. The observer selects a new adjusting point and measures a direction of 5840 to the new point. Since the difference between the directions to the old and new adjusting points exceeds 100 mils, the first element in the observer's next correction is DIRECTION 5840.

(2) Danger close. If FA/mortar fires will impact within 600 meters of friendly troops or NGF within 750 meters for 5-inch guns and 1000 meters for 6-inch and larger guns, the observer must inform the FDC by transmitting DANGER CLOSE. When DANGER CLOSE has been announced, each gun to fire for effect will be fired during the adjustment. The observer, using creeping fire (para 5-7) will make corrections from the round closest to friendly troops. If the adjustment of fire moves the rounds more than 600 meters from friendly troops, the observer transmits CANCEL DANGER CLOSE.

(3) Change in trajectory. The observer requests a change in the type of trajectory when it becomes apparent that high angle fire is necessary during a low angle adjustment or when it becomes apparent that high angle fire is no longer necessary during a high angle adjustment. For example, an observer is making an adjustment on some armored personnel carriers. During the adjustment, the vehicles move into deep gullies for protection. The observer knows from previous firing that high angle fire will be necessary to bring effective fire into the gullies. On the basis of this information, the observer makes a change in the type of trajectory by transmitting the correction HIGH ANGLE. Conversely, the observer changes from high angle to low angle fire when the high angle trajectory is no longer required. For example, an observer began an adjustment on a group of vehicles halted along a street between high buildings. During the adjustment, the vehicles moved to the edge of town. As soon as he notes the vehicles moving from the area of tall buildings, the observer decides that high angle fire is no longer required. He makes the change to low angle trajectory by transmitting the correction CANCEL HIGH ANGLE.

(4) Change in method of fire. The observer transmits any correction he desires to make in the method of fire. For example, if the observer desires to change from one gun to a platoon firing in order from left to right, he transmits the correction PLATOON LEFT. If he desires to change to a platoon firing in order from right to left, he transmits the correction PLATOON RIGHT.

(5) Change in distribution (figures 5-8, 5-9). When an observer desires to change the distribution of fire from a parallel sheaf to another type of sheaf, he transmits the sheaf desired (e.g., CONVERGE, OPEN, or SHEAF 100 METERS). Conversely, if the observer desires to change from a specific sheaf to a parallel sheaf, he transmits the correction CANCEL followed by the type of sheaf being used (e.g., CANCEL CONVERGE (OPEN) SHEAF).

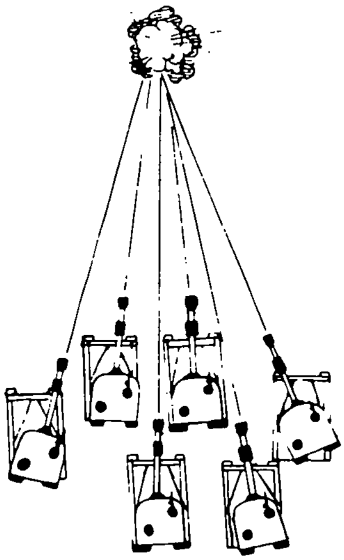


Figure 5-8. Converged sheaf.

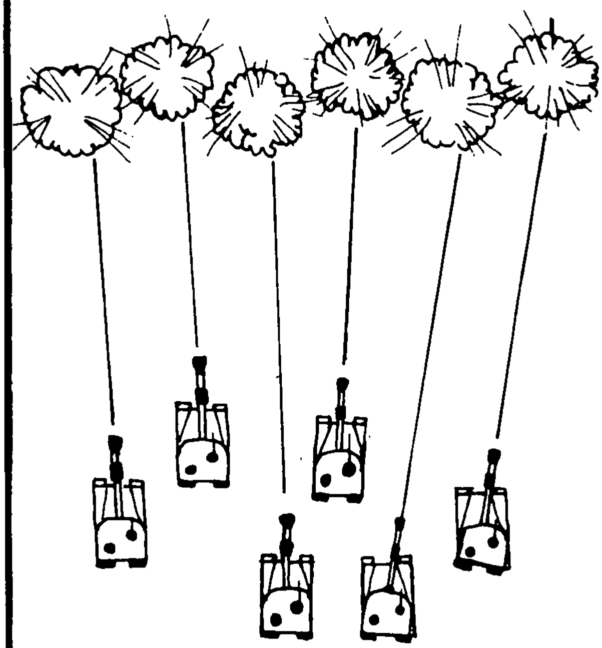


Figure 5-9. Open sheaf.

(6) Change in projectile. When the observer desires to change the type of projectile, he announces the desired change (e.g., SMOKE, WP).

(7) Change in fuze. When the observer desires to change the type of fuze or fuze action, he announces the desired change (e.g., DELAY, VT).

(8) Change in volume. When the observer desires to change the volume of fire, he announces the desired change (e.g., TWO ROUNDS or THREE ROUNDS).

(9) Correction for deviation. When the burst hits to the right or left of the OT line, the observer determines the correction required, to the nearest 10 meters, to bring the burst to the OT line. To make the correction, the observer transmits RIGHT (LEFT) (so much). If there is no deviation correction, the deviation element is omitted from the subsequent corrections.

(10) Correction for range. Range corrections are transmitted as ADD (DROP) (so much). If the burst appears beyond the target from the observer's position, the observer's correction is DROP (so much). If the burst appears between the observer and the target, the range correction is ADD (so much). If the observer does not desire a range correction, the range element is omitted from subsequent corrections.

(11) Correction for HOB. The observer transmits HOB corrections to the nearest 5 meters with the correction UP (DOWN) (so much). The desired HOB is 20 meters. In an area mission, HOB corrections are made after the deviation and range have been corrected to within 50 meters of the target, using fuze quick in adjustment.

(12) Change in control. When the observer desires to change the method of control, he transmits the desired method of control (e.g., FIRE FOR EFFECT). When the method of control being used includes AT MY COMMAND, his correction is CANCEL AT MY COMMAND. If there is no correction to be made in the method of control, the observer omits this element from his subsequent corrections.

(13) Splash. If an observer in a tactical situation is having difficulty identifying or observing his rounds because he has to remain down in a concealed position a large portion of the time, or due to other fire missions being conducted in the area, he may request assistance from the FDC by requesting SPLASH. The FDC will inform the observer that his round is about to impact by announcing SPLASH 5 seconds prior to impact. The observer may terminate this help by announcing CANCEL SPLASH.

(14) Repeat. Repeat is used when the observer desires a subsequent round or group of rounds fired with no corrections to deviation, range, or HOB (e.g., TIME, REPEAT). REPEAT is also used by the observer to indicate that he wants fire for effect repeated with or without changes or corrections to any of the elements (e.g., ADD 50, REPEAT).

Section II. AREA FIRE (ADJUSTMENT AND FFE)

There are four techniques that can be used to conduct area adjustment fires: successive bracketing, hasty bracket, one round adjustment, and creeping fire. The successive bracket technique is best suited for inexperienced observers or when precise adjustment is required, such as precision registrations and destruction missions. It mathematically insures that FFE rounds will be within 50 meters of the target. Hasty bracketing is best when responsive fires are required and the observer is experienced in the adjustment of fire. One round adjustment provides the most responsive fires, but is generally the least accurate. Creeping fire is used when firing danger close missions. When completed, all missions require refinement data and surveillance.

5-4. Successive Bracketing

After the first definite range spotting, the observer should send a range correction to the FDC to establish a bracket around his adjusting point. For example, if the first round landed over the adjusting point, the observer should send a drop correction sufficient to bring the next round short of the adjusting point (see fig 5-10).

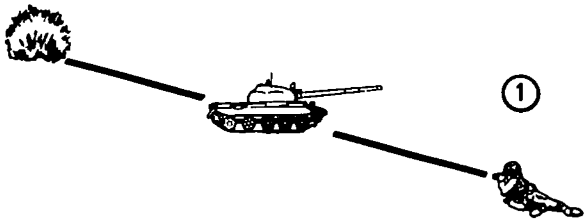


Figure 5-10. Round over adjusting point.

Once the bracket has been established, the observer will successively split the bracket until he is assured of being within 50 meters of the adjusting point when he fires for effect. Normally range changes of 100, 200, 400, or 800 meters are used to make splitting the bracket easier.

ENTER FFE WHEN YOU ARE WITHIN 50 METERS OF THE ADJUSTING POINT.

a. In this case, the observer sent a DROP 400 (-400) after observing his first round, and the next round came out short of the adjusting point as illustrated (fig 5-11).

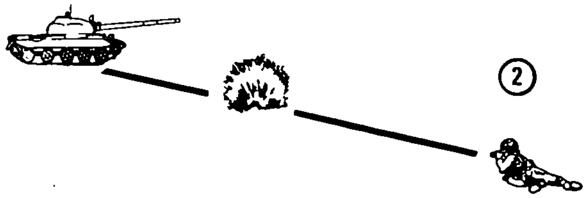


Figure 5-11. Round short of adjusting point.

b. The observer has just established a range bracket in that he now has a round over and one short of the adjusting point, separated by 400 meters.

c. Using the successive bracketing technique, the observer would now send ADD 200 (+200) (fig 5-12).

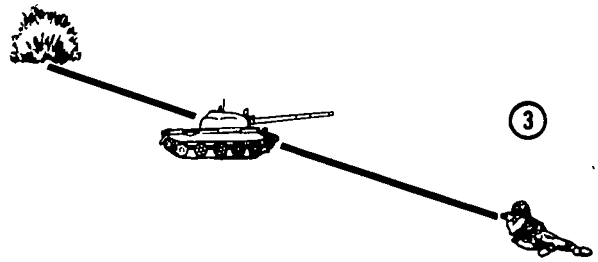


Figure 5-12. Round over adjusting point.

d. If the third round came out over the adjusting point, the observer has a 200-meter bracket because round 2 was short of the adjusting point, and the distance between the two rounds was 200 meters. Splitting his bracket, the observer would send DROP 100 (-100).

e. If the fourth round came out short, the observer has established a 100-meter bracket, so he now sends ADD 50, FIRE FOR EFFECT, to the FDC and the fire for effect rounds must be within 50 meters of the adjusting point (fig 5-13).

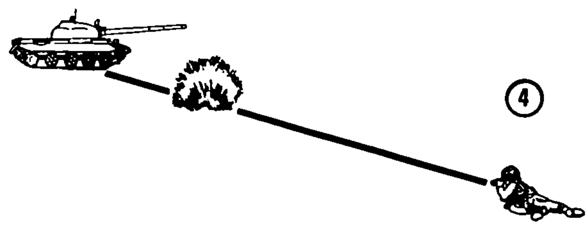


Figure 5-13. Round short of adjusting point.

5-5. Hasty Bracket Adjustment

Experience has shown that effectiveness on the target decreases as the number of rounds used in adjustment increases. An alternative to successive bracketing is the hasty adjustment technique. While successive bracketing assures the observer that the adjusting point will mathematically be within the appropriate distance upon entering FFE, it is a slow and unresponsive technique. Therefore, if the nature of the target dictates that effective fires are required in less time than the successive bracketing technique would require, the hasty adjustment technique should be employed. The success of hasty bracket adjusting is dependent on a good terrain analysis that provides the observer an accurate initial target location. The observer obtains a bracket on his first correction similar to the successive bracketing technique. Once the observer has this initial bracket, he uses it as a yardstick to determine his subsequent correction. He then sends the FDC the correction to move the rounds to the target and FIRE FOR EFFECT.

Example.

a. The first round impacted approximately 35 mils right and 100 meters short, and the observer spotted it as SHORT, 35 RIGHT. With an OT factor of 4, the observer sends LEFT 140, ADD 200 (fig 5-14).

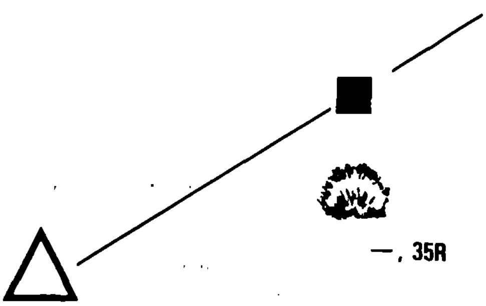


Figure 5-14. SHORT, 35 RIGHT.

b. The next round impacted approximately 10 mils left and 50 meters over, and the observer spotted it as OVER, 10 LEFT. The observer looks at the round and decides that he needs to go right 40 meters (10 x OT factor of 4) and DROP 50 and he will be on his adjusting point. Therefore, he sends RIGHT 40, DROP 50, FIRE FOR EFFECT (fig 5-15).

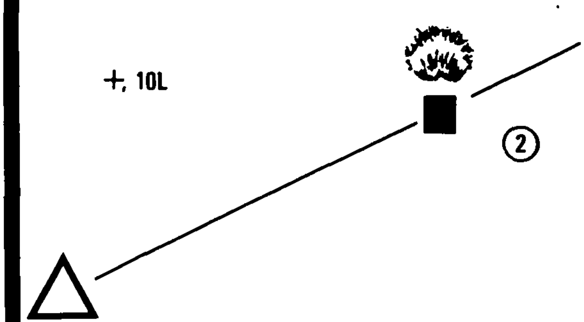


Figure 5-15. OVER, 10 LEFT.

The hasty adjustment technique improves with observer experience and judgment. Each observer must strive to improve his abilities in order to increase responsiveness on the battlefield.

5-6. One Round Adjustment

Unlike the preceding two adjustment techniques, this method does not require the establishment of a bracket. The observer spots the location of the first round, calculates and transmits to the FDC the corrections necessary to move the burst of the round to the adjusting point, and fires for effect. This technique requires either an experienced observer or an observer provided with accurate distance measuring equipment such as the AN/GVS-5 laser rangefinder.

5-7. Creeping Fire (Danger Close)

The creeping method of adjustment will be used exclusively during danger close missions. The observer should make range changes by creeping the rounds to the target, using corrections of 100 meters or less, rather than making large range corrections.

a. The observer must keep in mind the positions of all nearby friendly troops. Care must be taken to insure that a correction will not cause rounds to endanger friendly troops.

b. All weapons that will fire for effect will be used in adjustment.

c. For battalion missions, firing elements should be adjusted individually. The battalion danger close fire mission would then essentially be handled as three separate battery danger close missions.

5-8. Fire for Effect

The purpose of area fire is to cover the target area with dense fire so that the greatest possible effect will result. The type of ammunition and the amount of fire requested by the observer depend on the type of target and whether the target is moving. Fire for effect is started when a satisfactory adjustment has been obtained; that is, when the deviation, range, and HOB (if firing fuze time) are correct, or if effective fire will result when the range bracket is split.

a. Normally, the appropriate distance is 50 meters; however, under certain conditions when the range probable error (PE_R) of the weapon is 38 meters or larger, an observer is justified in calling for fire for effect when a 200-meter bracket is split. When this situation occurs, the fire direction center will notify the observer that the PE_R is greater than 38 meters.

b. If time fuze is used, the observer will request fuze time after range and deviation have been corrected, but before announcing FIRE FOR EFFECT. With time fire, fire for effect is not started until the HOB is correct or until the observer can compute the correction that should result in the correct HOB. Fire for effect is not to be started if the last rounds observed were all graze bursts or if the HOB correction is greater than 40 meters.

c. If ricochet action was sought in the adjustment, the use of fuze delay is continued in fire for effect when at least 50 percent of the bursts that established both ends of the 100-meter bracket were airbursts. If less than 50 percent of the bursts establishing the 100-meter bracket were airbursts, fire for effect is fired with fuze VT or quick.

5-9. Refinement/Surveillance (Fig 5-16)

The observer should observe the results of the fire for effect and then take whatever action is necessary to complete the mission.

a. If the fire has been accurate and sufficient, the observer announces END OF MISSION and reports the effect observed; for example, 20 CASUALTIES, INFANTRY DISPERSED.

b. If the fire has been inaccurate, but sufficient, the observer will make a correction to move the rounds to the target and end the mission; e.g., LEFT 20, DOWN 5, immediately followed by END OF MISSION.

c. If the fire has been accurate but insufficient, the observer may request REPEAT to obtain additional fire.

d. If any element of the fire for effect (deviation, range, or HOB) was sufficiently in error that the effect sought was not obtained, the observer should correct the element(s) in error and continue fire for effect; for example, ADD 50, DOWN 10, REPEAT.

RESULTS OF FFE	FO's ACTIONS
1. Accurate and sufficient	EM, surveillance, (END OF MISSION, RPG SILENCED)
2. Accurate, sufficient, target replot desired	Request replot, EM, surveillance (RECORD AS TARGET, END OF MISSION, BMP NEUTRALIZED)
3. Inaccurate and sufficient	Refinement, EM, surveillance (RIGHT 20 ADD 20, END OF MISSION, RPG SILENCED)
4. Inaccurate, sufficient, target replot desired	Refinement, request replot, EM, surveillance (RIGHT 10, RECORD AS TARGET, END OF MISSION, BMP NEUTRALIZED)
5. Inaccurate and insufficient	Refinement, repeat or reenter adjust fire (RIGHT 10 ADD 30 REPEAT)
6. Accurate and insufficient	Repeat (REPEAT)

Figure 5-16. Refinement surveillance.

e. If ricochet action with fuze delay was desired, but was not obtained from at least 50 percent of the rounds fired in fire for effect, and additional fire is needed, the observer must request a change to fuze VT, time, or quick and repeat fire for effect. He could also change to shell ICM.

f. If the observer desires that the target be replotted for future use, he announces RECORD AS TARGET immediately prior to announcing END OF MISSION (EOM) (e.g., RIGHT 10, RECORD AS TARGET, EOM, BMP NEUTRALIZED).

g. Figure 5-16 shows the observer's actions once the fire for effect rounds have been fired.

Section III. PRECISION FIRE

The precision fire procedures place a great deal of responsibility on the observer. There are two types of precision missions: precision registration and destruction.

5-10. Precision Registration

A registration is conducted with a single piece, normally the base piece of the firing battery. The FDO normally directs the observer to conduct the registration on a designated point or the observer may be directed to select the registration point. The registration point should be accurately located, semipermanent, and located on fairly level terrain if possible.

a. Initiation. The precision registration is initiated with a message to observer.

Example 1. Registration on a known point.

FDC to FO: H18 THIS IS H44, REGISTER ON REG PT 2 QUICK AND TIME, OVER.

(Read back by FO)

FO to FDC: DIR 6400, OVER.*

(Read back by FDC)

FDC to FO: SHOT, OVER.

Example 2. Registration point selected by the observer.

FDC to FO: H18 THIS IS H44, SELECT REG PT 1 VICINITY GRID 6138, QUICK AND TIME, OVER.

(Read back by observer)

FO to FDC: GRID 61243843**, DIR 6310, OVER.*

(Read back by FDC)

FDC to FO: SHOT, OVER.

*The FO's response to the message to observer indicates that he is ready to observe.

**The FO sent an eight-digit grid coordinate for the registration.

b. Impact registration.

THE OBJECTIVE OF A REGISTRATION IS TO OBTAIN SPOTTINGS OF TWO OVERS AND TWO SHORTS ALONG THE OBSERVER-TARGET LINE FROM ROUNDS FIRED WITH THE SAME DATA OR FROM ROUNDS FIRED WITH DATA 25 METERS APART (50 METERS WHEN PE_R IS GREATER THAN OR EQUAL TO 25 METERS).

This normally requires the spottings from four separate rounds; however, a target hit or a round that is spotted as range correct provides spottings of both an OVER and a SHORT. Thus the objective could be achieved with two consecutive target hits or range correct spottings. The following rules and procedures are applicable.

(1) The observer spots the rounds to the nearest 1 mil and brings the rounds onto the OT line prior to splitting a 200-meter bracket. No deviation corrections should be made after a 200-meter bracket has been established. Once the observer brings the rounds onto the OT line, he measures and records the deviation but makes no correction. If a doubtful range spotting is obtained, the observer will correct the deviation only. When a deviation correction

is made after a 200-meter bracket is established, the last round fired and all previous rounds cannot be considered as usable rounds for determining range and deviation refinement data.

(2) When the 50-meter range bracket has been established, two rounds must be fired with data 25 meters in the direction opposite that of the last range spotting. If both rounds result in spottings of SHORT (OVER), an ADD (DROP) 25 meters is sent and firing is continued until two definite range spottings have been obtained at the opposite end of the 25-meter range bracket.

(3) When the requirement of two OVERS and two SHORTS with the same data or data fired 25 meters apart has been met, the impact registration is ended with necessary refinement data. Refinement data may include either a range correction or a lateral correction, or both, to the nearest 10 meters.

(4) When determining refinement data for range, the location of the registration point is determined with respect to the two sets of spottings and then refinement data determined and announced. The criteria for determining range refinement data are as follows:

If the registration point is nearer the spotting(s) of the last round(s) fired, NO RANGE REFINEMENT is necessary (fig 5-17).

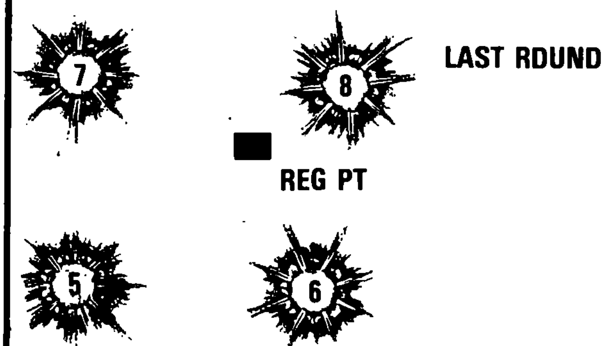


Figure 5-17. No range refinement necessary.

If the registration point is equidistant between the two sets of bursts, the observer determines the range refinement to be an ADD or DROP 10 from the last data fired (fig 5-18).

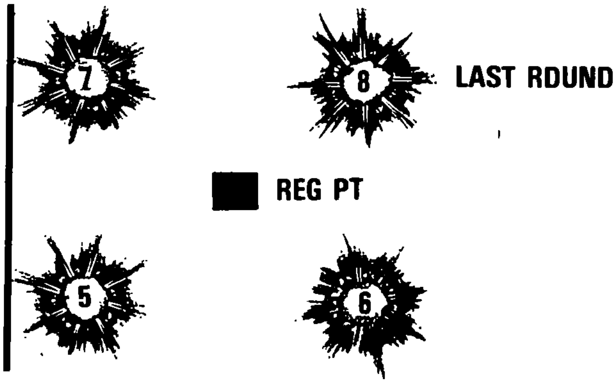


Figure 5-18. Drop 10.

If the registration point is nearer the pair of bursts at the opposite end of the bracket, the observer determines the range refinement to be a DROP 20 (fig 5-19).

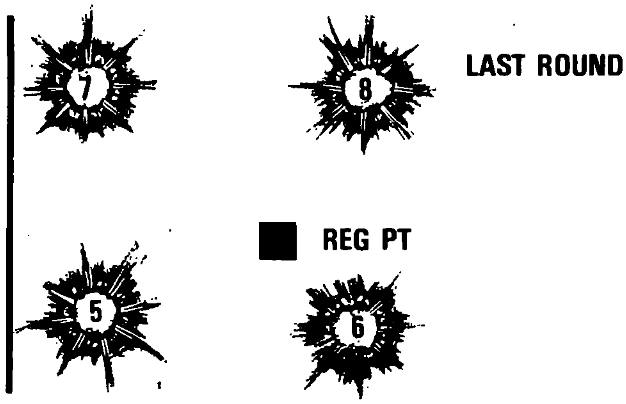


Figure 5-19. Drop 20.

The observer must keep track of [illegible] rounds and how they are sp[illegible] relation to the registration [illegible] most easily accomplished by [illegible] picture and numbering the [illegible]

(5) The deviation refinement is determined by adding the spotting deviations of the rounds establishing the two OVERS and two SHORTS (this may include two, three, or four deviation spottings). This total is then divided by the number of rounds (two, three, or four) to get an average deviation expressed to the nearest mil. The average

deviation times the OT factor equals the correction.

Example 1.

Rd	Spotting
1	+6R
2	-8R
3	-5R
4	+7R

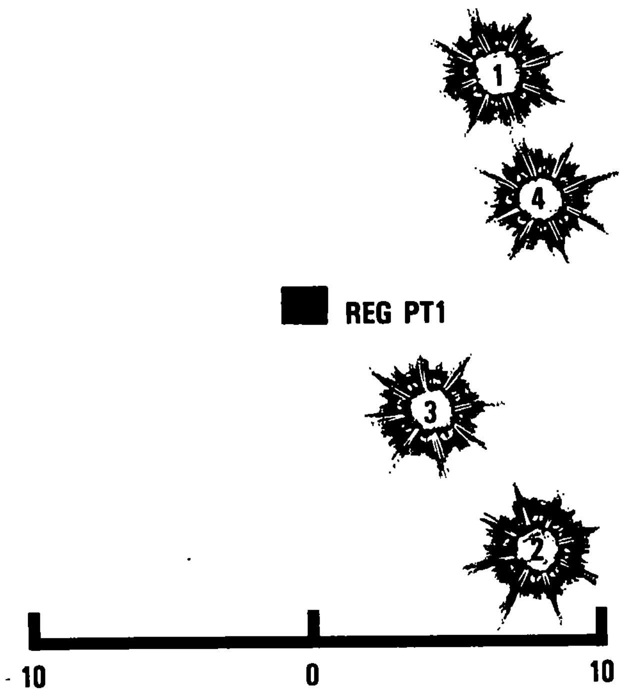
SUM OF DEVIATIONS
6R + 8R + 5R + 7R = 26R

AVERAGE DEVIATION
26R ÷ 4 rds = 6.5R ≈ 6R

OT = 3
MPI is 3 × 6R = 18M R ≈ 20M R

CORRECTION IS:

LEFT 20, DROP 10, RECORD AS REGISTRATION POINT 1, END OF MISSION, OVER.



Example 2.

Rd	Spotting
1	Target
2	+7R
3	-3L

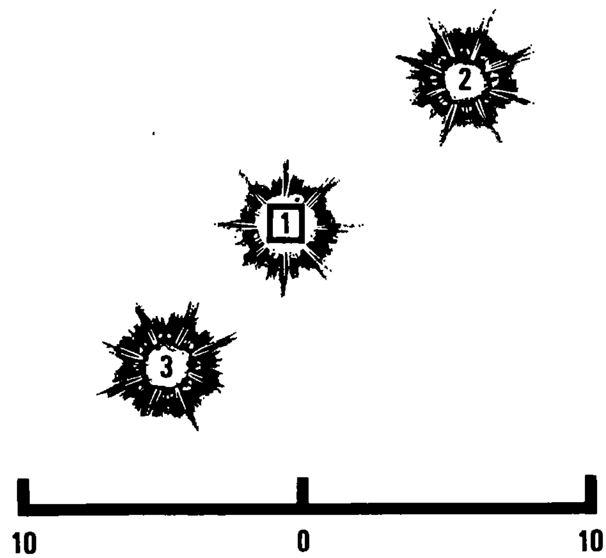
SUM OF DEVIATIONS
0 + 7R + 3L = 4R

AVERAGE DEVIATION
4R ÷ 3 rds = 1.33R ≈ 1R

OT = 2
MPI is 2 × 1R = 2M R ≈ 0

CORRECTION IS:

ADD 10, RECORD AS REGISTRATION POINT 1, END OF MISSION, OVER.



c. Time registration. If a time registration is required after the impact registration has been completed, the observer determines and announces refinement data and commands the time registration.

Example.

RIGHT 10, ADD 10, RECORD AS REGISTRATION POINT 1, TIME REPEAT, OVER.

(1) The objective of the time portion of the precision registration is to correct the mean height of burst of four rounds fired with the same data to 20 meters above the registration point. If the first round is GRAZE, a correction UP 40 is given. Once an airburst has been obtained, the command is 3 ROUNDS REPEAT. When four rounds have been fired with the same data, the registration is ended with the appropriate correction to achieve a 20-meter HOB.

(2) When four airbursts are spotted, the HOB IS CORRECTED TO 20 METERS in 5-meter increments. The mean HOB is determined by adding the four spottings in mils, dividing by 4, expressing to the nearest mil, then multiplying by the OT factor (the same technique used in determining deviation corrections).

Example.

UP 10 RECORD AS TIME REGISTRATION POINT 1, END OF MISSION, OVER.

(3) When three air and one graze are spotted, the HOB IS CORRECT.

(4) With two air and two graze, the HOB IS CORRECTED BY UP 10.

(5) With one air and three graze, the HOB IS CORRECTED BY UP 20.

(6) Check rounds may be fired to verify the validity of the time registration; however, it is not necessary. If the first airburst is extremely high, the observer may make a DOWN correction and fire one round. If that round is at a measurable height of burst, he can then fire the additional three rounds.

d. Contingency considerations. Tables 5-1 through 5-3 address some of the contingencies that may confront the observer. They are intended as aids to learning, not as "crutches" that the observer must have in order to conduct a registration. Each table represents a separate precision registration. The instructions for using each table are as follows:

(1) Each table is a continuation of the mission described on the left side of each table.

(2) The round that splits the appropriate range bracket or provides a range correct/target hit spotting in the adjustment phase is the first round of the table.

(3) The round number(s), spotting(s), and the observer's correction are given for each step of the table. In table 5-1, for example, RD 5 (-)②+ 25 indicates that the observer's spotting for round 5 was SHORT and his correction was:

2 ROUNDS, ADD 25, OVER.

(4) Some of the contingencies that may occur following the observer's correction are presented after each step. The user of the table simply picks the contingency that he is concerned with, determines the appropriate observer correction, and then moves on to the listed contingencies after this latest correction. This process continues until the impact registration is terminated.

(5) It should be noted that each completed mission is terminated by the words RECORD AS REG PT______. (Use spottings from rounds (so and so).) Each completed mission is terminated in this manner for simplicity; in most missions refinement data would be required prior to the observer's command to record as registration point; for example:

RIGHT 10, ADD 10, RECORD AS REG PT 2, EOM, OVER.

If a time registration is also to be conducted:

RIGHT 10, ADD 10, RECORD AS REG PT 2, TIME REPEAT, OVER.

Table 5-1. Add 25 at Round 5

- RD 2 L50 +200
- RD 3 −100
- RD 4 + 50
- RD 5 (−) ②+25 (See note 2.)
  - RD 6 & 7 (+,+) ①−25
    - RD 8 (−) — RECORD AS REG PT ______ (Use spottings from rounds 5,6,7,8.)
    - RD 8 (RG CORR/TGT) — RECORD AS REG PT ______ (Use spottings from rounds 5,7,8.)
    - RD 8 (+) RPT
      - RD 9 (−) — RECORD AS REG PT ______ (Use spottings from rounds 5,6,7,9.)
      - RD 9 (+) −25 — (See note 4.)
      - RD 9 (RG CORR/TGT) — RECORD AS REG PT ______ (Use spottings from rounds 5,8,9.)
  - RD 6 & 7 (−,+) ① RPT
    - RD 8 (+) — RECORD AS REG PT ______ (Use spottings from rounds 5,6,7,8.)
    - RD 8 (RG CORR/TGT) — RECORD AS REG PT ______ (Use spottings from rounds 6,7,8.)
    - RD 8 (−) — RECORD AS REG PT ______ (Use spottings from rounds 3,6,7,8.)
  - RD 6 & 7 (−,−) ①+25 (See note 4.)

Table 5-2. Drop 25 at Round 5

- RD 2 L50 +200
- RD 3 −100
- RD 4 + 50
- RD 5 (+) ②−25
  - RD 6&7 (−,−) ① + 25
    - RD 8 (+) — RECORD AS REG PT ______ (Use spottings from rounds 5,6,7,8.)
    - RD 8 (RG CORR/TGT) — RECORD AS REG PT ______ (Use spottings from rounds 5,7,8.)
    - RD 8 (−) RPT
      - RD 9 (+) — RECORD AS REG PT ______ (Use spottings from rounds 5,6,7,9.)
      - RD 9 (RG CORR/TGT) — RECORD AS REG PT ______ (Use spottings from rounds 5,8,9.)
      - RD 9 (−)+25 — (See note 4.)
  - RD 6&7 (+,−) ①RPT
    - RD 8 (−) — RECORD AS REG PT ______ (Use spottings from rounds 5,6,7,8.)
    - RD 8 (RG CORR/TGT) — RECORD AS REG PT ______ (See note 3.) (Use spottings from rounds 6,7,8.)
    - RD 8 (+) — RECORD AS REG PT ______ (Use spottings from rounds 4,6,7,8.)
  - RD 6&7 (+,+) ① − 25 (See note 4.)

Table 5-3. Range Correct/Target During Adjustment

RD 2 L50 +200 RD 3 (TGT) RPT (See notes 1 & 3.)	RD 4 (+)–25	RD 5 (+)–25	(See note 4.)
		RD 5 (–)	RECORD AS REG PT ______ (Use spottings from rounds 3,4,5.)
		RD 5 (RG CORR/TGT)	RECORD AS REG PT ______ (See note 5.) (Use spottings from rounds 3,5.)
	RD 4 (RG CORR/TGT)	RECORD AS REG PT ______ (See note 3.) (Use spottings from rounds 3,4.)	
	RD 4 (–)+25	RD 5 (–)+25	(See note 4.)
		RD 5 (+)	RECORD AS REG PT ______ (Use spottings from rounds 3,4,5.)
		RD 5 (RG CORR/TGT)	RECORD AS REG PT ______ (See note 5.) (Use spottings ffom rounds 3,5.)

Notes.

1. If a round is spotted as range correct or target during the adjustment phase, that round is considered as the first round in fire for effect and the observer continues fire for effect with REPEAT from round 3 in table 3.

2. If the spotting of the round as a result of the observer's correction of ADD or DROP 50 is in the same sense as that of the previous round, the observer uses the spottings and corrections beginning at round 5 and continues in the normal manner.

3. A round spotted as range correct or target may be equivalent to a pair of rounds at the same data bracketing the registration point.

4. The observer continues range corrections in 25-meter increments until a spotting of range correct, target, or a spotting in the opposite sense is obtained and then orders corrections, as appropriate, to obtain a verified bracket. If two or three 25-meter range corrections result in spottings the same as the preponderance, the observer may assume that he obtained a false bracket before entering fire for effect. The observer should continue the adjustment with appropriate range corrections until the proper range is obtained and then reenter fire for effect.

5. The observer ends the registration, since the equivalent of two pairs of rounds fired at data 25 meters apart bracketing the registration point has been obtained.

e. Second lot registrations. Second lot registrations are conducted in much the same manner as are first lot registrations. After the first lot impact registration has been completed, a time registration is conducted if required. The FDC must announce to the observer OBSERVE SECOND LOT REGISTRATION. The observer must reestablish the appropriate range bracket and complete the second lot registration by using the same procedures as for the first lot. The time portion of the registration is not fired with the second lot.

> Example.
>
> Message to observer for two lot registration:
>
> FDC to FO: [redacted]
>
> (Read back by FO)
>
> At the completion of first lot registration:
>
> FO to FDC: [redacted]
>
> FDC to FO: [redacted]

f. Abbreviated registrations.

(1) There may be occasions when the tactical situation or ammunition constraints prohibit conducting a full scale precision registration. Although not as accurate, an abbreviated precision registration can provide adequate compensation for the effects of nonstandard conditions. The decision to conduct an abbreviated registration rests with the fire direction officer. For this type registration, the observer merely shortens the standard procedures. He may:

(a) Obtain only one round OVER and SHORT instead of two.

(b) Establish a 50-meter bracket, then send refinement data that will move the last round to the registration point.

(c) Use any other abbreviated technique.

[redacted]

(2) If a time registration has also been requested, the observer announces TIME REPEAT instead of END OF MISSION. Once an airburst has been observed, he may use one or two more rounds to establish a mean height of burst. He then sends his refinement as usual.

5-11. Destruction Missions

A destruction mission is simply a continuation of an impact registration. Once the observer has made his refinement for the impact portion, he continues to fire additional rounds. After every third round, an additional refinement is made and firing is continued until the target is destroyed or the mission is stopped for some operational reason. Corrections may be made after every round if desired.

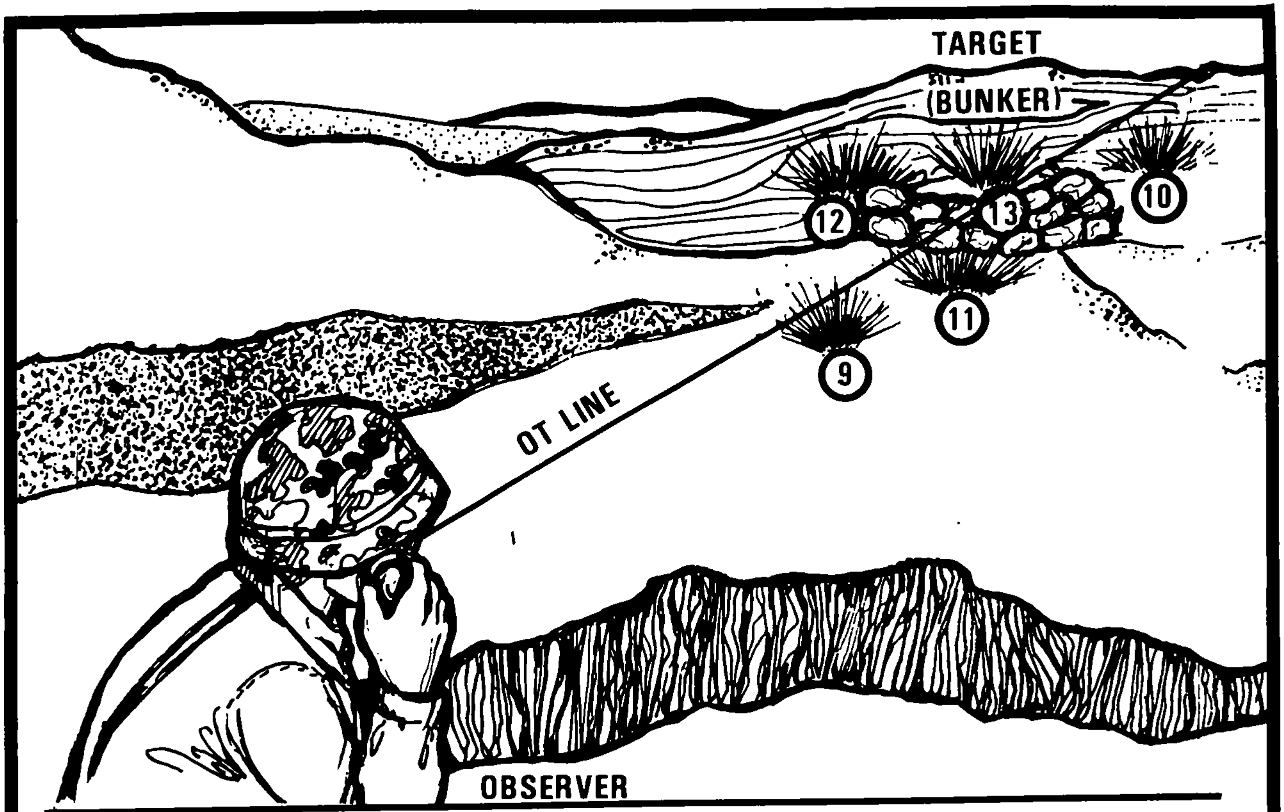
> Example (fig 5-20).
>
> The FO makes his refinement. OT FACTOR = 2.

Section IV. HELPFUL NOTES FOR THE OBSERVER

1. Initial rounds frequently can be located more quickly with the naked eye than with field glasses. The spotting should be instantaneous and the correction sent immediately to the FDC.

2. For observers who wear glasses, the protective plastic lens cap on the binoculars can be removed to increase the field of vision. Masking tape can be used on the metal retaining ring to prevent scratching the glasses.

3. The diopter adjustment ring can be taped in the correct position so that the observer does not have to adjust the diopter setting every time he uses his binoculars.



ROUND	SPOTTING	CORRECTION
		ADD 10[1]
9	— 4R	REPEAT
10	+ 5R	REPEAT
11	— 4R	LEFT 10[2]
12	RC 1L	REPEAT
13	TGT	EM BUNKER DESTROYED[3]

[1] TARGET WAS MIDWAY BETWEEN THE 4 SPOTTING ROUNDS

[2] PREPONDERANCE WAS $\frac{4R+5R+4R}{3} = \frac{13R}{3} = 4.3R \approx 4R$ Rx2 (OT FACTOR)=8M R≈(CORRECTION) L 10M

[3] MISSION ENDED SINCE TARGET WAS DESTROYED.

Figure 5-20. Destruction mission.

4. For adjust fire missions, angular deviations measured with the binoculars are measured to the nearest 5 mils for deviation and 1 mil for HOB.

5. The observer should memorize the width (in mils) of his fingers and hand so that, when shifts of 100 mils or more are required, he can use his hand instead of binoculars for determining shifts to place fire in the vicinity of the adjusting point as quickly as possible.

6. The OT factor must be applied to obtain corrections for HOB as well as for deviation.

7. A good terrain sketch provides an observer a means for conducting a good terrain-map association.

8. An observer can use the direction and flash-to-bang time of an impact burst to determine its grid location.

9. The observer must take appropriate immediate action if communication is not working properly.

10. The importance of surprise fire (fire for effect) cannot be overemphasized. The enemy will change posture (dig in, or move) if he knows that he is being fired upon.

11. The observer must take the initiative if delays occur.

12. A sketch can aid in determining usable rounds on a precision registration.

13. The service practice OP is not the place to learn conduct of fire procedure. All procedures should be learned before going to the observation post. Familiarity with procedures can be attained by firing simulated missions. A simple and effective method for practicing simulated missions is the "matchbox problem" (fig 5-21). Matchbox problems require no equipment except a small object, such as a matchbox, and a piece of paper on which a mil scale has been drawn to represent the scale of the reticle in the binoculars. Two or more persons should work together on these problems. The matchbox, which represents the target, is placed on a table or on any convenient surface, and the mil scale is placed on the table in front of the target. The person acting as the observer faces the target and mil scale and announces the call for fire and the OT distance to the second person, who stands beside the table and announces the message to observer and SHOT. After announcing SHOT, the person at the table places the top of a pencil on the table for a moment to simulate each burst. The observer determines the location of the burst(s) as over or short and the amount of deviation in mils in relation to the paper mil scale as seen from his position; e.g., LEFT 40, ADD 400. This procedure is continued until the mission is completed. The person at the table critiques the mission and changes places with the person acting as the observer.

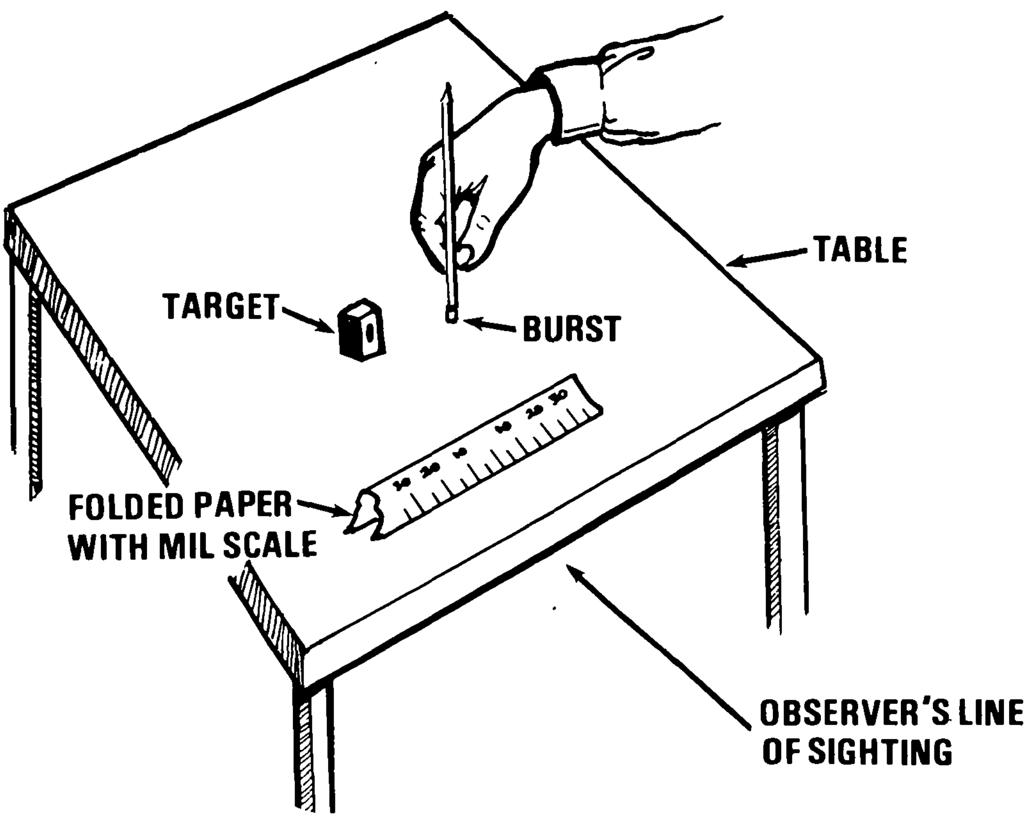


Figure 5-21. Matchbox problem setup.

CHAPTER 6

SPECIAL SITUATIONS

Section I. ICM

6-1. Characteristics

Improved conventional munitions (ICM) are base ejection projectiles. The projectiles are fired with a time fuze and are filled with a number of submunitions. The submunitions, grenades, are ejected through the base of the projectile and scattered in the target area. There are two types of ICM rounds: the antipersonnel (AP) round and the dual purpose (DP) round.

a. The AP round is most effective against unwarned, exposed personnel. When the fuze functions, a black powder expelling charge forces the grenades out through the base of the projectile. Small vanes on the grenade flip upward, arming the grenade and stabilizing it in flight. When the striker plate (on the base of the grenade) contacts the ground, the steel ball is hurled upward 5 to 6 feet in the air and detonates.

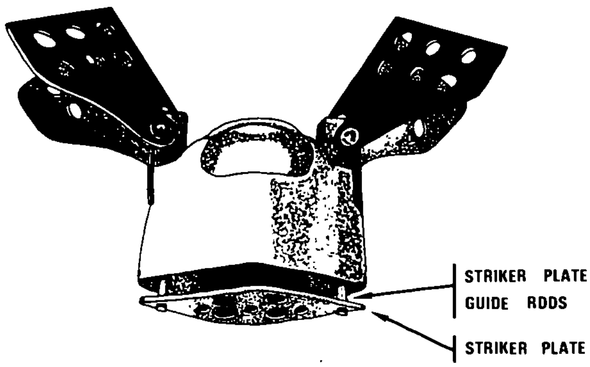


Figure 6-1. The antipersonnel (AP) round.

b. The DP round is most effective against lightly armored vehicles and other materiel; however, it is also effective against personnel. A ribbon streamer arms and stabilizes the grenade. Upon impact, a shaped charge capable of piercing light armor is detonated. Additionally, fragments are expelled.

c. Table 6-1 shows the number of grenades in the various ICM rounds.

6-2. Delivery Techniques

Improved conventional munitions (ICM) may be fired using three procedures.

a. Transfer (FFE) using current corrections. Transfer using current corrections is most desirable because surprise and the best effects can be achieved with this technique.

b. Adjustment with HE firing ICM in effect. When current corrections are not available, the observer should adjust with HE onto a point near the target and then shift and fire for effect with ICM on the target.

c. Adjustment with ICM. Adjustment with ICM is the least preferable procedure because of the increased amount of ICM ammunition expended and the loss of surprise, which decreases the effectiveness of ICM. The 483A1 series of ICM has a self-registering mode and functions as an HE round and a GFT setting can be derived from a registration. This is also good for the FASCAM series of munitions.

6-3. Call for Fire and Adjustment

The call for fire for ICM is the same as the

Table 6-1. Number of Grenades in Each ICM Round

WEAPON	PROJECTILE	NUMBER OF GRENADES
105mm	M444	18
155mm	M449 Family	60
8 inch	M404	104

ICM DUAL PURPOSE (DP)

WEAPON	PROJECTILE	NUMBER OF GRENADES
155mm	M483A1	88
8 inch	M509	195

regular call for fire. Procedures for adjustment of ICM are similar to the procedures used for a normal HE adjustment.

a. Range and deviation. Range and deviation are adjusted from the center of the effects pattern. Since ICM is most effective when delivered as surprise fires, the observer should make a bold shift from the center of the initial effects pattern and fire for effect. Due to the size of the effects pattern, deviation shifts of less than 50 meters and range corrections of less than 100 meters should not be made.

b. Height of burst (HOB). Height of burst is adjusted in increments of 50 meters. There are no specific rules for the amount an observer should correct the height of burst; this determination is made based on the observer's experience.

(1) If a large number of duds are observed or the effects pattern is too small, the observer should give an UP correction. The UP correction should not exceed 100 meters until the observer becomes familiar with the result of height of burst corrections.

(2) A height of burst that is too high is normally not critical.

[redacted]

c. Danger close. When adjusting close-in fires with ICM, the observer must start the adjustment at least 600 meters from friendly troops, depending on the relative locations of weapons, target, and friendly troops. Special consideration must be given to the direction and speed of the wind in the target area. The adjustment should be made with the entire battery and corrections should be made from the near edge of the effects pattern.

6-4. Sample Missions

a. Fire for effect with ICM.

P51, THIS IS P87, FIRE FOR EFFECT, OVER.

GRID 372461, OVER.

PLATOON ASSEMBLY AREA, ICM, OVER.

b. HE adjustment, ICM in effect.

P51, THIS IS P87, ADJUST FIRE, OVER.

GRID 933876, OVER.

INFANTRY COMPANY HALTED, ICM IN EFFECT, OVER.

c. ICM adjustment, ICM in effect.

P51, THIS IS P87, ADJUST FIRE, OVER.

GRID 361290, OVER.

COMPANY ASSEMBLY AREA, ICM, OVER.

Section II. ILLUMINATION

6-5. Characteristics

Battlefield illumination provides friendly forces with sufficient light to assist them in ground operations at night. Illumination facilitates operations for both the forward observer and the maneuver unit and harasses the enemy. The illumination shell is used for illuminating areas of suspected enemy activity, providing illumination for night adjustment, harassing enemy positions, and furnishing direction to friendly troops for attacks or patrol activities.

6-6. Employment Considerations

The amount of illumination that is required for a particular mission depends on the observer-target distance, the conditions of visibility, and the size, width, and depth of the area to be illuminated. By selecting the proper illuminating pattern and by controlling the rate of fire, the observer can illuminate an area effectively with a minimum expenditure of ammunition. The different illuminating patterns are discussed in *a* through *e* below. The rates of fire for continuous illumination and other information pertinent to the employment of illuminating shells are given in table 6-2. The major improvements in the M485 projectile (155-mm only) over the M118 projectile include greater illumination, longer burning time, and a slower descent rate. In addition, the use of a drogue chute reduces chute failure, but requires fuze activation prior to main chute deployment. The optimum height of burst for the older M118 projectile was 750 meters; however, because of the longer burning time and slower rate of descent, the optimum height of burst for the M485 projectile is 600 meters.

a. The one-gun illumination pattern is employed when effective illumination can be accomplished by firing one round at a time. To obtain this pattern, the observer calls for ILLUMINATION as the type of adjustment and type of projectile.

b. The two-gun illumination pattern is employed when an area requires more illumination than can be furnished by one-gun illumination. In two-gun illumination, two rounds are caused to burst simultaneously in the same place. To obtain this pattern, the observer calls for TWO-GUNS ILLUMINATION.

c. The two-gun illumination range spread pattern (fig 6-2) is employed when the area to be illuminated has greater depth than width. Spread illumination causes less shadows than illumination that is concentrated in one place. To obtain this pattern, the observer calls for ILLUMINATION RANGE SPREAD. The fire direction center will center the spread over the point indicated by the observer and orient the spread in relation to the gun-target line.

Table 6-2. Employment Factors for Illuminating Shells

CANNON	PROJECTILE	INITIAL HEIGHT OF BURST (METERS)	DISTANCE BETWEEN BURSTS (SPREAD) (METERS)	BURNING TIME (SECONDS)	RATE OF CONTINUOUS ILLUMINATION (ROUNDS PER MINUTE)	RATE OF FALL (METERS PER SECOND)
105-mm	M314A2	750	800	60	2	10
105-mm	M314A3	750	800	70-75	2	10
155-mm	M118	750	800	60	2	10
155-mm	M485A2	600	1000	120	1	5

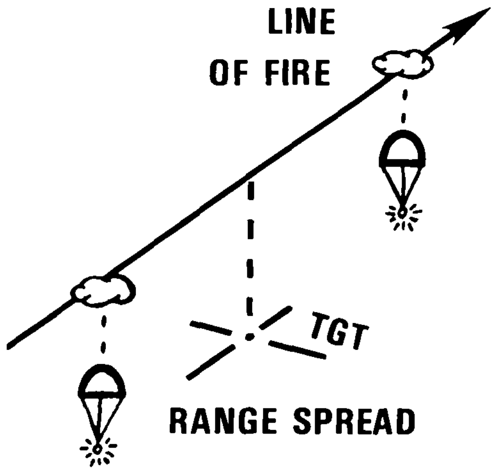


Figure 6-2. Illumination, range spread.

d. The two-gun illumination, lateral spread pattern (fig 6-3) is employed when the area to be illuminated has greater width than depth. To obtain this pattern, the observer calls for ILLUMINATION LATERAL SPREAD.

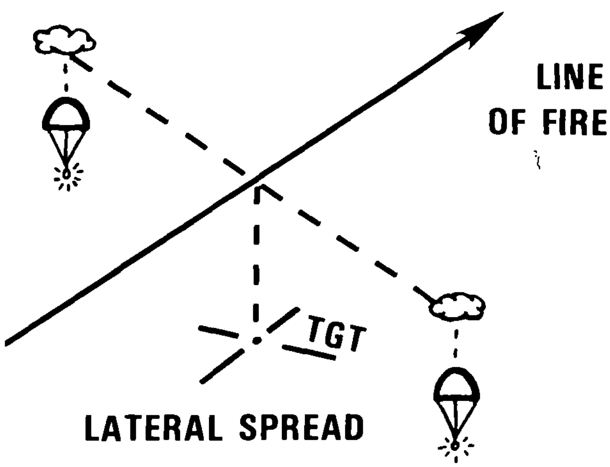


Figure 6-3. Illumination, lateral spread.

e. The four-gun illumination pattern is used to illuminate a large area (fig 6-4). Four rounds are caused to burst simultaneously in a diamond pattern. This pattern will illuminate an area with practically no shadows or dark spots. To obtain this pattern, the observer calls for ILLUMINATION RANGE AND LATERAL SPREAD.

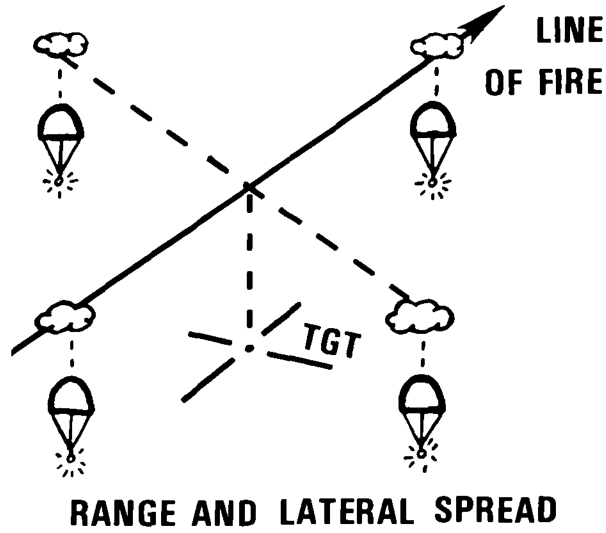


Figure 6-4. Illumination, range and lateral spread.

6-7. Call for Fire and Adjustment of Illumination

In the call for fire, ILLUMINATION is given as the type projectile and the appropriate range or lateral spread is given as the distribution. Procedures for adjusting illumination are as shown below.

a. Range and deviation are adjusted by use of standard observed fire procedures, except that adjustment of the illumination to within 200 meters of the adjusting point normally is considered adequate because of the size of the area illuminated by the flare. Normally range and deviation corrections of less than 200 meters should not be made.

b. The correct position of the flare in relation to the area to be illuminated depends on the terrain and wind. Generally, the flare should be to one flank of the area and at about the same range. In a strong wind, the point of burst must be some distance upwind from the area to be illuminated because the flare will drift. If the area is on a forward slope, the flare should be on the flank and at a slightly shorter range. For illuminating a very prominent object, better visibility can be obtained if the flare is placed beyond the object so that the object is silhouetted.

c. The proper height of burst is that which will allow the flare to strike the ground just as the flare stops burning. HOB corrections are made in multiples of 50 meters. Variations in time of burning between individual flares make any finer adjustment of the height of burst pointless.

d. When burnout occurs during descent, the HOB correction is estimated from the height of the flare when it burned out. When visibility permits, the height above the ground of the burnout may be measured with binoculars. The measured height (in mils) is multiplied by the OT factor to determine the height of burnout in meters. This height is expressed to the nearest 50 meters and the proper DOWN correction sent.

Example.

The flare burns out 20 mils above the ground. The OT factor is 3; 20 mils × 3 = 60 meters ≈ 50 meters. The correction is DOWN 50. When the flare continues to burn after it strikes the ground, the correction required is estimated from the length of time (T) in seconds that the flare burned on the ground. By multiplying T × 5 (approximate rate of descent is 5 meters per second), the observer can determine the approximate correction required for illuminating shell M485 (155-mm). (Use T × 10 to determine the approximate correction for all other illuminating projectiles.)

Example.

The flare burned 23 seconds on the ground; 23 × 5 = 115. The correction is UP 100 (correction expressed to nearest 50 meters).

6-8. Call for Fire and Adjustment Under Illumination

a. When the observer has located a target suitable for HE or other fire, he will initiate a call for fire in the normal manner. If no better means of designating the location of the target is possible, the burst center of the illumination can be used as a reference point.

b. If the observer decides to adjust the illuminating fire and the HE fire concurrently, he prefaces corrections pertaining to illumination with the word ILLUMINATION and those pertaining to HE with the letters HE; for example, ILLUMINATION, ADD 200, HE, RIGHT 60, ADD 200.

c. Once the observer has adjusted the illuminating shell to the desired location, he should control the rate of fire and number of pieces firing, reducing ammunition expended to the minimum necessary for the required observation.

d. The observer may allow the FDC to control the firing of both illumination and HE by announcing COORDINATED ILLUMINATION in his call for fire. When the illumination has been adjusted to yield the best light, the observer announces ILLUMINATION MARK to the FDC to notify them of the exact time when the target is best illuminated. The FDC times the interval between the actual firing of the illuminating round and receipt of the observer's ILLUMINATION MARK. By comparison of this time interval with the time of flight of the HE, the FDC can control the firing of the HE rounds so that they arrive at the target during the period of maximum illumination.

e. As an alternate method, the observer may request COORDINATED ILLUMINATION and announce the method of control as BY SHELL, AT MY COMMAND. This indicates that both the HE and illumination will be fired only at the observer's command. As soon as the FDC reports that the illumination and HE fires are ready, the observer commands the firing of illumination and then gives the command to fire the HE so that the HE will arrive during the period of maximum illumination of the target. The observer can request the HE time of flight to better coordinate the firing of each round. If the observer desires to change the method of control to allow the piece to fire illumination when ready while he controls the firing of HE shell, he announces ILLUMINATION, CANCEL AT MY COMMAND.

f. Because of the amount of ammunition expended, the least desirable method is for the observer to request CONTINUOUS ILLUMINATION. In this case, the FDC will fire illumination continuously (intervals between firing will depend upon the type of projectile) while the observer adjusts HE.

6-9. Sample Missions (Fig 6-5)

The observer hears a number of heavy vehicles at an azimuth estimated at 5800. He cannot detect any lights and the entire area is in complete darkness. Judging from the sounds and a study of his map, the observer estimates the source of the noises as grid 616376. This is about 2000 meters from his observation post. He sends the following call for fire to a 155-mm battery.

P53 THIS IS P67, ADJUST FIRE, OVER. GRID 616376, OVER. VEHICLE NOISES, SUSPECTED TANKS, ILLUMINATION, OVER.

a. The first illuminating round bursts about 100 mils left of the suspected area and burns out 40 mils too high (measured with binoculars). Using an OT factor of 2, the observer transmits:

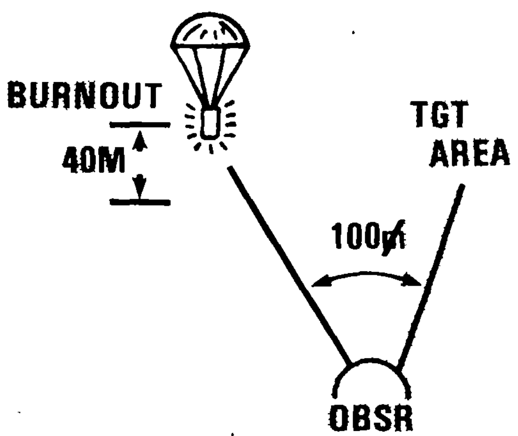


Figure 6-5. Initial illumination round.

DIRECTION 5800, RIGHT 200, DOWN 100, OVER (40 meters × 2 = 80 meters ≈ 100 meters.)

b. The second round bursts short near the OT line but is too low; the round burns 6 seconds on the ground. The observer requests:

ADD 400, UP 50, OVER.
(6 × 5 = 30 ≈ 50)

c. The third round bursts at the appropriate height over the suspected area, but haze, along with the distance of the area from the observer, makes visibility poor with only one round of illuminating shell. The observer believes that two rounds will be adequate, but desires a lateral spread along a section of road that he is observing in order to extend the visible area and reduce shadows. The observer requests:

LATERAL SPREAD, OVER.

d. Two rounds burst in a spread over the suspected area, and the observer notices two tanks and a number of infantrymen moving over to the right at the extreme edge of the illuminated area. He then prepares and transmits a separate call for fire and moves his illumination over to the target.

RIGHT 400, COORDINATED ILLUMINATION, OVER. ADJUST FIRE, OVER. GRID 611382, OVER. 2 TANKS AND PLATOON OF INFANTRY, ICM IN EFFECT, OVER.

The observer may also have sent his target location by polar plot (ADJUST FIRE, POLAR, OVER) or by shifting from the center of the illumination (ADJUST FIRE, SHIFT, ILLUMINATION, OVER).

e. With the next rounds of illumination, the observer transmits ILLUMINATION MARK when the illumination has best illuminated the target. He then adjusts the HE and fires for effect as in a normal mission.

Note. The above procedures also apply to mortars.

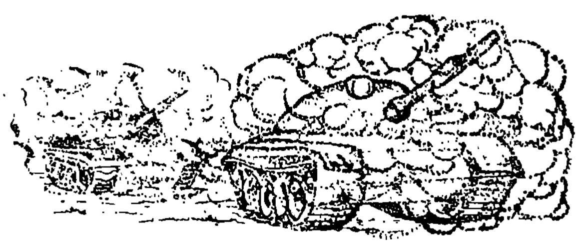
Section III. SMOKE

6-10. Characteristics

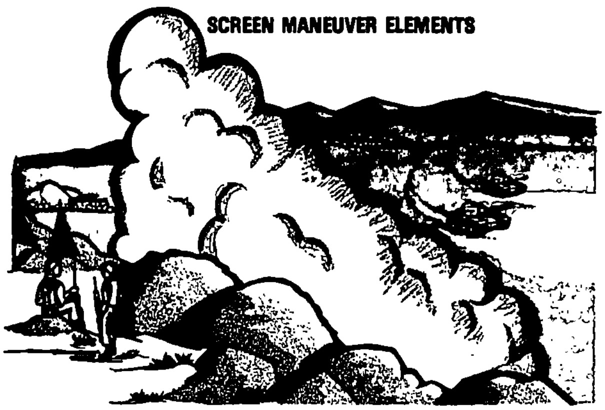
Smoke generally is not equated to combat power because it is not lethal. Nevertheless, when used correctly, it can significantly reduce the enemy's effectiveness both in the daytime and at night. Smoke, combined with other suppressive fires, will provide increased opportunities for maneuver forces to deploy and aircraft to attack frontline targets, thus enhancing the chances of mission accomplishment without catastrophic losses. Smoke attenuates laser beams and inhibits the use of optically-guided missiles, such as the SAGGER. Smoke may be used to reduce the ability of the enemy to deliver effective fires, to hamper hostile operations, and to deny the enemy information on friendly positions and maneuver. The effective delivery of smoke by the field artillery at the critical time and place will help the combined arms team accomplish its mission (see table 6-3). Smoke is used to obscure or screen.

OBSCURING SMOKE—EMPLOYMENT AND EFFECT OF A SMOKE SCREEN PLACED DIRECTLY ON OR NEAR THE ENEMY WITH THE PRIMARY PURPOSE OF SUPPRESSING OBSERVERS AND MINIMIZING HIS VISION.

OBSCURE ENEMY VISION



SCREENING SMOKE—A SMOKE CURTAIN EMPLOYED ON THE BATTLEFIELD BETWEEN ENEMY OBSERVATION POINTS AND FRIENDLY UNITS TO MASK MANEUVERS OR TO DECEIVE AND CONFUSE THE ENEMY AS TO THE NATURE OF FRIENDLY OPERATIONS.


SCREEN MANEUVER ELEMENTS

Do not neglect the use of smoke at night. Enemy direct fire weapons, such as the SAGGER, are equipped with night vision devices. Darkness can bring on a FALSE sense of security which can be fatal to the maneuver elements.

WHETHER USED IN OFFENSIVE OR DEFENSIVE OPERATIONS, SMOKE CAN MINIMIZE VULNERABILITY AND MAXIMIZE EFFECTIVENESS.

a. Obscuring smoke is used to—

(1) Defeat flash ranging; restrict the enemy's counterfire program.

(2) Obscure artillery OPs; reduce the accuracy of enemy observed fires.

(3) Obscure enemy direct fire weapons, including wire-guided missiles, to reduce their effectiveness up to 90 percent.

(4) Obscure enemy lasers to reduce their effectiveness.

Table 6-3. Field Artillery Smoke Capabilities and Effects.

Delivery System	Type Round	Nomenclature	Fuze	Time to Build Effective Smoke	Average Burning Time	Average Obscuration Length (Meters) Per Round — Wind Direction: Cross	Head/Tail
155mm	WP	M110A2	M557	½min	1-1½ min	100	50
	SMK	M116B1	M501A1	1-1½ min	4 min	350	75
105mm	WP	M60A1	M557	½ min	1-1½ min	75	50
	SMK	M84B1	M501A1	1-1½ min	3 min	250	50

(5) Instill apprehension; increase enemy patrolling.

(6) Slow enemy vehicles to blackout speeds.

(7) Increase command and control problems; prevent effective visual signals and increase radio traffic.

(8) Defeat night observation devices and reduce the capability of most IR devices.

b. Screening smoke is used for—

(1) Unit maneuvers. Smoke draws fire. Deceptive screens cause the enemy to disperse his fires and expend his ammunition.

(2) Flank screening. Smoke may be used to screen exposed flanks.

(3) Areas forward of the objective. Smoke assists the maneuver units in consolidating on the objective unhindered by enemy ground observers.

(4) River-crossing operations. Screening the primary crossing site denies the enemy information, and deceptive screens deceive the enemy as to the exact location of the main crossing.

c. Non-field artillery smoke ammunition and delivery means.

(1) Mortars. Mortars can provide good initial smoke coverage with WP ammunition because of their high rates of fire. Mortar smoke information is shown in table 6-4.

(2) Tanks. Tanks firing from overwatch positions can suppress antitank guided

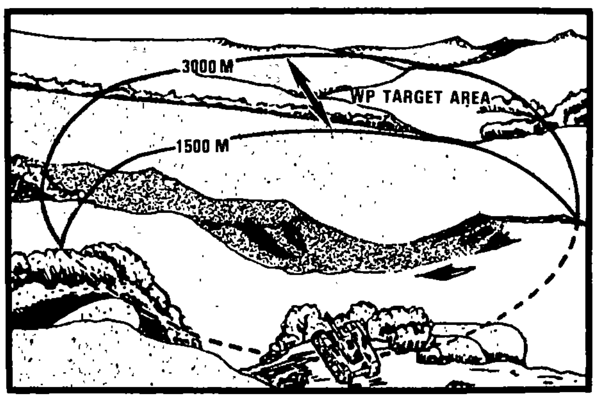


Table 6-4. Mortar Smoke Information.

Mortar Delivery System	Number/Bn	Sustained Rate of Fire	Type Round	Time to Build Effective Smoke	Average Burning Time	Average Obscuration Length (M) Per Round — Wind Direction: Cross	Head/Tail
4.2-inch ★	4	3 Rds/min	WP	1/2 min	1 min	200	40
81mm	9	8 Rds/min	WP	1/2 min	1 min	100	40

★ The 4.2-inch mortar is a better smoker than the 105mm howitzer firing WP.

Table 6-5. Field Artillery Smoke Delivery Techniques.

DELIVERY TECHNIQUE	TYPE OF TGT	NO OF GUNS	TYPE OF AMMO	SHEAF	OBSCURATION TIME	COMMAND AND CONTROL
IMMEDIATE SMOKE * (POINT/ SUPPRESSION)	POINT OR SMALL AREA 150M OR LESS	1 PLT ** (2 GUNS)	1ST RD'S WP-SMK 2D RD'S SMK	PARALLEL OR TERRAIN GUN POSITION CORRECTIONS	1/2-5 MIN	BY SOP AND/OR APPROVAL OF MANEUVER COMPANY COMMANDER
QUICK SMOKE (SMALL AREA/ SUPPRESSION)	SMALL AREA 150 TO 600M ***	1-2-3 PLT **	SMK OR WP	PARALLEL OR TERRAIN GUN POSITION CORRECTIONS	4-15 MIN	APPROVAL OF MANEUVER BATTALION COMMANDER

*THE IMMEDIATE SMOKE TECHNIQUE CAN BE USED IN AN IMMEDIATE SUPPRESSION MISSION ON A TARGET OF OPPORTUNITY; BY UNIT SOP, A MIX OF WP AND HC NORMALLY WILL FOLLOW THE INITIAL SUPPRESSION ROUNDS WHEN IMMEDIATE SMOKE IS REQUESTED

** RESPONSIVENESS DICTATES THAT BOTH IMMEDIATE AND QUICK SMOKE MISSIONS BE FIRED BY PLATOON

*** FOR LARGER AREAS, CONSIDER MULTIPLE AIMPOINTS USING THE QUICK SMOKE TECHNIQUE

missile gunners at 1500-3000 meters with WP ammunition. The basic load for tanks in Europe includes some WP ammunition.

6-11. Delivery Techniques

Using different amounts of smoke on the battlefield against targets of various sizes requires different gunnery techniques. The use of the two delivery techniques outlined below does not preclude the use of smoke on other occasions or for different objectives. The objective of the two prescribed techniques is to obscure the enemy's vision or screen the maneuver element. The two delivery techniques are outlined in table 6-5 and are discussed in detail in paragraphs 6-13 and 6-14.

6-12. Employment Considerations (Fig 6-6)

a. Weather. The observer is the normal source of wind component data for the target area; he determines the data (headwind, tailwind, or crosswind) based on what he sees and feels. Atmospheric stability, wind direction, and windspeed are the major factors influencing the effectiveness of smoke.

(1) Atmospheric stability. The weather conditions, the time of day, and the windspeed all affect atmospheric stability. Although determined by the FDC, the observer must be aware of the effect of three temperature gradients which are discussed in FM 6-40, chapter 11.

(2) Wind direction and speed (table 6-6). The movement of smoke depends on the speed and direction of the wind. Windspeeds ranging from 4 to 14 knots are best for the production of smokescreens. Optimum speeds vary with the type of smoke used. Wind direction influences the desired location of smoke in the target area. To determine an approximate windspeed, the observer can use either the equivalent wind scale table (table 6-6) or the grass drop (expedient) method. With the grass drop (expedient) method, extend arm downwind and drop grass from hand. Point extended arm at dropped grass on ground. Divide the angle (in degrees) between the arm and the body by 4 to determine the approximate wind velocity in knots. To determine wind direction in the target area, observe drifting of smoke or dust, bending of grass or trees, and ripples on water. Determine the wind direction in relation to the maneuver target line for obscuration. Only the wind direction in terms of crosswind or tailwind/headwind need be determined.

(3) Temperature. A rise in temperature may increase the rate of evaporation, causing the smokescreen to dissipate more rapidly.

(4) Humidity and precipitation. Humidity and precipitation may enhance the effectiveness of smoke.

b. Ammunition. The amount of smoke ammunition in basic loads is limited. Expenditures of smoke ammunition vary considerably with each specific mission. All users must know the amount of ammunition

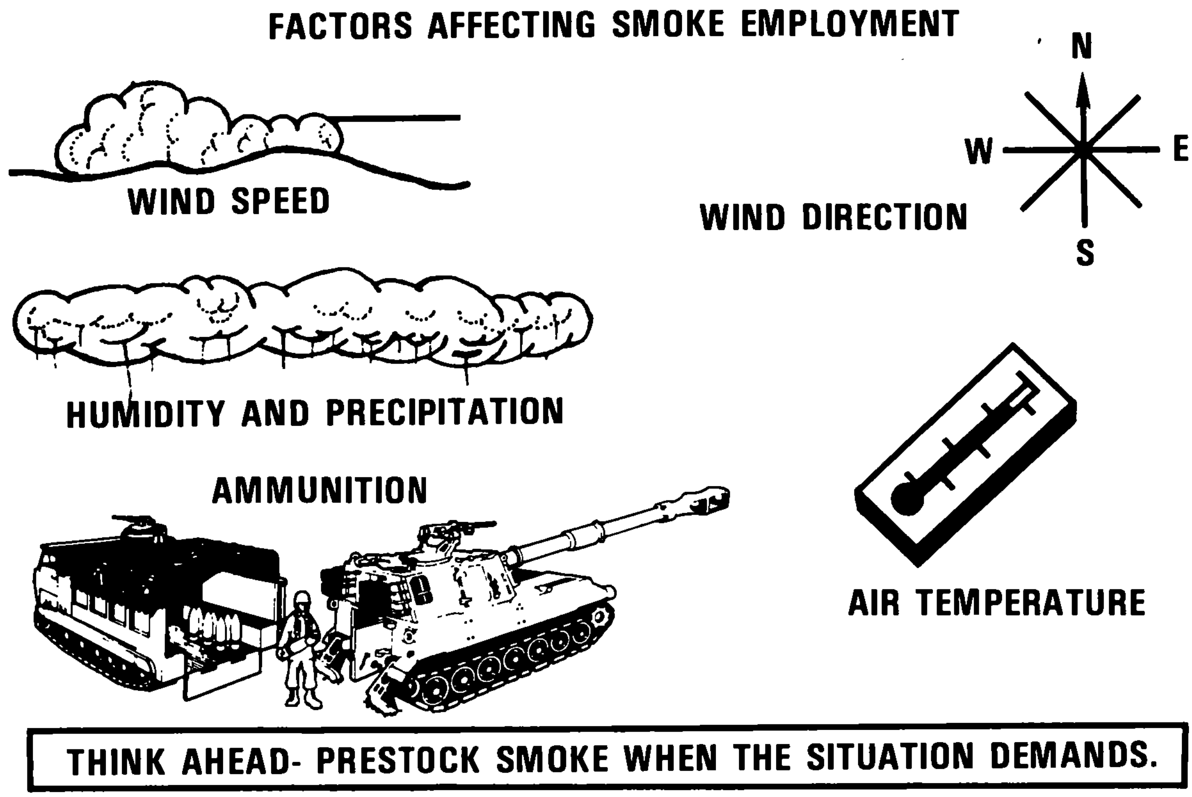


Figure 6-6. Weather factors which affect smoke employment.

available and how much smoke it will provide. Large requirements for smoke may require redistribution of the basic loads of several units or issue of additional smoke ammunition for a specific operation. Combat experience has shown that smoke ammunition will not be available to support all smoke requests.

c. Available means. Prior to firing a smoke mission, the observer, FDO, and FSO must consider the means available. The FIST chief recommends to the maneuver commander whether mortars or artillery should fire. The FDO decides which weapons will fire or whether to have a reinforcing unit, if available, support the mission. The FSO provides tactical information that could affect the fire support available. All assets are limited and for each mission the decision must be made: WHO CAN BEST FULFILL THE REQUIREMENTS?

Table 6-6. Equivalent Wind Scale.

KNOTS	OBSERVATION
1	SMOKE, VAPOR FROM BREATH, OR DUST RAISED BY VEHICLES OR PERSONNEL RISES VERTICALLY/NO LEAF MOVEMENT
1-3	DIRECTION OF WIND SLIGHTLY SHOWN BY SMOKE, VAPOR FROM BREATH OR DUST RAISED BY VEHICLES OR PERSONNEL SLIGHT INTERMITTENT MOVEMENT OF LEAVES
4-6	WIND SLIGHTLY FELT ON FACE/LEAVES RUSTLE
7-10	LEAVES AND SMALL TWIGS IN CONSTANT MOTION
11-16	WIND RAISES DUST FROM GROUND/LOOSE PAPER AND SMALL BRANCHES MOVE
17-21	SMALL TREES WITH LEAVES SWAY/COASTAL WAVELETS FORM ON INLAND WATERS
22-27	LARGE BRANCHES ON TREES IN MOTION/WHISTLE HEARD IN TELEPHONE OR FENCE WIRES
28-33	WHOLE TREES IN MOTION/INCONVENIENCE FELT WALKING AGAINST WIND

d. Terrain. The terrain affects the employment of smoke. The following rules should be applied.

(1) Smoke tanks in defile; they lose their sense of direction.

(2) Remember that smoke seeks low spots.

(3) Remember that firing smoke on dry vegetation may start fires.

(4) Do not fire smoke on deep mud, water, or snow; the smoke canisters normally will not function properly.

(5) Do not fire smoke on steep slopes; canisters roll downhill.

e. Enemy. Know and anticipate the enemy.

(1) Fire smoke on enemy artillery OPs/gunners to greatly reduce the effectiveness of his artillery.

(2) Fire smoke and HE on the enemy when he deploys from column to line formation. The HE will keep him buttoned up. The smoke will cause maximum confusion.

(3) Fire smoke and HE on minefields to cause maximum confusion.

(4) Understand the effects of smoke on effectiveness. Smoke used without sufficient thought and planning will reduce the user's effectiveness more than that of the enemy.

f. Command and control. The maneuver commander for whom the smoke is planned must approve its employment. When he issues his plans and concepts for an operation, he should state the guidelines on the amount of smoke that can be used, along with any restriction on its use. To insure that smoke is responsive, the FIST chief, FSO, and/or FSCOORD must request this smoke planning guidance if it has not been stated. The maneuver commander responsible for the operation must coordinate smoke operations with all units participating in or potentially affected by the operation. The operation officer (S3/G3) is responsible for the integration of smoke into the plan of maneuver. The FSO/FSCOORD must keep the maneuver commander advised on the availability of munitions and delivery systems. Combat arms troops must be well trained in smoke operations and comprehensive SOPs must be available and known to all. This will shorten reaction time.

6-13. Immediate Smoke (Fig 6-7)

a. Description. The objective of immediate smoke is to obscure the enemy's vision. Suppression of a small location can be achieved by use of immediate smoke to reduce the enemy's ability to observe. Immediate smoke can be planned, as other planned suppressive fires, or can be used after immediate suppressive fire has been found to be ineffective. When immediate smoke is planned, the immediate smoke target will be sent to the FDC as part of the target list. Weather conditions must be considered in planning immediate smoke, since a change in wind direction could make the planned smoke ineffective. If immediate suppressive fire is ineffective because of inaccurate target location, the observer has the option of giving a bold shift and requesting that the smoke be fired.

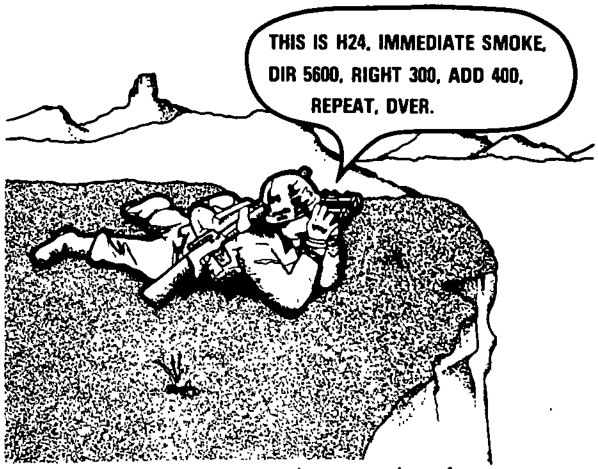
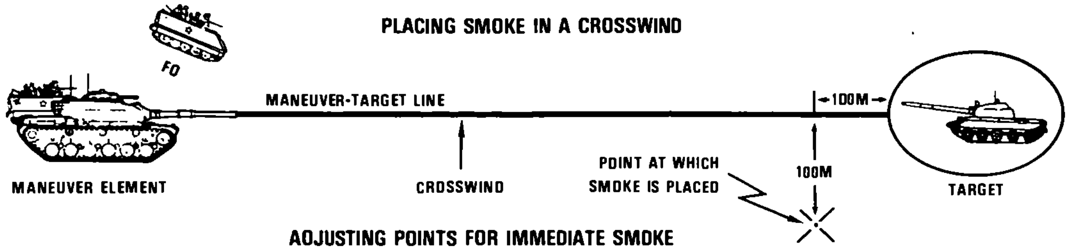


Figure 6-7. Immediate smoke after immediate suppression.

b. Employment considerations.

(1) Immediate smoke should not be requested initially if HE is in the loading tray by SOP. Rather than change the ammunition, the observer should request a fire mission that will expend the SOP suppression rounds (use them as adjusting rounds) and then call for immediate smoke. Before firing immediate smoke, the observer



ADJUSTING POINTS FOR IMMEDIATE SMOKE

DELIVERY TECHNIQUE	WIND DIRECTION			ADJUSTING POINT WITH RESPECT TO
	CROSS	HEAD	TAIL	
IMMEDIATE (WP & SMK) POINT/SUPPRESSION	100S-100UW	100S	200S	POINT TO OBSCURE ON MT LINE

S-SHORT UW-UPWIND 105MM AND 155MM HOWITZER

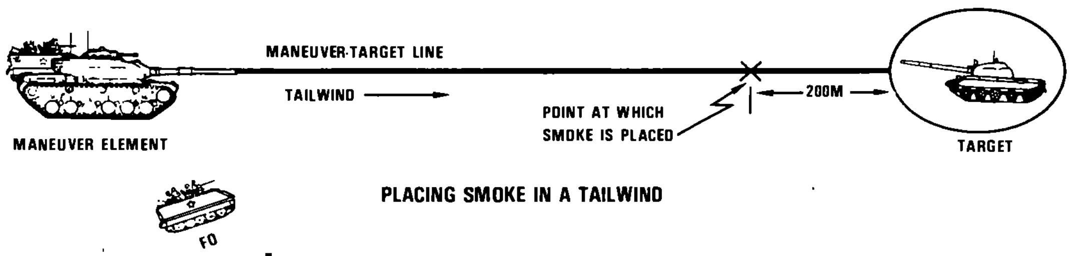


Figure 6-8. Placement of immediate smoke.

must realize that suppression by smoke will not be as immediate as suppression by HE since it takes time for the smoke to build up, but inaccurately placed smoke may still provide obscuration, whereas inaccurately placed HE may not give the desired results. Although immediate smoke will provide suppression (by obscuration) for a longer period of time than will HE, it is effective only against a pinpoint target or small area target less than 150 meters in diameter.

(2) The type of ammunition to be fired should be dictated by SOP. A suggested mix is two guns with one gun firing WP (for quick buildup) and with the other gun firing smoke on the first volley, followed by both guns firing smoke on subsequent volleys.

(3) Since immediate smoke normally is used on a planned suppressive target or when shifting after immediate suppression with HE has been found to be ineffective because of positioning, corrections for deviation, range, and height of burst must be made. The minimum correction for deviation should be 50 meters and for range should be 100 meters. The height of burst can be adjusted as follows:

Ground burst: UP 100.

Canisters bouncing excessively: UP 50.

Canisters too spread out: DOWN 50.

(4) When a mixture of smoke and WP is fired, it can be expected that the smoke will be effective 30 seconds after the shells land and that it will last approximately 4 to 5 minutes. If the smoke is required for a longer period of time, additional volleys of smoke should be requested.

(5) The point at which the smoke is placed depends on weather conditions (fig 6-8). Under normal circumstances, the point at which it is directed should be approximately 100 meters short on the maneuver-target line and 100 meters upwind of the enemy location. If the wind is a crosswind (blowing across maneuver-target line), the smoke is placed upwind so that it obscures the enemy's vision along the maneuver-target line. If the wind is a headwind (blowing away from the target), the smoke is placed 100 meters short on the maneuver-target line.

CARE MUST BE USED WITH HEADWINDS, SINCE THE SMOKE MAY BE BLOWN ONTO THE MANEUVER ELEMENT.

When the wind is a tailwind (blowing toward the target), the smoke is placed at least 200 meters short of the target to preclude the smoke from landing beyond the target.

6-14. Quick Smoke

a. Description. The objective of quick smoke is to obscure the enemy's vision or screen maneuver elements. The quick smoke mission equates to the normal HE adjust fire mission: obscuring the enemy is required, but the urgency of the situation does not dictate immediate smoke procedures. The mission is begun by adjusting with HE, shifting to smoke when near the adjusting point, then firing for effect with smoke.

b. Employment considerations.

(1) The quick smoke mission is used to obscure an area up to 600 meters in width. For areas larger than 600 meters, the observer can fire multiple quick smoke missions. Smoke may be effective up to 1500 meters downwind.

(2) When preparing a quick smoke mission, the observer first determines the nature of the target and the location of the adjusting point, determines the size of the area, and then determines the wind direction in relation to the maneuver-target line (fig 6-9).

(3) To select the HE adjusting point, the observer needs to determine the wind direction and whether WP or smoke is to be fired in effect.

(4) The FDC must be informed of the target length, the wind direction, and the length of time the smoke is required. This information is sent to the FDC as early as possible (prior to commanding FIRE FOR EFFECT). The observer also has the option of extending the time of effective smoke by requesting subsequent volleys.

(5) If the smoke must be effective beginning at a specific time, the observer requests AT MY COMMAND and the time of flight. To determine when to order the smoke fired, the observer adds the time of flight to the average buildup time of 30 seconds for WP and 60 seconds for smoke.

(6) If the smoke is ineffective, the observer must decide whether to shift the smoke or fire HE. If the decision is to shift, there may be a break in the screen while new data is being computed.

ADJUSTING POINTS FOR QUICK SMOKE

DELIVERY TECHNIQUE		WIND DIRECTION CROSS	HEAD	TAIL	ADJUSTING POINT WITH RESPECT TO :
QUICK (SMALL AREA/ SUPPRESSION)	WP	200S-150UW	100S	200S	AREA TO BE OBSCURED OR SCREENED
	SMK	200S-200UW	100S	400S	ON MT LINE

S-SHORT UW-UPWIND DATA IN METERS 105-mm AND 155-mm HOWITZER

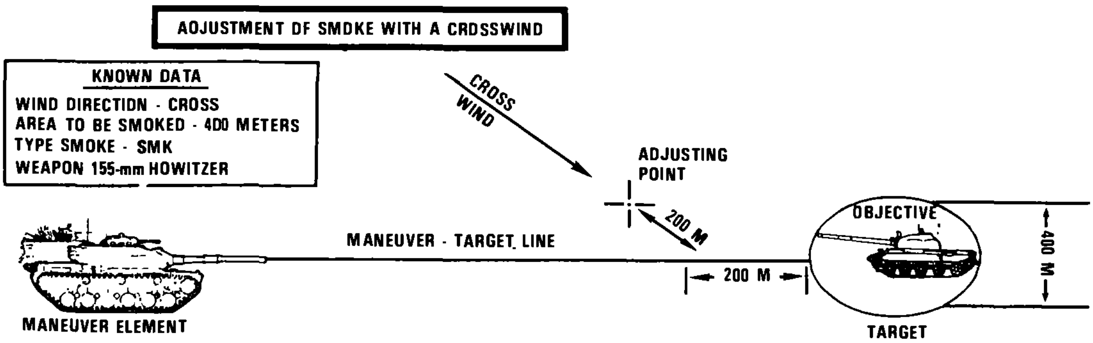


Figure 6-9. Placement of quick smoke.

6-15. Sample Missions

a. Immediate smoke as a continuation of an immediate suppression mission:

THIS IS H24, IMMEDIATE SMOKE, DIRECTION* 5600, RIGHT 200, ADD 400, REPEAT, OVER.

*If direction is not sent previously in immediate suppression mission.

b. Immediate smoke as the initial CFF:

THIS IS H24, IMMEDIATE SMOKE, GRID 628543, OVER.

c. Smoke with duration 5 minutes:

THIS IS H24, AF, SHIFT, REG POINT 1, OVER.

DIRECTION 2400, RIGHT 100, ADD 200, OVER.

SUSPECTED PLATOON LOCATION, 200 METERS, TAIL, DURATION 5 MINUTES, SMOKE IN EFFECT, OVER.

d. Smoke greater than 5 minutes duration:

THIS IS H24, AF, OVER.

GRID 432895, OVER.

SCREEN TREELINE, 200 METERS, CROSSWIND, DURATION 8 MINUTES, SMOKE IN EFFECT, OVER.

e. Smoke, multiple aiming points: Observer fires a quick smoke mission, observes effects, and announces to FDC:

SECOND AIMING POINT, RIGHT 500, DROP 200, REPEAT, OVER*.

*Had the observer simply desired to move the quick smoke to another point, he would have made a normal subsequent correction and said:

RIGHT 500, DROP 200, REPEAT, OVER.

SECOND AIMING POINT (or a local SOP term) informs the FDC that the observer desires to fire on a second point at this time and that the battery should be prepared to replenish smoke on either point. By observing how long the smoke remains effective near either aiming point, the observer can determine a time interval at which to replenish his smoke should he desire to do so.

INTERVAL = EFFECTIVE SCREEN TIME - BUILDUP TIME

He can pass this information to the FDC by saying:

CONTINUE SMOKE AT 3-MINUTE INTERVALS FOR 15 MINUTES, OVER.

f. Smoke: Observer calls for multiple aiming points at the beginning of the mission:

H18, THIS IS H24, FIRE FOR EFFECT, OVER.

GRID 843321 AND GRID 840322, OVER.

TRENCH LINE, 800 METERS, CROSSWIND DURATION 12 MINUTES, SMOKE, OVER.

Section IV. SPECIAL OBSERVER MISSIONS

6-16. Air Observer Missions

Because of the helicopter's speed, range, and ability to bypass obstacles, the aerial observer (AO) has the ability to provide observation for indirect fire at extended distances from ground units.

a. If possible, the AO and the pilot should be given a detailed preflight briefing by the battalion FSO and the battalion S3/S2. The preflight briefing should cover the following points:

(1) The location of battery position areas, registration points, targets, reference lines used in making corrections (if the GT line is not used), suspected targets, and areas to be searched.

(2) The tactical situation, to include coordinating measures, frontlines, and zones of action of the support troops.

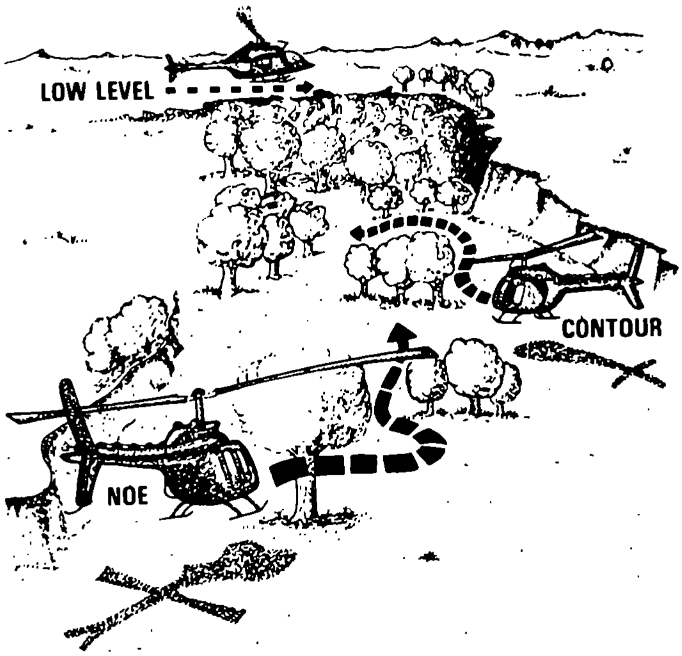


Figure 6-10. Types of terrain flying.

(3) The surveillance required, the time of the mission, maps and photographs to be used, known enemy antiaircraft defenses, flight instructions, and security restrictions.

(4) Communication details to include the locations of ground radios and panel stations, channels to use, call signs, check-in time(s), and prearranged signals.

(5) The method of calling for and executing suppression of air defenses (SEAD).

(6) Recording on the appropriate map of all important enemy locations, coordinating measures, and other critical areas indicated in the briefings.

(7) Any SOP items regarding smoke, registrations, or use of specific ammunition.

LACK OF ADEQUATE PREFLIGHT BRIEFINGS CAN BE FATAL.

b. There are three types of terrain flying: nap-of-the-earth, contour, and low level (fig 6-10).

(1) Nap-of-the-earth (NOE) flight is flight as close to the earth's surface as vegetation or obstacles will permit. Airspeed and altitude are varied as influenced by the terrain, weather, and the enemy situation. Due to the intricate maneuvering involved in NOE, airspeeds are normally quite low.

(2) Contour flight is flight at low altitude generally conforming to the contours of the earth. It is characterized by a varying airspeed and a varying altitude as vegetation and obstacles dictate.

(3) Low level flight is flight conducted at a selected altitude that minimizes detection or observation. The route generally conforms to a straight line and a constant airspeed and altitude.

(4) The enemy actions are the primary consideration in determining whether or not terrain flying will be used. With the acquisition capability of the enemy, only a brief exposure time is allowable to locate a target once it has been observed. To insure survivability, the AO should attempt to be exposed no more than 10 seconds when determining target location.

c. The spotting line is the line along which the observer is going to adjust. The spotting line and its direction must be known by the FDC personnel. There are several possible spotting lines that the AO can use: gun-target line (GT), observer-target line (OT), cardinal

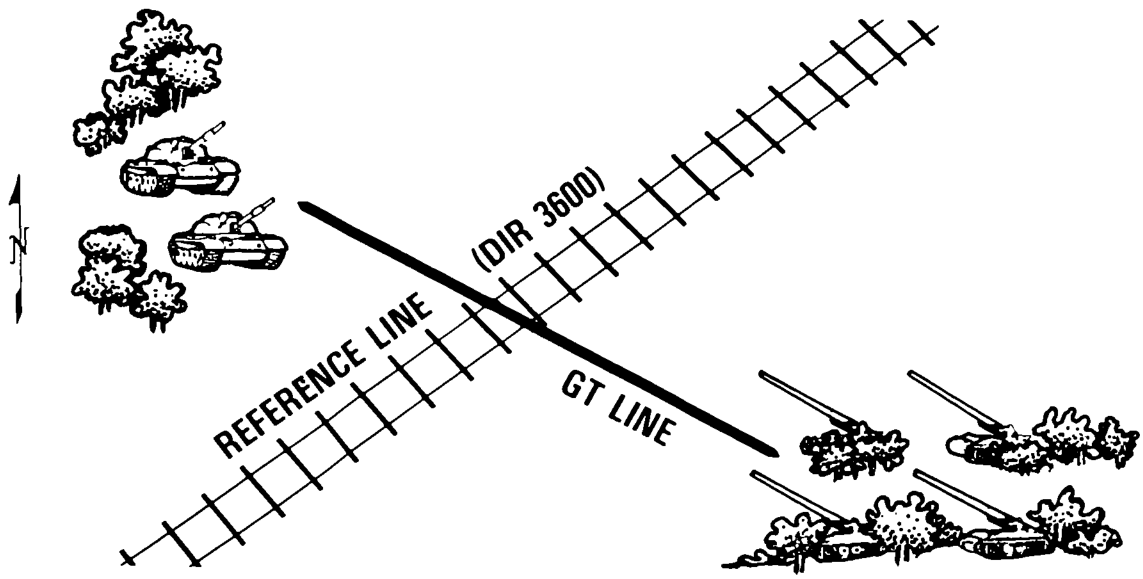


Figure 6-11. Reference line and GT line.

direction, and readily identifiable terrain feature.

(1) Gun-target line (fig 6-11). Knowledge of the firing unit's location allows the AO to determine the GT line without requesting ranging rounds. Use of ranging rounds is normally undesirable since it may facilitate the enemy's determination of the firing battery's position. The FDC will assume that the GT line is being used unless otherwise specified by the observer. If the observer does use the GT line, he should select a terrain feature (e.g., a road, stream, or ridgeline) that will assist him in remembering the GT direction. However, due to the low altitudes at which the observer is flying, using a spotting line other than the GT line will often be required.

(2) Observer-target line. The aircraft heading indicator can be used to determine the OT direction. Since the aircraft is normally in a head-on posture whenever the observer is looking at the target, the heading indicator will provide an accurate direction in most cases. Using this technique, direction should be sent to the nearest 10 degrees (e.g., DIRECTION 70 DEGREES). When the OT direction changes more than 10 degrees during a mission, the new direction should be sent to the FDC (assuming that the next corrections are being sent in relation to the new OT line).

(3) Cardinal direction (fig 6-12). The observer may use cardinal direction for sending direction. If this method is used, the observer will notify the FDC by sending the number of mils corresponding to the cardinal direction (e.g., using west, DIRECTION 4800).

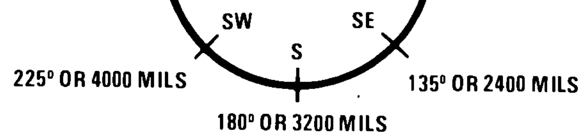


Figure 6-12. Cardinal directions.

(4) Readily identifiable terrain feature. The observer may select a line formed by a road, a railroad, a canal, or any series of objects. Prior to flight, if possible, the observer selects the line and transmits the data to the FDC.

d. Obtaining accurate target location is difficult since targets are normally acquired with the naked eye. Use of binoculars is limited because of distortion caused by the windscreen and vibration of the aircraft.

e. Target location is indicated by grid or shift from a known point. The announced direction of the shift is with respect to the spotting line. If any spotting line other than the gun-target line (GT) is used, it must be identified (e.g., FROM TGT AA7733, SPOTTING LINE NORTH-SOUTH HIGHWAY, RIGHT 440, ADD 800).

f. When adjusting fire, the AO will probably use one of two techniques: stationary hover or popup.

(1) Stationary hover. The pilot positions the aircraft behind trees or other vegetation that provides concealment for the aircraft and still permits observation of the target.

(2) Popup. The pilot will "unmask" the aircraft 2 to 3 seconds prior to the impact of the round. The AO will observe the burst and the pilot will then return the aircraft to the hide position or move to another hide position. The observer sends his corrections as the pilot is "remasking" the aircraft. Use of the time of flight may become necessary. This allows the pilot to position the aircraft properly if "splash" time is not sufficient. Set patterns of movement should be avoided to enhance survivability.

g. Sample calls for fire are discussed below.

(1) An example of a call for fire in which the air observer uses grid coordinates as the means of locating the target follows:

H18, THIS IS H90, ADJUST FIRE, OVER.

GRID 421791, OVER.

INFANTRY PLATOON AND 10 TRUCKS IN THE OPEN, ICM IN EFFECT, OVER.

When adjusting rounds on a grid fire mission, the spotting line must be identified prior to subsequent corrections, or the FDC will plot the corrections along the gun-target line.

(2) An example of an air observer's initial call for fire in which the target location is based on a shift from a known point and the gun-target line is used as the spotting line follows:

H18, THIS IS H90, ADJUST FIRE, SHIFT, REGISTRATION POINT 1, OVER.

RIGHT 400, ADD 800, OVER.

INFANTRY PLATOON AND 10 TRUCKS IN THE OPEN, ICM IN EFFECT, OVER.

No reference is made to the line to be used as the reference line. When the spotting line is not identified in the call for fire for a shift mission, the fire direction center uses the gun-target line.

(3) An example of an air observer's call for fire in which the target location is based on a shift from a known point and a line of known direction is used as the spotting line follows:

H18, THIS IS H90, ADJUST FIRE, SHIFT, AA7734, OVER.

REFERENCE LINE WESTERLY RAILROAD, RIGHT 400, DROP 800, OVER.

INFANTRY PLATOON AND 10 TRUCKS IN THE OPEN, ICM IN EFFECT, OVER.

When a spotting line other than the GT line is to be used, the spotting line must be identified in the air observer's call for fire.

(4) An example of an air observer's call for fire in which the target location is indicated by cardinal direction follows:

H18, THIS IS H90, ADJUST FIRE, SHIFT, AA7734, OVER.

400 METERS NORTHEAST, OVER.

4 TRUCKS STALLED AT FORD, OVER.

(5) An example of an air observer's call for fire in which he requests ranging rounds follows:

H18, THIS IS H90, ADJUST FIRE, SHIFT, ROAD JUNCTION 1630, OVER.

DIRECTION 1200, RIGHT 800, DROP 1600, OVER.

TANK RETRIEVER AND STALLED TANK, RANGING ROUNDS, OVER.

Subsequent correction is made from either near or far round (in relation to guns).

6-17. High Angle Fire (Fig 6-13)

Fire delivered at elevations greater than the elevation for maximum range is called high angle fire. High angle fire is often required when the weapons fire out of deep defilade, from within built-up areas, or over high terrain features near friendly troops. High angle fire may also be required when the targets are located directly behind hill crests, in jungles, or in deep gullies or ravines and cannot be reached by low angle fire.

Generally, those weapons with a maximum elevation substantially in excess of 800 mils have the capability to fire high angle. All US artillery weapons are capable of high angle fire. The observer procedure for the adjustment of high angle fire is the same as that for the adjustment of low angle fire. The observer must realize that small deviation corrections during adjustment may be unnecessary and time consuming because of the increased dispersion experienced during high angle fire. Since the time of flight is long in both adjustment and fire for effect, the FDC will announce SHOT when the round(s) is fired and will announce SPLASH 5 seconds before the burst(s) occurs.

6-18. Final Protective Fires (FPF)

a. An FPF is a prearranged barrier of fire designed to protect friendly troops. Basically, it is an entire battery or mortar section firing so that the rounds are arranged on line. The size of the FPF depends on the type of weapon.

Weapon	Size of FPF
81-mm mortar	100 meters
107-mm mortar	200 meters
105-mm howitzer	180 meters
155-mm howitzer	300 meters

Note. Individual 81-mm mortars may be assigned an FPF (34 meters × 50 meters). Two 107-mm mortars may be assigned an FPF (100 meters × 50 meters).

b. The location of the FPF is normally designated by the maneuver commander for which it is being planned. It may be any distance from the friendly position, but is normally within 200-400 meters (danger close). The importance of accurate defensive fires, and the danger close situation require that each weapon firing the FPF be adjusted into place.

c. The call for fire is similar to the normal call for fire in an adjust fire mission with some exceptions.

(1) The target location initially sent is not the location of the center of the FPF but a grid a safe distance (400 to 600 meters) from friendly troops. Because this grid is part of a final defensive plan, it should be encoded. The attitude or direction of the long axis of the FPF is also announced.

(2) In place of a target description, the phrase "FINAL PROTECTIVE FIRES" is announced.

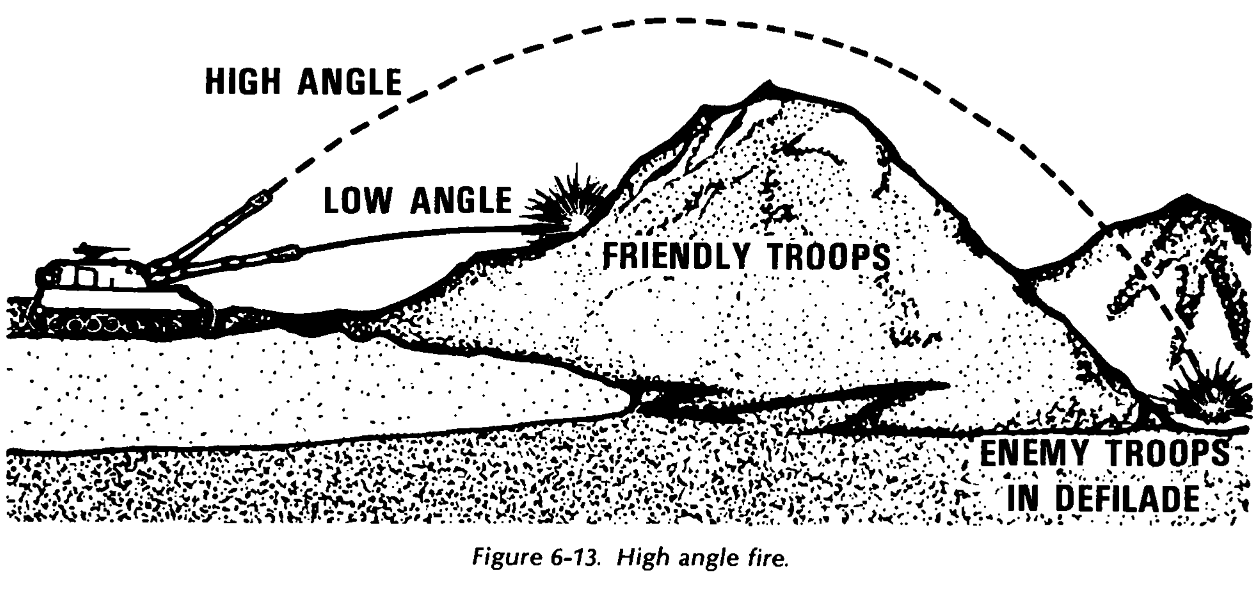


Figure 6-13. High angle fire.

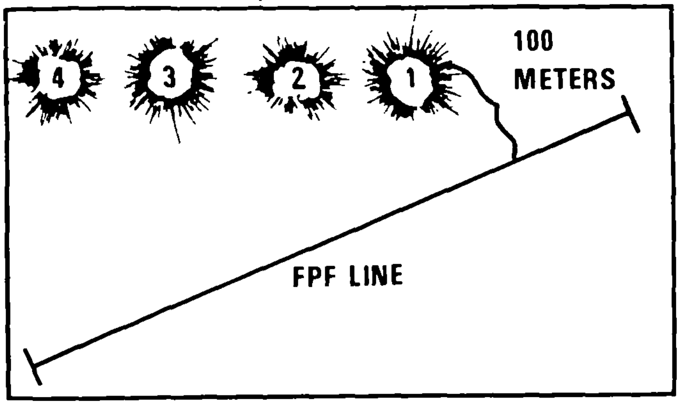


Figure 6-14. Adjustment of the FPF begins with round nearest the FPF line.

(3) "DANGER CLOSE" is announced in the method of engagement.

d. The battery or mortar section will fire a battery (section) 1 volley centered about the initial grid sent by the observer. Assume the rounds impacted as seen in figure 6-14. The observer begins his adjustment with the flank piece impacting closest to FPF line (in this case number 1). Recall that creeping fire must be used because of the danger close situation. Corrections of 50 meters or less are not fired.

e. Once the first gun is adjusted, the observer sends NUMBER 2, REPEAT and adjusts each weapon in succession.

f. A sample mission follows: The weapons firing are a 105-mm battery. The observer is shown the FPF line by the maneuver commander and sends the following call for fire.

B6H12, THIS IS B6H18, ADJUST FIRE, OVER.
GRID XYLPEFTX, OVER.

FINAL PROTECTIVE FIRE ATTITUDE 1900, DANGER CLOSE, OVER.

The battery fires a battery 1 round. The sheaf is shown in figure 6-15. The observer notes that number 6 is closest to the FPF line and will begin the adjustment with it.

DIRECTION 810, NUMBER 6, LEFT 100 DROP 50, OVER.

The observer believes the round is within 50 meters, so he sends a correction (the round is not fired) and he calls for number 5 to fire.

NUMBER 6, DROP 50
NUMBER 6 IS ADJUSTED
NUMBER 5, REPEAT

The other weapons are adjusted as discussed above.

g. In some instances, there will not be time to "shoot in" the FPF. In this instance, the FPF will be called in giving the grids of the two ends or giving the center grid and attitude.

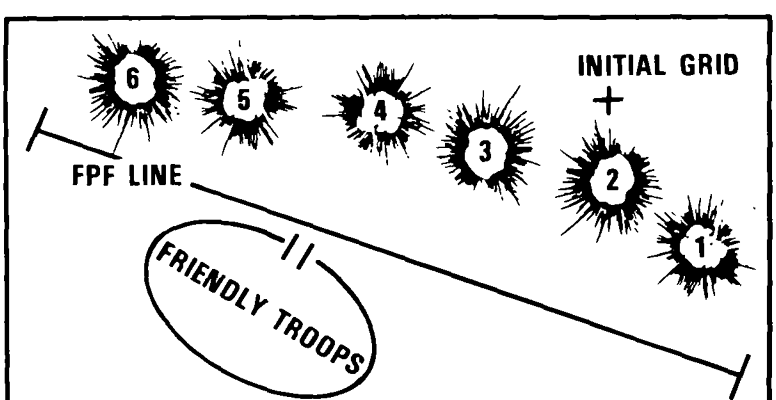


Figure 6-15. Adjustment of FPF begins with round 6.

6-19. Adjustment by Sound

a. During operations when observer visibility is limited, fire may be adjusted by the use of sound alone. Target location may be reported to the observer by the supported unit or may be determined by the observer. If the observer can hear noises at the enemy position (for example, weapons firing, vehicles, or troop movements), he can estimate a direction and distance from his position. When the fire is to be adjusted by the use of sound, the observer must alert the FDC concerning this fact.

b. Upon hearing the burst of the adjusting round, the observer estimates the direction to the burst and compares it with the direction to the target. He converts the deviation to a lateral shift in meters by using the estimated distance from his position to the target. Distance to the adjusting point is difficult to judge; therefore, it may be necessary for the observer to use creeping techniques to adjust onto the target. He can determine distance by measuring the time it takes for the sound of the burst to reach him and multiplying the time interval by the speed of sound, which is approximately 350 meters per second. To assist the observer in determining distance accurately, the FDC can announce the precise moment of impact.

c. The observer must exercise caution in very broken terrain. In hills or mountains the sound may travel around a hill mass before it arrives at the observer and may produce a false direction to the burst.

6-20. Multiple Missions

Contact with the enemy may be so intense that the forward observer must transmit two or more calls for fire and conduct the adjustment of all missions simultaneously. The observer should consult the maneuver unit commander, if possible, or use his own best judgment to determine which of several important targets should be engaged first. The experienced observer will have little trouble handling multiple missions if he assigns a number (such as mission 1 and mission 2) to each mission. The observer may also record the corrections determined for each target to eliminate any confusion that may arise in the heat of battle. If other observers are using the same fire net, each observer should continue to use his call sign during the mission.

6-21. Observing High Burst (HB) or Mean-Point-of-Impact (MPI) Registrations (Fig 6-16)

The opportunities for a precision registration are limited, since it requires visual observation on a clearly defined, accurately located registration point in the target area. At night, visual adjustment of fire on a registration point is impossible without some type of illumination. In desert, jungle, or arctic operations, clearly defined registration points in the target area are not usually available. Special procedures, including observation techniques, have been developed to provide for registration under these conditions. One such procedure is the HB or MPI registration. In a high burst registration, two observers, referred to as 01 and 02, simultaneously observe time fire aimed at a point in the air above the target area. The fire direction center selects the point at which the fire is to be aimed by selecting a point on the ground in the area where the registration is desired and projecting this point into the air with a prescribed height of burst. The fire direction center controls the high burst registration. A single weapon is used to fire the registration. All rounds are fired with the same data. Each observer, using an aiming circle or BC scope, reports the direction from his position to the bursts and one observer reports the vertical angle after each round. An MPI registration is the same except the rounds have fuze quick.

a. Location and initial orientation of the observing instruments. In a high burst registration, the accurate location of the observation posts and the proper orientation of the observing instruments are very important. Each location is surveyed and a line of known direction is materialized on the ground so that the observer can orient his instrument for direction. If possible, the observers should establish their observation posts and orient their instruments for direction during daylight. However, the exact location of the instrument and the line of known direction should be marked so that

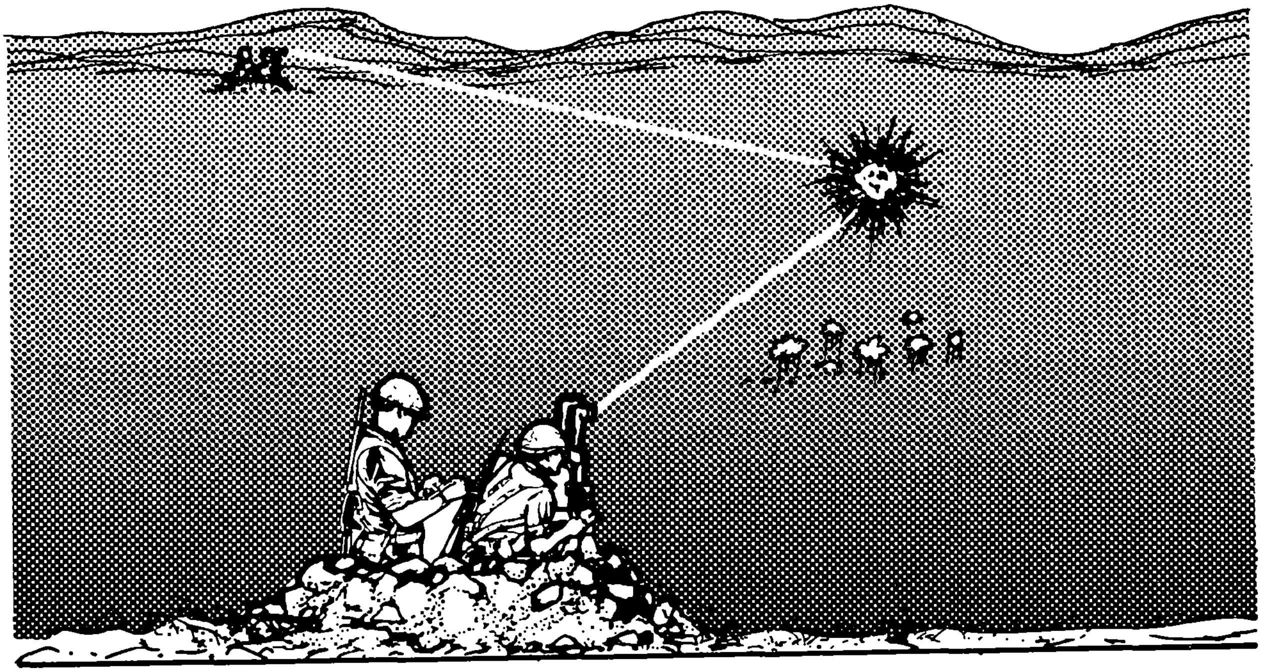


Figure 6-16. High burst registration.

they can be identified during darkness. These precautions will enable the observers to position and orient their instruments during darkness if necessary. To establish the observation posts, the observers set their instruments over the position markers, make sure that the instruments are level, and then orient the instruments on the line of known direction. To orient his instrument on the line of known direction, the observer sets the azimuth of the line of known direction on the azimuth scales of the instrument with the upper motion and then, using the lower motion, alines the vertical crosslines in the reticle on the marker or point that identifies the known direction on the ground. The instrument will then be properly oriented for direction.

b. Orientation of the observing instruments on the orienting point. The fire direction center furnishes each observer with the direction and vertical angle from his position to the orienting point. The following is a typical message from the fire direction center to the observers.

OBSERVE HIGH BURST REGISTRATION, 01 DIRECTION 1164, VERTICAL ANGLE PLUS 12, MEASURE THE VERTICAL ANGLE.

02 DIRECTION 718, VERTICAL ANGLE MINUS 3. REPORT WHEN READY TO OBSERVE.

Each observer, using the upper motion, sets the direction given him on the azimuth scales of his instrument. The horizontal line of sight of the instrument now coincides with the horizontal line of sight from the observer's position to the registration point. Each observer also sets the vertical angle given him on the elevation scales of his instrument to orient the instrument for height of burst. The manner in which the observer sets the vertical angle on the scales of his instrument depends on the type of observing instrument he is using.

(1) The elevation scales on the aiming circle (M2) are graduated so that a 0 reading on the scales corresponds to a vertical angle of 0. The scales are graduated and numbered in each direction from 0. The graduations and numbers in one direction from 0 are printed in black; those in the other direction are printed in red. Positive (plus) vertical angles are indicated by the black numbers, and negative (minus) vertical angles are indicated by the red numbers. The elevation scales on the aiming circle are operated with the elevation micrometer knob. If the vertical angle given

the observer is a positive (plus) angle, he sets its value on the elevation scales in the direction represented by the black numbers; if the vertical angle given the observer is a negative (minus) angle, he sets its value on the elevation scales in the direction represented by the red numbers. This action places the center of the crosslines in the reticle of the instrument in line with the point in the air selected as the registration point.

(2) If the observer is using a battery commander's telescope, he orients the instrument for height of burst by applying the vertical angle to the angle-of-site scales. These scales are graduated in such a manner that a vertical angle of 0 corresponds to a reading of 300 on the angle of site scales. If the vertical angle given the observer is a positive (plus) angle, its value is added to 300 and the resulting number is set on the angle-of-site scales. If the vertical angle is a negative (minus) angle, its value is subtracted from 300 and the value of the remainder is set on the angle-of-site scales.

Example.

The vertical angle is +12, the reading set on the angle-of-site scales is 312 (300 +12 = 312). The vertical angle is -3, the reading set on the angle-of-site scales is 297 (300 - 3 = 297).

After setting the reading on the angle-of-site scales, the observer levels the angle-of-site mechanism by using the elevation knob to center the bubble in the level vial. This action places the center of the crosslines in the reticle of the instrument in line with the point in the air at which the rounds will be fired.

c. Reorientation on the first round (fig 6-17). When the observers report READY TO OBSERVE, the fire direction center directs the firing of the rounds singly and reports SHOT after each round is fired and SPLASH 5 seconds prior to the round detonating. The observers use the first round in reorienting their instruments. When the burst of the first round appears, each observer, using the upper motion of the azimuth mechanism, centers the vertical crossline in the reticle of his instrument on the burst. Each observer then reads the azimuth to the first burst directly from the azimuth scales on the instrument. If the observer is using an aiming circle, he reorients the instrument for height of burst by using the elevation micrometer knob to center the horizontal crossline on the burst (this must be done at the same time that he centers the vertical crossline in reorienting for direction). He then reads the vertical angle to the first burst directly from the elevation scales of the

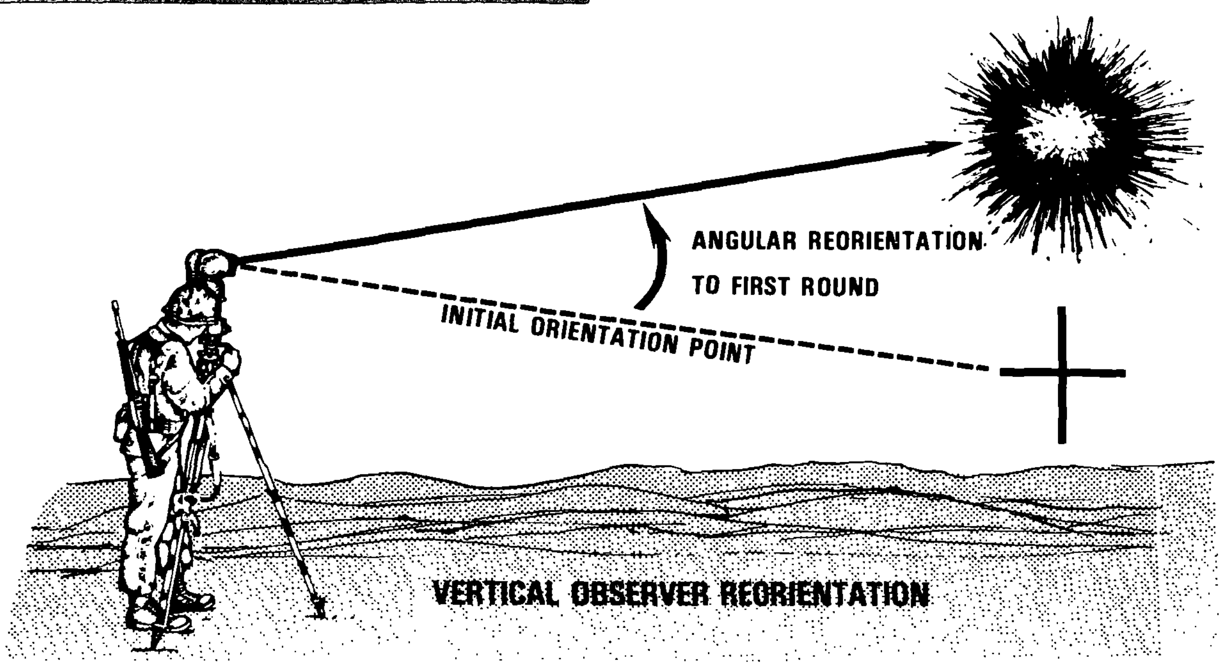


Figure 6-17. Reorientation after first round.

instrument. If the observer is using a battery commander's telescope, he reorients the instrument for height of burst on the burst of the first round by using the elevation knob to center the horizontal crossline in the reticle of the instrument on the burst (this must be done at the same time he centers the vertical crossline to reorient for direction). After centering the horizontal crossline in the burst, he uses the angle-of-site knob to level the bubble in the level vial on the angle-of-site mechanism. The vertical angle to the first burst is the difference between the reading on the angle-of-site scales and 300.

> Example.
>
> The reading on the angle-of-site scales is 287, the vertical angle is -13; if the reading on the angle-of-site scales is 313, the vertical angle to the first burst is +13.
>
> After reorienting his instrument on the burst of the first round, each observer reports the direction reading on his instrument, but only the observer directed to measure the vertical angle reports the vertical angle.

d. Measuring and reporting subsequent instrument readings. After the first, or orienting, round, the observers do not change the positions of their instruments. Each observer determines the direction of each subsequent round by reading the horizontal deviation from the vertical crossline in the reticle of the instrument and then combining this value with the reading on the azimuth scales. If the deviation is to the left of the vertical crossline, he subtracts the value from the reading on the azimuth scales; if it is to the right of the vertical crossline, he adds the value to the reading on the instrument.

> Example.
>
> A round bursts 20 mils right of the vertical crossline and the reading on the azimuth scales is 480, the azimuth to the burst is 500 (480 + 20 = 500).

The vertical angle to subsequent bursts is determined in one of two ways:

(1) If the observer directed to measure the vertical angle is using an aiming circle, he reads the number of mils the burst appears above or below the horizontal crossline in the reticle of the instrument and combines this reading with the reading on the elevation scales.

> Example.
>
> The burst appears 10 mils above the horizontal crossline and the reading on the elevation scales is +20, the vertical angle to the burst is +30 (20 + 10 = 30). The burst appears 10 mils below the horizontal crossline in the reticle of the instrument and the reading on the elevation scales is +6, the vertical angle to the burst is -4 (6 - 10 = -4).

(2) If the observer directed to measure the vertical angle is using a battery commander's telescope, he reads the number of mils the burst appears above or below the horizontal crossline in the reticle of the instrument and combines this reading with the reading on the angle-of-site scales. The value of the vertical angle is the difference between this combined reading and 300. If the combined reading is greater than 300, the value of the vertical angle is plus (positive); if the combined reading is less than 300, the vertical angle is minus (negative).

> Example.
>
> The burst appears 20 mils above the horizontal crossline and the reading on the angle-of-site scales is 305, the vertical angle is +25 (305 + 20 = 325; 325 - 300 = +25). If the burst appears 20 mils below the horizontal crossline and the reading on the angle-of-site scales is 305, the vertical angle is -15 (305 - 20 = 285; 285 - 300 = -15).

e. Example of observer procedures in a high burst registration. The following example illustrates the observer procedures in the conduct of a high burst registration. Only observer 01 is discussed.

Observer 01 arrives at his position and locates the survey stake that marks the exact location of his instrument. The tag on the survey stake indicates that the azimuth of the known direction is 1860 mils and that the direction is identified on the ground as the left edge of a red building approximately 1500 meters to the right flank. Observer 01 places his aiming circle over the marking stake, with the upper motion sets off an azimuth of 1860 mils on the azimuth scales, and using the lower motion, alines the crosslines in the reticle of the instrument on the left edge of the red building. He reports to the FDC that he is in position. Observer 01 receives the following messages from the FDC:

OBSERVE HIGH BURST REGISTRATION, 01, DIRECTION 430, VERTICAL ANGLE PLUS 15, MEASURE THE VERTICAL ANGLE.

With the upper motion, 01 turns the azimuth scales to 430 and sets off +15 on the elevation scales. 01 reports to the FDC:

01 READY TO OBSERVE.

The FDC sends commands to the battery to fire the first round and when the round is fired, reports to 01:

SHOT, SPLASH.

When the round bursts, 01 centers the vertical and horizontal crosslines on the burst by using the upper motion (azimuth micrometer knob) and the elevation micrometer knob. He reads the direction of the first burst from the azimuth scales as 390 and the vertical angle from the elevation scales as +10 and then reports the first instrument reading as follows:

01 DIRECTION 390, VERTICAL ANGLE PLUS 10.

The FDC directs the battery to fire and, when the second round is fired, reports to 01:

SHOT, SPLASH.

When the second round bursts, 01 observes the burst 10 mils right of the vertical crossline and 2 mils above the horizontal crossline. Since the deviation is to the right of the vertical crossline, 01 adds 10 to the setting on the azimuth scales (390) and obtains a direction of 400. The burst appeared 2 mils above the horizontal crossline; therefore, 01 adds +2 to the setting on the elevation scales (+10) and obtains a vertical angle of +12. 01 reports the instrument readings for the second round as follows:

01 DIRECTION 400, VERTICAL ANGLE PLUS 12.

The procedures for measuring and reporting subsequent rounds are the same as those for the second round. When the fire direction center has obtained a sufficient number of instrument readings to compute the registration data, it terminates the registration by notifying the 01 observer:

END OF MISSION.

f. Mean-point-of-impact registration. In a mean-point-of-impact registration, the fire direction center selects a ground location as the registration point and employs impact fuzes in the registration. The establishment of the observation posts and the procedures followed by the observers are the same as those in a high burst registration.

6-22. Auxiliary Adjusting Point (Fig 6-18)

To achieve surprise, the observer may decide not to adjust on the target but to adjust on a nearby point. This nearby point, the auxiliary adjusting point, must be far enough away from the target that the real purpose of the adjustment is obscured. At the same time, the auxiliary adjusting point must be selected so that an accurate (preferably lateral) shift to the target can be determined. When the adjustment on the auxiliary adjusting point is complete, the shift to the target is made.

6-23. Observer Not Oriented

Poor visibility, unreliable maps, deceptive terrain, or rapid movement through unfamiliar terrain sometimes makes it difficult for the observer to orient himself.

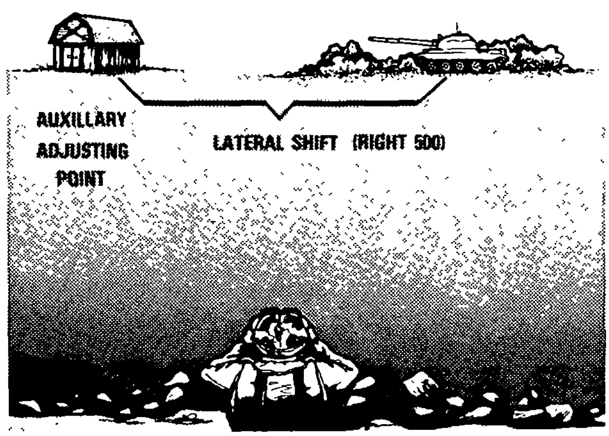


Figure 6-18. Auxiliary adjusting point.

The observer may call for a marking round(s) to be fired on a registration point, previously fired target, or a prominent terrain feature (e.g., MARK REGISTRATION POINT 1 or MARK HILL 37). As a last resort, the observer may call for a round(s) to be fired into the center of the target area (e.g., MARK CENTER OF SECTOR). The observer usually calls for a type of projectile that is easily identifiable, such as white phosphorus, or for a high airburst, or both. (The unit may have an SOP for SHELL/FUZE combination.) The FDC prepares data that will place the round at the point of impact or point of burst requested by the observer. If the observer fails to see the round, the FDC prepares data that will move the next round to a different point of impact or that will raise the burst higher in the air. This procedure is continued until the observer positively identifies the round. He then orders a shift from the point of impact (burst) of the identified round to a target or an object that is permanent or semipermanent in nature such as a road junction or the ruins of a building. Once this point has been located by adjustment of fire and has been plotted at the FDC, the observer may use it as a known point from which shifts can be made to subsequent targets.

6-24. Irregularly Shaped Targets

When calling for fire on an irregularly shaped target, the observer must locate the target in sufficient detail to allow the FDO to make a decision as to the best method of attack.

a. The observer can send a grid, size, and attitude of the target. The grid sent by the observer is the grid location of the center of the target. The target attitude is best described as a clockwise angle in mils measured from grid north to a line passing through the long axis of the target (fig 6-19).

E22, FFE, OVER.
GRID 847751, OVER.
INF PLT IN TRENCH LINE, SHEAF 50 × 200, ATTITUDE 2600, OVER.

b. The observer can send the target by sending two grids. The grids sent are the two

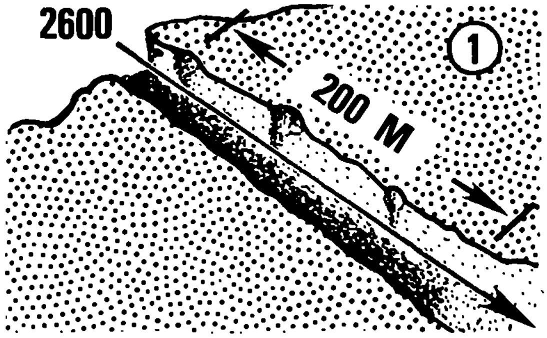


Figure 6-19. Target attitude.

end grids (fig 6-20).

E22, FFE, OVER.
GRIDS 168198 AND 171196, OVER.
3 BTR 60s HALTED IN TREELINE, OVER.

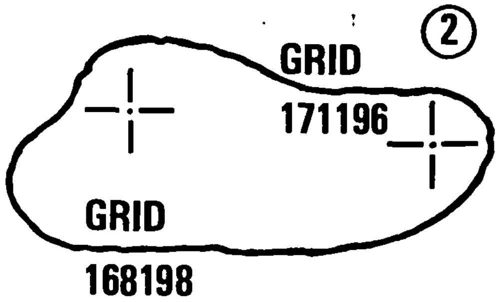


Figure 6-20. Target identified by two end grids.

c. If the target cannot be described by a straight line between two grids, the observer can send three grids. For example, if the target is in a treeline that is V shaped, the observer sends the grids of the two ends and the grid of the turning point (fig 6-21).

E22, FFE, OVER.
GRIDS 168197 AND 169198 AND 170197, OVER.
INF CO IN TREELINE, OVER.

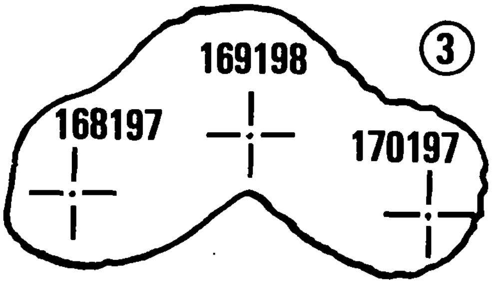


Figure 6-21. Target identified by three grids.

d. The target might best be described as a circle. The observer would send the grid of the circle center and the radius of the circular target (fig 6-22).

E22, FFE, OVER.
GRID 642377, OVER.
SAGGER MISSILE CLUSTER, RADIUS 150, OVER.

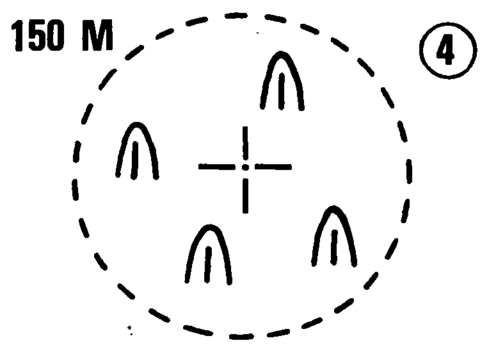


Figure 6-22. Circular target.

6-25. Emergency Observer Procedures (Fig 6-23)

a. In an emergency situation when no FDC is available, the observer may determine and send fire commands directly to the battery. Initial data are determined using the following steps:

(1) Estimate the range from the battery to the target.

(2) Determine the charge using the rule:

105-mm: Charge equals range in thousands plus 1 (for range 4000, the charge is 5)

155-mm: Charge equals range in thousands (for range 5000, the charge is 5)

8-inch: Charge equals range in thousands minus 1 (for range 5000, charge is 4)

(3) Determine approximate deflection to target or fire common deflection.

(4) Fire quadrant 240 mils.

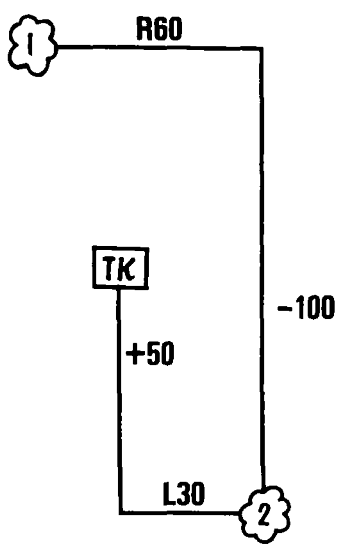
b. Subsequent corrections are done with respect to the gun-target line.

(1) Determine 100/R: 100/R equals 100 divided by the range in thousands to the nearest hundred. (Rg 4600: 100/R = 100/4.6≈22)

(2) Correction in deflection in mils equals the change in meters times 100/R.

(3) Determine the number of mils change to quadrant that will give a 100-meter range change (C factor) using the table below.

Weapon	C Factor
105-mm M101A1	13 minus charge
105-mm M102	12 minus charge
155-mm M114A1	12 minus charge
155-mm M109/M114A2/M109A1	11 minus charge
8-inch M110/M110A1	10 minus charge



Initial Data
Def 3200 (Common Deflection)
QE 240

100/R = 100 ÷ 4000/1000 = 100 ÷ 4 = 25
DEV CORR = CORR/100
C FACTOR FOR 155mm = 11-Charge = 7
DE Corr = Range Change/100×C FACTOR

ROUND 2

Dev. Corr = R60
Df Corr = .6 × 25 = R15 mils = 3200 − 15 = 3185
Range Corr = -100
DE Corr = -100/100 × 7 = -7mils = 240 − 7 = 233

ROUND 3 (FFE Data)

Dev. Corr = 630
Df Corr = .3 × 25 = R7.5≅8mils = 3185 + 8 = 3193
RANGE Corr = +50
DE Corr = +50/100 × 7 = 3.5≅4 = 233 + 4 = 237

Figure 6-23. Emergency observer procedures for M109A1, charge 4.

(4) Change in quadrant is expressed in mils (range change in hundreds of meters times C factor).

(5) Determine fuze setting by estimation.

(6) Adjust height of burst arbitrarily.

c. This system is only valid for charges 3, 4, and 5 of all weapons systems.

6-26. AN/GVS-5 Laser Rangefinder (Fig 6-24)

a. The AN/GVS-5 is a lightweight, hand-held, laser rangefinder that can accurately determine the range to a target within 1 second after the FIRE button has been depressed. The device emits an invisible laser burst and detects its return when the burst is reflected from a distant object. The time lapse between emission of the beam and return is converted to meters and displayed in the eyepiece on the range-to-target display. The entire AN/GVS-5 package, including battery, weighs 5 pounds. When accurately aimed, the AN/GVS-5 will provide a range that is accurate to within plus or minus 10 meters of the target.

b. To use the AN/GVS-5, an observer simply aims the device by superimposing the circle at the center of the reticle pattern over the target and depresses the FIRE button. The range will be displayed in the range-to-target window and will remain there as long as the FIRE button is depressed. The observer should not automatically consider the displayed range to be the correct range to the target. On the contrary, clutter in front of or behind the target may, on occasion, produce false ranges. The observer must continually associate the displayed range with a terrain-map analysis and his own range estimate to decide whether or not the reading is accurate. When, in the observer's opinion, all of these figures do not correlate, he should consider the following:

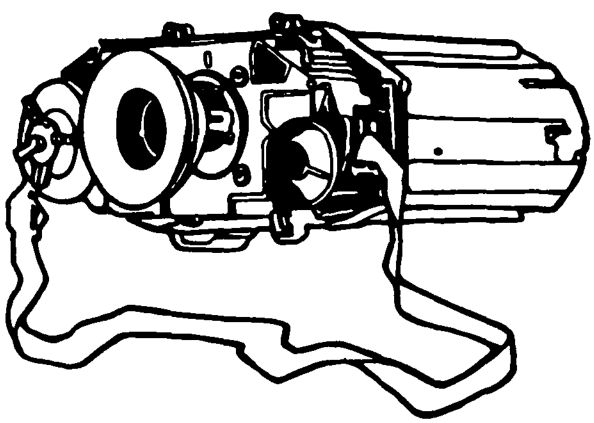


Figure 6-24. AN/GVS-5.

(1) Multiple firings. To insure that the observer is aiming at the correct target, he should take a series of readings on the same target. Three consistent readings generally indicate that the observer has aimed in the same place each time.

(2) Minimum range set. Although the emitted laser beam is relatively narrow, it is sufficiently wide to reflect from more than one target or object. The AN/GVS-5 is equipped with a "multiple target" warning light inside the eyepiece that illuminates when more than one return signal is received. When multiple target readings are indicated, the range displayed will be the range to the first object from which the beam is reflected. To prevent obtaining a false reading from an intermediate object between the observer and the target, the AN/GVS-5 is equipped with a minimum range set (MIN RG SET). Ranges to the nearest 10 meters and up to 5000 meters may be set on the MIN RG SET using the variable control. The range set indicates that range within the AN/GVS-5 will not register a return, thereby eliminating receiving false readings from intermediate objects once the MIN RG SET is properly established. The observer must continue a trial and error process of eliminating false ranges by adjusting the MIN RG SET until the range read in the display correlates with the observer's own range estimate based on map and terrain analysis. The observer can save time in this process by establishing on the MIN RG SET the maximum range beyond which he is certain the target lies before he begins ranging a target.

(3) Self-location. The AN/GVS-5 can aid the observer in locating himself by giving him accurate distances to two known points. The observer can report these distances to his fire direction center who will in turn, using graphical or computer means, provide him his location. Self-location may also be

obtained by providing the FDC distances to two burst locations of rounds that have been fired after the unit has completed registration. A combination of one round and one known point may also be used for self-location.

(4) Adjustment of fire. Lateral and vertical shifts in the adjustment of fire are computed using the mil relation in the same way as adjustment of fire using binoculars. Range adjustments are made by taking the difference in range between the target and the burst and making the correction in the appropriate direction.

(5) Target location. The distance provided by the AN/GVS-5 should always be used with the most accurate direction to the target available and a quick, but thorough, map analysis. The observer should remember that the AN/GVS-5 is designed to help the observer estimate distance. As such, the distances determined by the device should always be correlated with known information before a target location is produced.

Section V. SEARCHLIGHT MISSIONS

6-27. Searchlight Characteristics

There are very few searchlight units in use today; however, searchlights can provide good direct and indirect light. The primary use of searchlights by the observer is for illumination surveillance of artillery fire from air or ground observation posts. Searchlights are also used to guide friendly elements, mark coordinating lines, mark targets for close air support mission, and illuminate objectives in an attack. Direct or indirect illumination may be used (see para 6-28*a*(5)(a)). The number of lights used in any mission will depend on the number available and the situation at that particular time. Normally, when direct illumination is used, a single light will suffice.

6-28. Searchlight Call for Fire

a. Elements of the illumination request are the same as a regular call for fire.

(1) Identification of observer. Identification of the observer in an illumination request is the same as that in a call for fire.

(2) Warning order. The warning for a searchlight mission is ILLUMINATION MISSION. Since this term is used only for a searchlight mission, it alerts all personnel involved to pass the mission to the searchlight light direct center (LDC).

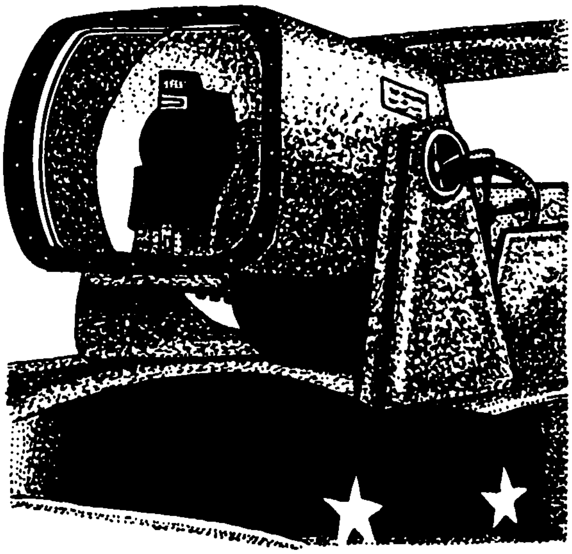


Figure 6-25. 23-inch Xenon searchlight.

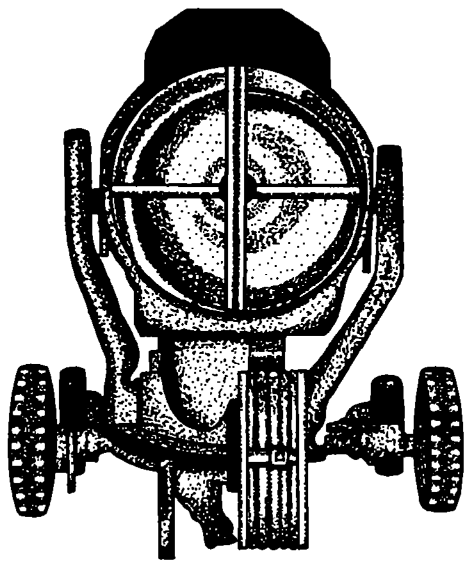


Figure 6-26. 30-inch Xenon searchlight.

Operators in the communication network must be familiar with this warning signal and the action to be taken.

(3) Target location. The target may be located by any of the methods described in chapter 3.

(4) Description of target. The description of the target is preceded by the word SUSPECTED if the target cannot be positively identified. If the target is identified, the procedure is the same as that for a call for fire. This element will enable the LDC to determine the priority of the mission.

(5) Method of engagement.

(a) Type of adjustment. If the type of adjustment is omitted in the illumination request, the observer will receive one light in adjustment. The observer may request two or more lights if he desires.

(b) Type of illumination. The observer has a choice of direct or indirect illumination. Direct illumination (fig 6-27) requires a clear line of sight between the searchlight and the target area. Visibility into the illuminated area is nearly equivalent to daylight observation if the light source is behind the observer. When a single beam is used at a low angle of elevation, deep shadows are cast by brush and other small objects. Intersecting beams may be used to eliminate shadows in the immediate target area. Direct illumination eases control. It is, however, more vulnerable to enemy fire than indirect illumination. Direct illumination may impair the night vision of friendly forces and silhouette friendly troops and installations.

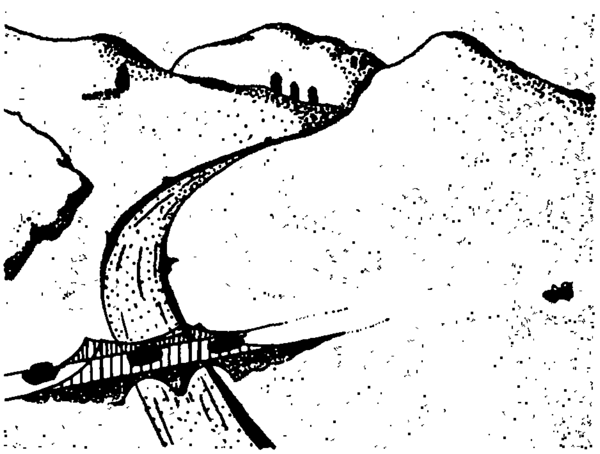


Figure 6-27. Direct illumination.

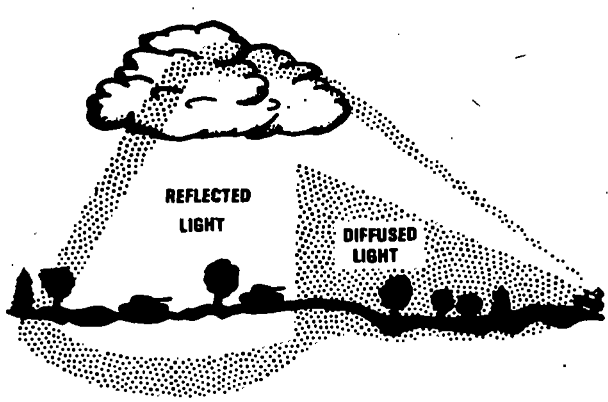


Figure 6-28. Indirect illumination, reflected light.

The observer must avoid both of these situations. If the observer does not specify indirect illumination, the LDC will assume that he desired direct illumination. Indirect illumination uses the diffused or reflected light rays from the main searchlight beams (figs 6-28 and 6-29). For an observer looking away from the light source, visibility in the illuminated area is equal to visibility under a quarter moon. The diffused light of indirect illumination reaches into hollows, draws, and tree-lined roads. An observer in an area illuminated by diffused light can detect with the naked eye a man standing at ranges up to 150 meters. With the aid of binoculars, an observer can detect a man moving at considerably greater ranges. Indirect illumination can be employed for longer periods of time than direct lighting because the light source is less vulnerable to enemy interference. However, indirect illumination does provide sufficient light for limited

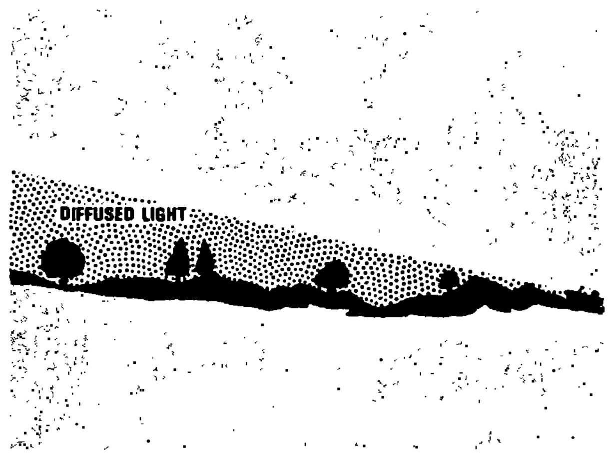


Figure 6-29. Indirect illumination, diffused light.

surveillance. When the observer is looking away from the light source, visibility in the illuminated area is approximately three times as great as it is when he is looking toward the light source.

(c) Degree of beam spread. The observer requests the beam spread necessary to illuminate the area under observation. The degree of beam spread is designated in the illumination request as FOCUS, DEFOCUS, or SPREAD BEAM. If the observer omits this element, focus beam will be used.

(6) Control. ADJUST LIGHT is the only method of control used with searchlights. If the observer desires to control the time of turning the lights on, he includes AT MY COMMAND, FLICK immediately preceding ADJUST LIGHT. To prevent personnel from misinterpreting fire commands, the observer uses the command FLICK to order the lights on.

b. Some of the terms used in an illumination mission that are not common to field artillery are defined in (1) through (5) below:

(1) FLICK—Put light in action (corresponds to the command FIRE).

(2) ACTION COMPLETE—Pointing data have been set on light (corresponds to the command SHOT).

(3) CUT—Put light out of action (corresponds to the command CHECK FIRING).

(4) HOLD—Keep the light on the same azimuth, elevation, and beam spread (corresponds to the command REPEAT).

(5) HOLD-CUT—Keep the light on the same azimuth, elevation, and beam spread, then put light out of action.

6-29. Searchlight Adjustment

a. The observer procedures for the adjustment of the searchlight beam is similar to that employed in a fire mission. However, the observer makes the adjustment on the searchlight-target line in deviation and elevation. Corrections are made in one of two ways: the observer can move the beam right or left and up or down in increments of ½ or 1 beam width, or he may make these shifts in mils. In most cases, the beam width is simpler and faster for the observer, since his yardstick is the width of the beam itself. For the 30-inch searchlight, the width of the focus beam is 30 mils, and the width of the spread beam is 180 mils. The spread beam cannot be used when the infrared lenses are on the searchlight. For the 23-inch searchlight, the width of the focus beam is 9 to 13 mils, and the width of the spread beam is 120 mils. Examples of observer corrections are as follows:

RIGHT 50 MILS or RIGHT 2 BEAMS
UP 15 MILS or UP ½ BEAM

b. The smallest correction in mils that can be made by the observer is 5 mils. In the beam width method, the smallest correction is a ¼ beam width shift. It is not necessary to give a change in both deviation and elevation each time an adjustment is desired: only the element to be corrected need be sent. Omission of the other element indicates it is to remain the same. If it is desired to change the degree of beam spread from focused beam to defocused beam, the command is DEFOCUS AND HOLD AT MY COMMAND, FLICK. If spread beam is desired, the command is SPREAD BEAM. This correction precedes the deviation and elevation corrections.

c. On occasion, the searchlight may be used in a continuous sweep or in a sweep in one direction of the searchlight beam. The searchlight may be used in this manner in either the visible or infrared mode; however, infrared is the normal mode in which the sweep is made. If the observer wishes to exercise a greater degree of control, he may command SWEEP RIGHT (LEFT) AND HOLD AT MY COMMAND, FLICK. Visible light is rarely used in this manner because potential targets can normally hide or conceal their locations as the light approaches. Infrared illumination may be employed in this manner unless the enemy is equipped with infrared viewers. When the searchlight is employed in a continuous sweep, the searchlight crew must observe the sweep so that they can keep the light on the terrain in the manner that best uses the infrared illumination.

6-30. Sample Mission

a. The observer hears movement and suspects that an attempt is being made to repair a disabled tank that is blocking a road in his sector. Searchlights are available and a study of the terrain indicates that it is possible to illuminate the tank directly. He sends the following mission:

T18, THIS IS T25, ILLUMINATION MISSION, OVER.

GRID 672444, OVER.

SUSPECTED ACTIVITY VICINITY DISABLED TANK, 2 LIGHTS, ADJUST LIGHTS, OVER.

b. The left beam appears below the target, and the right beam is two beam widths to the left. He orders:

DIRECTION 780, NUMBER 1, RIGHT 2 BEAMS: NUMBER 2, UP ½ BEAM, OVER.

c. Both beams having been centered on the target, the observer orders HOLD. The command HOLD causes the lights to be held on the target and allows the observer to call for a destruction mission on the tank. After the tank has been destroyed, the observer will terminate the mission as indicated below:

END OF MISSION, STALLED TANK DESTROYED, OVER.

d. If, in the course of the HE mission, the observer decides that it is better to cut off the lights yet he wants to hold the position of the lights, he orders HOLD, CUT. To restore light to the target, he next orders FLICK.

e. Using these commands, together with his artillery fire AT MY COMMAND, the observer is able to light the target for surveillance or adjustment and hold to a minimum the exposure of friendly light positions.

CHAPTER 7

ADJUSTMENT OF OTHER FIRE SUPPORT MEANS

Section I. MORTARS

7-1. Mortar Employment

a. The 107-mm (4.2-inch) mortars are employed as a platoon (four guns). The 81-mm and 60-mm are employed as a section of three guns. Portions of these elements may be employed to engage targets as necessary. Table 7-1 lists information pertinent to mortars.

b. Mortars are organic to maneuver companies (except tank companies) and battalions. They are high-angle, relatively short-range, area fire weapons, well suited for maneuver close support. Mortars can provide a heavy volume of responsive, accurate, and sustained fire. Mortars are ideal weapons for attacking targets on reverse slopes, in narrow gullies or ditches, and in other areas that are difficult to reach with low-angle fires.

c. Mortars are especially effective for smoke and illumination missions. Mortars can provide excellent initial smoke coverage with WP ammunition because of their high rate of fire. Mortars can provide immediate illumination within the company or task force area. Commanders should always consider using mortars for smoke and illumination missions.

d. The 107-mm mortar can provide chemical fires.

e. Mortars are limited by:

(1) relatively short range compared to FA;

(2) less accuracy in high winds;

(3) easier detection by enemy radar due to high angle of fire and long projectile flight time; and

(4) ammunition-carrying capability that restricts prolonged periods of heavy firing.

7-2. Call for Fire and Adjustment

The call for fire and observer procedures for mortar fire are the same as those for artillery fire. Certain differences in the conduct of specific missions are discussed below.

a. Even though all rounds are high angle, SPLASH will not be announced by FDC unless requested by the observer.

b. Adjustment of height of burst for fuze time (107-mm) is conducted with only one mortar.

c. Section fire: SECTION LEFT (RIGHT) commands the FDC to fire from LEFT (RIGHT) at 10-second intervals using all weapons currently engaged in the mission.

7-3. Registration

a. Precision registration procedures for mortars are identical to the impact registration procedures for artillery except that once a 100-meter range bracket has been split and the last fired round is within 50 meters of the target, refinement corrections are sent to the FDC, and the mission is ended. Range corrections are made to the nearest 25 meters. The last two transmissions to the FDC appear in figure 7-1.

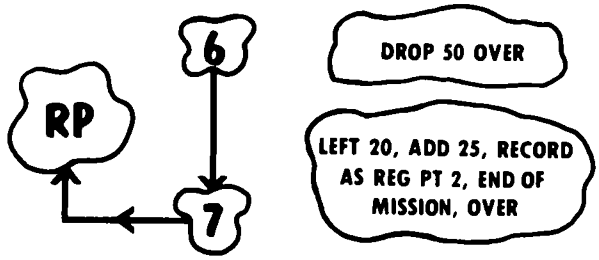


Figure 7-1. Mortar registration.

Mortars do not conduct time registration.

b. One additional step that is not done for artillery, but may be required for mortars, is adjusting the sheaf. This may be done any time during a fire mission, but may be directed by the FDC after a registration. If this is directed, the FDC will send:

PREPARE TO ADJUST THE SHEAF, OVER.

The purpose of adjusting the sheaf is to get all mortars firing parallel. The mortars will be positioned with numbers 1-3 for 81-mm or 1-4 for 107-mm from right to left. To start adjustment of the sheaf, the observer requests:

Table 7-1. Mortar Capabilities

Weapons		Min Range	Max Range
107-mm	M329A1	920 meters	5650 meters
	M329A2	770 meters	6840 meters
81-mm	M347A2	70 meters	4595 meters
	M329A3	70 meters	4850 meters

Shell-Fuze Combinations

107-mm (4.2-inch) Mortar		81-mm Mortar	
Shell	Fuze	Shell	Fuze
HE	PD (quick and delay), TI, prox (VT)	HE	PD (quick and delay), prox (VT)
WP	PD	WP	PD
ILL	TI (base ejecting)	ILL	TI (base ejecting)
CML	TI		

CO UNIT	MORTARS			BN TOTAL
	107-mm	81-mm	60-mm	
Inf Co		3		9
Inf Cbt Spt Co	4			4
Mech Co		3		9
Mech Cbt Spt Co	4			4
Abn Co		3		9
Abn Cbt Spt Co	4			4
AASLT Co		3		9
AASLT Cbt Spt Co		4		4
Armor Co				
Armor Cbt Spt Co	4			4
Armd Cav Trp	3			9
Ranger Co			2	6

**A new lightweight company mortar (60-mm) is in development. It is planned for issue to all non-mechanized infantry on the basis of three per infantry company. At the same time, all 107-mm mortars will be replaced by improved 81-mm mortars on a one-for-one basis.*

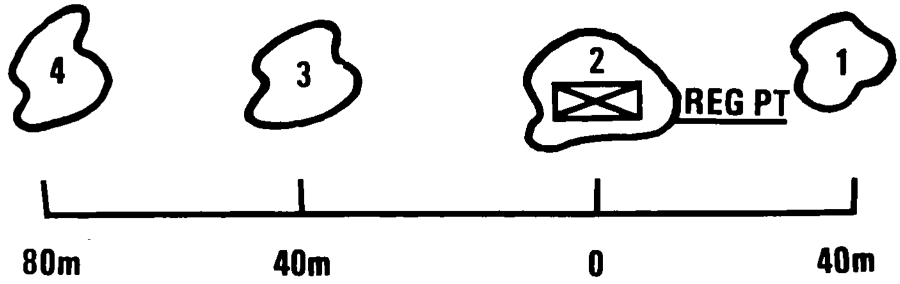


Figure 7-2. Adjusted mortar sheaf.

SECTION RIGHT (LEFT) REPEAT, OVER.

The entire section will then fire, in order, starting at the right (or left), with 10-second intervals between rounds. The mortar that was used to register will not fire. If the observer requests:

SECTION RIGHT, REPEAT, OVER

for a 107-mm section, numbers 1, 3, and 4 will fire, in that order. To adjust the sheaf, all rounds must be adjusted on line at approximately the same range (within 50 meters) and with 40 meters lateral spread between rounds. In adjusting the sheaf, ignore *range* correction for rounds impacting within 50 meters of the sheaf line. The sheaf is adjusted perpendicular to the gun-target line. (If angle T is greater than 500 mils, each piece is adjusted onto the registration point and the FDC computes data for the sheaf.) Lateral refinement corrections are made to the nearest 10 meters, but corrections less than 50 meters are not fired. Once refinement corrections for all mortars have been determined, the sheaf has been adjusted. An adjusted sheaf for a 107-mm section is shown in figure 7-2:

Example.

The sheaf of a 107-mm section is being adjusted. The observer has requested:

SECTION RIGHT, REPEAT, OVER.

The rounds fired look like figure 7-3:

All rounds are within 50 meters of the correct range, and only number 3 is more than 50 meters out in lateral adjustment, so the adjustment for number 3 is sent first, then the refinement data for numbers 1 and 4.

NUMBER 3, LEFT 60, REPEAT, OVER NUMBER 1, LEFT 20, NUMBER 1 IS ADJUSTED, NUMBER 4, RIGHT 30, NUMBER 4 IS ADJUSTED.

Number 3 is now fired, and the round impacts 10 meters left of the desired burst location as indicated in figure 7-4.

The observer would then send:

NUMBER 3 RIGHT 10, NUMBER 3 IS ADJUSTED, SHEAF IS ADJUSTED, END OF MISSION, OVER.

7-4. Other Missions

a. Final protective fires are conducted the same as artillery fires except that in the initial call for fire the observer requests SECTION RIGHT (LEFT) based on wind direction to cause the first round to impact downwind. Fuze delay should be requested during the adjustment to minimize danger to friendly troops.

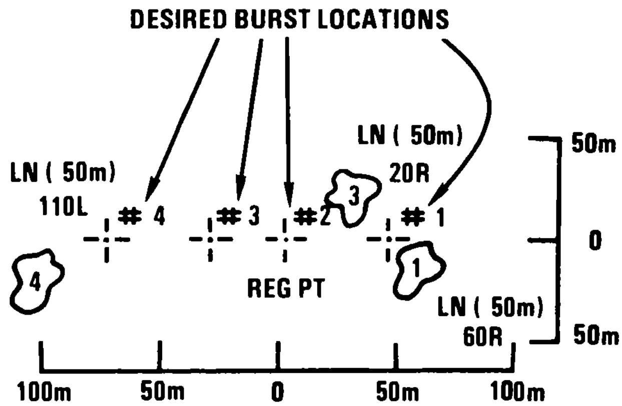


Figure 7-3. Section right, repeat.

Table 7-2. Tabulated Data Using Illuminating Rounds.

Cannon	Projectile	Initial HOB (meters)	Distance between Bursts (spread)	Burning time (sec)	Rate of continuous illumination (rounds per min)	Rate of fall (meters per sec)
4.2 in	335	700	500	60	2	10
4.2 in	335A1	700	500	70	2	10
4.2 in	335A2	400	1000	90	1	5
81-mm	301A1	400	500	60	2	6
81-mm	301A2	400	500	60	2	6
81-mm	301A3	600	500	60	2	6

b. A time-on-target mission is the same as for artillery.

c. Continuous and coordinated illuminations (chapter 6, section II) are conducted the same as for artillery. Employment factors for mortar illumination rounds are shown in table 7-2.

d. Suppression and immediate suppression procedures (para 4-3) are the same as for artillery.

e. Immediate smoke procedures (para 6-13) are the same as for artillery except that only WP is available with mortars.

f. Quick smoke procedures (screening mission) (para 6-14) are the same as for artillery except that:

(1) After adjusting with HE, a parallel sheaf is fired for all quick smoke missions without regard to wind direction.

(2) If the smoke rounds do not impact on or near the selected points, the observer makes corrections as necessary. Deviation corrections for individual guns may be sent back to the FDC.

(3) When employing 81-mm smoke, the observer selects a second aiming point halfway between the target and the initial aiming point. The second aiming point may be used to supplement firing on the initial aiming point or shift fires quickly after smoke is fired for effect and proven ineffective.

(4) Corrections for rate of fire or deviation can be made for individual mortars or the entire section after fire for effect.

Example.

NUMBER 1, DOUBLE RATE OF FIRE, RIGHT 20 METERS, or SECTION DOUBLE RATE OF FIRE, LEFT 30 METERS.

7-5. Reregistration

Reregistration on the same registration point may be directed by the FDC.

REREGISTER ON REGISTRATION POINT 1, OVER

The observer announces his OT direction to tell the FDC he is ready to reregister.

DIRECTION 1680, OVER.

The observer then adjusts the base piece onto the registration point following mortar registration procedures.

RIGHT 20, ADD 25, END OF MISSION, REREGISTRATION COMPLETE, OVER.

The sheaf normally is not adjusted for reregistration.

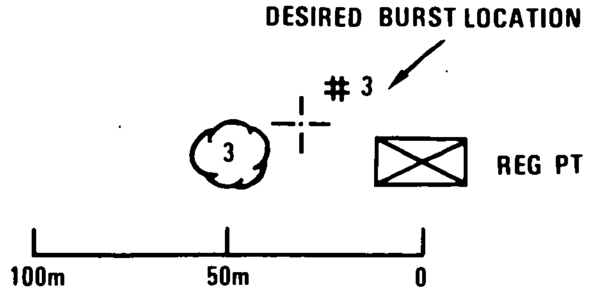


Figure 7-4. Number 3 is adjusted.

7-6. Destruction Mission

Destruction missions are identical to low-angle adjustment procedures for artillery except that the 50-meter bracket is split and destruction is accomplished by firing one, two, or three rounds at a time from the adjusting mortar.

3 ROUNDS RIGHT 20, ADD 25, OVER.

The observer continues firing until the target is destroyed.

7-7. Irregularly Shaped Targets

To adjust on an irregularly shaped target defined by grid, attitude, and length *or* by two grids, the observer chooses one end of the target, designates a flank mortar to adjust, and adjusts that mortar onto the end point.

Section II. CLOSE AIR SUPPORT

7-8. Types of Requests

There are two types of close air support requests: preplanned and immediate. Preplanned requests follow the format outlined in FM 6-20. The initial request for CAS may be made by the FIST chief or the FSO. Immediate requests may be initiated at any level and must include the following elements:

a. Observer identification.

b. Warning order ((immediate) (planned) CAS request).

c. Target location (grid coordinates).

d. Target description.

(1) Type and number.

(2) Activity or movement.

(3) Point or area target.

e. Friendly location/enemy ADA.

f. Desired time on target (TOT).

7-9. Employment

a. Processing. The battalion S3 air, FSO, and air liaison officer (ALO) will determine if the target is appropriate for a CAS mission. If so, the ALO will submit an immediate CAS request. If no Air Force forward air controller (FAC) is available and the aircraft are equipped with FM radios, the FIST chief will direct the mission. Aircraft equipped with FM radios are USAF A-10, A-7, A-37 and USMC A-4, and AU-8A Harrier. The ALO in this case will prepare mission data and attack information and transmit these data to the FIST chief. (Example is given in c below.) After the FIST chief makes initial radio contact with the flight leader, he will ask the flight leader to transmit the lineup information. This will be the same format as the mission data and will reflect actual air assets allocated for the mission. There are three control measures for CAS missions with which the FIST chief will be concerned:

(1) Contact point (CP). The point at which the aircraft will make initial radio contact with the ground controller (FIST chief).

(2) Initial point (IP). The point from which the aircraft starts the timed run toward the pullup point.

(3) Pullup point (PUP). The point at which an aircraft at low level begins a climb to identify the target and gain altitude for the strike on target.

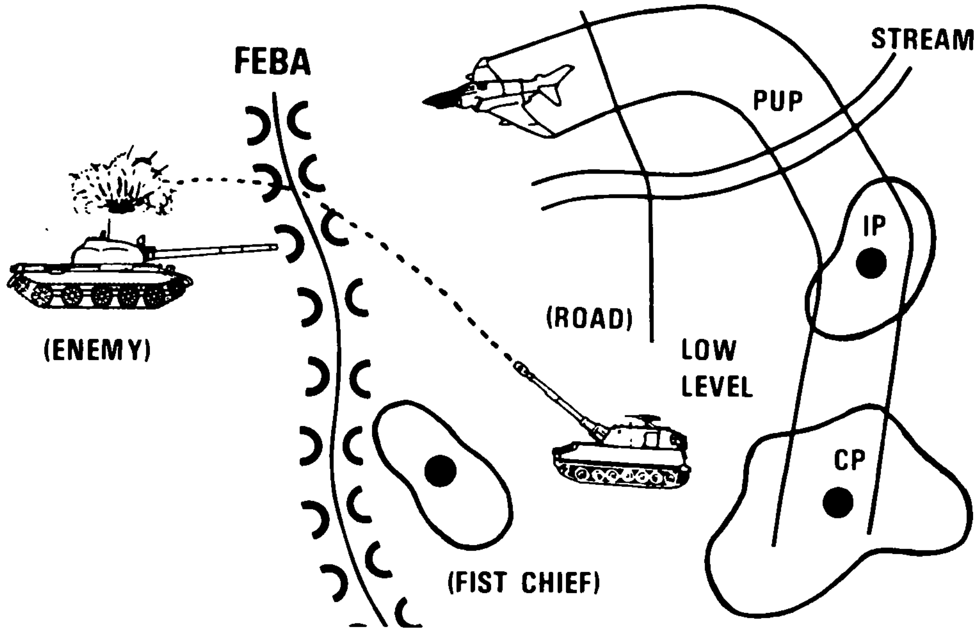


Figure 7-5. CAS mission.

Example. Depicted in figure 7-5.

(a) Mission data:

Mission number—1210027
Fighter call sign—HAMMER 11
Type/number aircraft—two A-7s
Ordnance—six Mavericks (antitank missile) and 20-mm
On station time—30 minutes
FAC call sign—K12
IP location—hilltop at grid 459854
Frequency—45.50

(b) Attack information:

Target description—five T-62s
Target location—grid 132968
PUP location—intersection of road and stream at grid 150955
Run-in—IP to PUP
Heading—305°
Distance—16 nautical miles
Air speed—500 knots
Time—2 minutes
Attack heading—240°
Target marking—WP
Location of friendly troops—east of road from grid 1475 to 1496
Release clearance—K12
Reattack—affirmative
Attack restrictions—none
Threat—ZSU-23s 2 km west of target
Weather/winds—fair/light and variable

THE FIST CHIEF MUST TRANSMIT THE ATTACK INFORMATION TO THE AIRCRAFT IF THEY ARE NOT AWARE OF THE FORMATION WHEN HE CONTACTS THEM.

b. Marking. The preferred method of marking a target for a close air support mission is with artillery smoke or artillery or mortar white phosphorus (WP). The FIST may be required to designate the target with a laser. The round, if it is to be most effective, should impact approximately 10 seconds prior to the aircraft reaching the PUP. The FIST chief can obtain the time for the aircraft to go from the IP to the PUP from the attack information provided to him by the ALO. Proper timing of the marking round is done by obtaining time of flight of the round from the FDC, adding a 20-second buffer to that time, and firing the round this total time (time of flight plus buffer) prior to the aircraft reaching the PUP. If smoke is used to mark the target, an additional 20-second buildup time must be added in.

Example.

Time of flight of aircraft, IP to PUP, is 2 minutes.

Time of flight of round is 25 seconds.

WP is being fired.

Backoff time is 25 seconds (time of flight) + 20 seconds (buffer time) = 45 seconds.

Aircraft departs IP at 1410 hours.

Aircraft due at PUP at 1410 + 2 minutes = 1412 hours.

Round is fired at 1412 - 45 seconds = 1411 and 15 seconds.

THE FIST CHIEF MUST CONTROL THE FIRING OF THE MARKING ROUND: USE AN "AT MY COMMAND" MISSION.

c. Control.

(1) The FIST chief's control of the mission begins when the flight leader makes initial contact when at the CP. Once communication is established, the FIST chief should ask the flight leader for his lineup information. This may differ from the mission data provided earlier by the ALO. The FIST chief should then verify that the flight leader has the attack information. If he does not, the FIST chief transmits it to him.

(2) Prior to the aircraft's reaching the IP, the FIST chief should have determined the desired backoff time for the firing of the marking round. He should also have sent his fire mission to the battery as an "AT MY COMMAND" mission, but not directed "FIRE."

(3) The FIST chief clears the aircraft to depart the IP and has the flight leader report departing the IP. He starts timing the flight toward the PUP. The FIST chief then requests that the flight leader notify him when he is at the backoff time from the PUP. The FIST chief should be prepared to fire the marking round at the desired time even if communication with the aircraft is interrupted. The FIST chief can then direct the battery to fire the marking round and he can observe the target in relation to the round. He should be prepared to orient the aircraft.

(4) The observer should watch for the aircraft to appear at the PUP and orient the flight leader as to the direction of the marking smoke from the aircraft using the clock method. Once the flight leader has identified the marking smoke, he is oriented as to the direction and distance of the target from the marking smoke. Distance and one of the eight main compass directions are used. Once the observer is certain the flight leader has identified the target correctly and the aircraft is pointed at the target, he clears the aircraft to strike the target. The observer should be prepared at any time prior to actual ordnance delivery to call off the attack if the aircraft starts to attack the wrong target or to have the aircraft reattack the target if additional ordnance is required.

IT IS THE FIST CHIEF'S RESPONSIBILITY TO INSURE THAT THE CORRECT TARGET IS ATTACKED.

Example.

FLIGHT LEADER (HAMMER 11)	FIST CHIEF (K12)	BATTERY (K28)
K12, THIS IS HAMMER 11, NOW AT CP, OVER.		
	THIS IS K12, REQUEST LINE UP, OVER.	
THIS IS HAMMER 11, MISSION NUMBER 1210027. I HAVE TWO A7s, SIX MAVERICKS AND 20-MM ON EACH, ON STATION FOR 45 MINUTES, OVER.		
	THIS IS K12, ROGER. DO YOU HAVE ATTACK INFORMATION? OVER.	
THIS IS HAMMER 11, AFFIRMATIVE, OVER.		
	THIS IS K12, ROGER, OUT. K28, THIS IS K12, FIRE FOR EFFECT ONE GUN GRID 132968, MARKING WP, AT MY COMMAND, REQUEST TIME OF FLIGHT, OVER.	
		THIS IS K28, READY, TIME OF FLIGHT 25 SECONDS, OVER.
K12, THIS IS HAMMER 11, NOW AT IP, OVER.		
	THIS IS K12, ROGER. YOU ARE CLEARED TO DEPART IP, REPORT DEPARTING IP AND WHEN 45 SECONDS FROM PUP, OVER.	
THIS IS HAMMER 11, DEPARTING IP, OVER. THIS IS HAMMER 11, 45 SECONDS FROM PUP, OVER.		

FLIGHT LEADER (HAMMER 11)	FIST CHIEF (K12)	BATTERY (K28)
	K28, THIS IS K12, FIRE, OVER.	
		THIS IS K28, SHOT, OVER.
	HAMMER 11, THIS IS K12, I HAVE YOU IN SIGHT. DO YOU SEE SMOKE AT YOUR 10 O'CLOCK? OVER.	
THIS IS HAMMER 11, AFFIRMATIVE, OVER.		
	THIS IS K12, YOUR TARGET IS THE GROUP OF T-62s ON THE RIDGE 200 METERS NORTHWEST OF THE SMOKE. CAN YOU IDENTIFY? OVER.	
THIS IS HAMMER 11, ROGER, I SEE THE TARGET, OVER.		
	THIS IS K12, YOU ARE CLEARED IN HOT, OVER. HAMMER 11, THIS IS K12, END OF MISSION, T-62s DESTROYED, YOU ARE RELEASED FROM CONTROL, OVER. K28, THIS IS K12, END OF MISSION, OVER.	
		THIS IS K28, END OF MISSION, OUT.

Section III. NAVAL GUNFIRE

7-10. Call for Fire

On most occasions when naval gunfire (NGF) is available, an NGF spot team will be with the company to call for and adjust NGF. The FIST chief, however, must be able to call for and adjust NGF if a spot team is not available. The call for fire for NGF follows the same general format as a call for fire for artillery support. Certain elements, however, are modified when calling for NGF support.

a. Observer identification. Same as for artillery fires. Call sign of ship will be provided to the FIST chief by the naval gunfire liaison officer (NGLO) with the FSE at battalion.

b. Warning order. Observer can only request SPOTTER ADJUST, FIRE FOR EFFECT, as for artillery. SHIP ADJUST is used when the ship observer clearly can see the target better than the ground observer, and adjustment by spotters on the ship is desired. The warning order must also include a target number. A group of target numbers, to be used sequentially, will be assigned to the FIST chief by the NGLO. The NGF spot team call for fire uses FIRE MISSION as the warning order (with the target number) and indicates SHIP ADJUST, ADJUST FIRE, or FIRE FOR EFFECT under method of control.

c. Location of target. Same as for artillery fires. The polar plot, shift from a known point, or grid method can be used. When using the grid method, include the altitude of the target and direction to the target.

d. Description of target. Same as for artillery fires.

e. Method of engagement.

(1) Danger close. Announce DANGER CLOSE if friendly troops are within 750 meters for 5-inch guns and 1000 meters for 6-inch guns and above. Send the direction and distance of friendly forces from the target.

(2) Trajectory. Request REDUCED CHARGE to raise the trajectory of the projectiles to increase accuracy and engage targets in defilade.

(3) Ammunition.

(a) Projectiles. High explosive (HE) is the standard projectile for naval guns. Other projectiles that may be requested are armor piercing (AP), smoke, white phosphorus (WP), and illuminating (ILLUM).

(b) Fuzes. Fuze quick is the standard fuze for naval guns. Other fuzes that may be requested are fuze delay (DELAY), mechanical time (TIME), and controlled variable time (CVT). A variable time (VT) fuze is available, but is used against aircraft. It is extremely sensitive and should normally not be fired at ground targets. It may not be fired over friendly troops without the maneuver commander's permission.

(4) Distribution of fire. Not requested by observer for NGF.

(5) Standard elements. Standard elements may be omitted from the call for fire.

f. Method of fire and control.

(1) Method of fire. Must indicate number of guns desired to fire in adjustment, and number desired to fire in effect if different from number firing in adjustment.

(2) Method of control. Two methods of control are used in NGF: CANNOT OBSERVE and AT MY COMMAND. Both are used in the same manner as for artillery fires. In addition, the terms "SPOTTER ADJUST," "FIRE FOR EFFECT," or "SHIP ADJUST" are used.

Example.

Ship's call sign is MUSTANG UNION, the observer's is K12.

MUSTANG UNION, THIS IS K12, FIRE MISSION, TARGET AA7755, OVER.

GRID 579262, ALTITUDE 650, DIRECTION 3800, FIVE ENEMY BUNKERS, REDUCED CHARGE, FUZE DELAY, ONE GUN IN ADJUSTMENT, TWO GUNS IN EFFECT, SPOTTER ADJUST, OVER.

7-11. Adjustment Terms

Additional terms, not used in the adjustment of other fires, may be used in the adjustment of NGF.

a. Terms used by the observer.

(1) LARGE SPREAD. Indicates distances between bursts is excessive.

(2) TREND. Indicate fires are creeping off target. Followed by direction and distance.

TREND SOUTHWEST, 50 METERS PER SALVO.

(3) SPREADING FIRE. Informs the ship that fire is about to be distributed over an area target. Followed by appropriate correction.

(4) FRESH TARGET. Informs the ship that a target of higher priority has appeared during the conduct of a mission and will be engaged. Followed by a shortened call for fire, locating the new target by shift-from-known-point procedures (shift from the previous target).

(5) REFIRE TARGET NUMBER. Used to fire on a recorded target (targets are recorded in the same manner as artillery).

b. Terms used by the ship.

(1) DELAY. Indicates that the ship is not ready to fire. Will be followed by estimated time when the ship will be ready.

(2) NEGLECT. Informs the observer that the last rounds were fired with incorrect settings.

(3) WILL NOT FIRE. Informs the observer that the ship is unable to fire for safety or other reasons.

APPENDIX A

TARGET ANALYSIS AND MUNITIONS EFFECTS

A-1. Observer Responsibilities

As the "eyes" of the artillery and mortars, the observer has two major responsibilities regarding target analysis and munitions effects. He must properly describe the target so that the fire direction officer can make a decision on the attitude of the target and he must make a recommendation as to the best method of attack based on the size, type, and posture of the target.

A-2. Target Description

The following is a brief description of the considerations in describing a target properly to the FDC. It is based on weapons effects analysis found in the FM 6-141 series of manuals.

a. Target characteristics.

(1) Targets encountered on the battlefield vary considerably in composition degree of protection, shape, mobility, and recuperability. To simplify the comparison of effectiveness of particular weapons and rounds, targets have been divided into four categories (table A-1). Several examples are listed in each category. Under certain conditions, some examples could be listed in more than one category. For example, a motorized rifle battalion could be both a category 1 and a category 4 target.

(2) For personnel targets in particular, the posture of the target is extremely important. Target postures normally used for personnel targets are standing, prone, and foxhole. Information in weapons effects manuals is based on the assumption that the personnel are wearing helmets and that personnel in foxholes are in a crouching position. When describing a given target's posture, consideration must be given to the protection afforded by the terrain (e.g., an infantry platoon may be attacking in a standing posture; however, the irregularities of the terrain may provide protection equivalent to the prone position). Normally, personnel targets will seek a more protective posture during an engagement (e.g., from standing to prone position). This change is called posture sequencing. This characteristic causes considerable degradation of effects as additional volleys are fired and is the reason for the emphasis on surprise or mass fires.

(3) A target must be analyzed to determine its weak points. The decision as to where the target is most vulnerable and what fires will best exploit its weaknesses is influenced by the degree of damage desired. Often there is a tendency to overkill the target when less combat power would suffice. Based on the maneuver commander's criteria, the observer must ascertain the degree of effects needed (destruction-neutralization-suppression) to support the tactical plan. The acceptable degree of damage is that level that yields a significant military advantage. For example, fire from a heavily protected machinegun emplacement may be silenced by obscuration through FA smoke and subsequent engagement by direct fire as opposed to the expenditure of an excessive number of HE rounds required for destruction.

b. Target location. The proximity of the target to friendly troops and the accuracy of

Table A-1. Categories of Targets

Categories of Targets	Examples
1. Area Personnel	Squad Platoon Battery Company
2. Small Personnel	Observation Post Small Patrol Command Post
3. Small Materiel (Point)	Tank Armored Personnel Carriers Bunker, Machinegun
4. Area Materiel	Armored Formation Truck Park Ammo Dump

the target location must be weighed. The importance of certain targets that are not accurately located may justify the fire of several units to insure coverage. Close-in direct support fire requirements may dictate the use of specific caliber of weapon.

c. Terrain. The terrain in the target area has direct effect on the vulnerability of a target. Rugged terrain affords considerable natural cover and makes target location difficult. Certain terrain provides a complete defile from some angles of approach but not from others, thus influencing the type weapon and munitions to be employed. The nature of the vegetation in the target area should be considered in recommending ammunition.

d. Weather. Weather is of little consequence when evaluating a target to be attacked with HE/Q. Precipitation and wind is of particular importance in evaluating a target to be attacked with ICM, smoke, FASCAM, or illumination projectiles. Low clouds, thick fog, surface water, and rain degrade the effectiveness of VT fuze M513/M514.

e. Commander's criteria. All phases of target analysis are conducted within constraints established by the commander. Based on ammunition constraints, a commander will stipulate the type effects he desires to be attained against specific target categories. The three target effects categories are discussed below.

(1) Suppression of a target limits the ability of the enemy personnel to perform their mission. Firing HE/VT reduces the combat effectiveness of personnel and armored targets by creating apprehension or surprise and causing tanks to button up. Smoke is used to blind or confuse. The effect of suppressive fires usually lasts only so long as the fires are continued. This type fire is used against likely, suspect, or inaccurately located firing units. It can be delivered by small delivery units or means and requires a low expenditure of ammunition.

(2) Neutralization of a target knocks the target out of the battle temporarily. Experience has shown that 10 percent or more casualties will neutralize a unit. The unit will become effective again when the casualties are replaced and damage is repaired. Neutralization fires are delivered against targets located by accurate map inspection, by indirect fire adjustment, or by a target acquisition device. The assets required to neutralize a target vary according to the type and size of the target and the weapon/ammunition combination used.

(3) Destruction puts the target out of action permanently. Thirty percent casualties or materiel damage inflicted during a short time span normally renders a unit permanently ineffective. Direct hits are required to destroy hard materiel targets. Targets must be located by accurate map inspection, by indirect fire adjustment, or by

a target acquisition device. Destruction usually requires large expenditures of ammunition from many units. Destruction of armored or dug-in targets with artillery weapons is not economical.

A-3. Determining the Most Suitable Ammunition

Once an observer has decided to attack a target, he must select a weapon/ammunition combination capable of achieving a desired effect with a minimum expenditure of available ammunition stocks. Table A-2 shows optimum shell/fuze combination for various personnel and materiel targets. Targets not listed should be equated to listed targets to determine a shell/fuze combination.

a. Munitions.

(1) Ammunition type and quantity. The nature of the target and its surroundings and the desired effects dictate the type and amount of ammunition to be used. For a detailed discussion of ammunition and fuzes refer to table A-3. The ammunition resupply system may sometimes rule out an optimum ammunition selection. For example, extensive smoke fires may be needed to screen maneuver movement, but such fires would probably impose a considerable resupply problem on the parent organization. Some types of fires require greater ammunition expenditures than others. Suppression and neutralization fires usually consume less ammunition than destruction fires.

(2) Troop safety. Troop safety is a major concern when considering the weapon/ammunition selection for firing close-in targets. The observer insures that fires do not endanger troops, equipment, and facilities.

(3) Residual effects in target area. Residual effects from special ammunition will influence the occupation of an area, and FASCAM munitions may alter the direction of movement of supported elements. If supported troops are to occupy an area immediately following attack by certain munitions, conditions may be hazardous. Weather changes may alter choices of certain munitions (e.g., smoke, illumination, and special ammunition). The incendiary effects of munitions may make areas untenable for supported forces. These effects can also deny the enemy use of selected terrain.

(4) Effectiveness. When properly delivered against appropriate targets, artillery and mortar fire support can be the decisive factor in a battle. The observer must insure that maximum effectiveness is attained from every mission fired. To match a munition to a target, the observer must know what damage a munition can produce as well as the damage required to defeat a target. The lethality of a munition must be matched to the specific vulnerability of the target. Thus the observer must understand the damage potential of these effects from specific munitions: blast, cratering, fragmentation, incendiary, and penetration.

b. Caliber and type weapons available. The observer must have a thorough knowledge of the characteristics, capabilities, and vulnerabilities of artillery and mortar. Weapons possessing slow rates of fire and poor delivery accuracy are suited for long range fires. Weapons possessing rapid rates of fire and good delivery accuracy are suited for close fires. Small and medium weapons possess a quicker firing response time than heavy weapons.

A-4. Determining the Method of Attack

The final step in target analysis is the selection of a method of attack. The observer must select a method of attack that insures target area coverage and desired target effects. To determine an optimum method of attack, the FDO must consider aiming points and density and duration of fires.

a. Aiming points. Normally, the size of the area to be attacked is determined by the size of the target or the size of the area in which the target is known or suspected to be located. A single aiming point located on the center of the target is used to attack small targets. When attacking large targets, multiple aiming points must be designated to distribute the fires and insure adequate coverage. Chapter 6 gives procedures for establishing multiple aiming points.

b. Density and duration of fires. Intense fires of short duration generally produce the best target effect; however, the tactical situation may require fires to be continued over a long period of time. Some examples are harassing and interdiction fires during darkness, screening smoke fires, continuous illumination, and suppressive fires supporting a maneuver final assault on an objective.

Table A-2. Optimum Shell/Fuze Combinations for Engaging Personnel and Materiel Targets

		SHELL/FUZE COMBINATIONS						
PERSONNEL	SIZE(M)	HE/PD	HE/TI	HE/VT	HE/CP	WP/PD	ICM(AP)	ICM(AD/AM)
Squad/Small Patrol	50	E	D	C	*	E	B	A
Small Unit Headquarters	50	E	D	C	*	E	B	A
Platoon	150	E	D	C	*	F	B	A
Company	250	E	D	C	*	F	B	A
Battalion	250-500	*	D	C	*	*	B	A
Observation Post	50	E	D	C	F	E	B	A
Command Post	50	E	D	C	F	E	B	A
T-55 Tank	50-250	B	D	C	*	E	*	A
APC	50	B	D	C	*	E	*	A
MG Bunker	50	B	E	D	A	*	*	C
AAA Radar Van	50	D	C	B	*	E	*	A
ZIL-157 Medium Truck	50-250	C	D	B	F	E	*	A
FROG	50	B	C	B	E	D	*	A
FROG-Tactical Transporter	50	C	D	B	F	E	*	A
140-mm Rocket & Launcher	125	C	D	B	E	F	*	A
152-mm Gun/Howitzer	125	B	D	C	E	F	*	A

Notes. 1. Asterisks (*) indicate combination will not produce a significant number of casualties or amount of damage.

2. Optimum combination is listed in descending order with "A" being the optimum.
3. For materiel targets, a converged sheaf will increase percent of damage when radius of target is less than 150 meters.
4. All targets are considered to be in open terrain.
5. If target area is wooded, use of VT fuze may result in high airbursts.
6. If target area is marshy, effects of PD fuze are greatly reduced.
7. Use of smoke in conjunction with another combination may increase effects by increasing enemy command and control problems.
8. For all personnel targets, one-half are considered standing and one-half are considered prone on the first volley. All are considered prone on subsequent volleys. If personnel are crouching in foxholes, ICM/DP will have little effect.

Table A-3. Guide for Cannon Attack of Typical Targets

Type Target	Observation	Weapons	Projectile	HE Fuze	Results Desired	Remarks
Personnel						
In open or In foxhole w/o overhead cover	Observed unobserved.	All	HE	Prox(VT), time	Destruction	Massing is required.[1] TOT missions are most effective. 1st volley most effective.
					Neutralization	Massing is required except for small targets.
				Quick, prox, time	Suppression	Response time is critical against active targets. Preferred fuze is proximity.
		All except 175-mm	(AP) ICM		Destruction	Massing is required on large targets. TOT missions are most effective.
					Neutralization	Cannon battery volleys are sufficient.
In foxhole with overhead cover	Observed	All	HE	Quick/delay (ricochet)	Neutralization	Massing is required. TOT missions are most effective. Consider use of WP to drive personnel out of foxholes.
				Prox, time delay, quick	Suppression	Response time is critical against active targets. Proximity fuze is preferred. Consider use of smoke for obscuration.
		All except 175-mm	(AP) ICM		Neutralization	Massing is required. TOT missions are most effective.
					Suppression	Consider use of ICM on intermittent basis for increased effectiveness.
In dugouts or caves	Observed	All (pref 155-mm or larger)	HE	Delay, quick	Destruction	Direct fire, assault techniques. Fire HE quick at intervals to clear away camouflage, earth cover, and rubble.
Attacking btry pos	Observed	105-mm	Beehive			
		All	HE (AP) ICM	Time	Destruction	Set fuze to detonate on up-leg of trajectory for close-in defense of battery area.

Table A-3. Guide for Cannon Attack of Typical Targets—Continued

Type Target	Observation	Weapons	Projectile	HE Fuze	Results Desired	Remarks
Vehicle[2]						
Tanks	Observed	All		Prox, time	Suppression	Projectile HE to force tanks to "button up" and personnel outside to take cover or disperse. WP may blind vehicle drivers and fires may be started from incendiary effect on outside fuel tanks, but it may also obscure adjustment. (Note: (AP, AM) ICM is preferred munition for unobserved fire.)
	Observed/ unobserved	155-mm	(AP, AM) ICM		Suppression	See paragraph 7-7, FM 6-141-2. Massing is effective. ICM is preferred.
		8-inch	(AP, AM) ICM		Suppression	See paragraph 7-7, FM 6-141-2. Massing is effective. ICM is preferred.
	Observed/ unobserved	155-mm	FASCAM			Both antitank and antipersonnel projectiles should be used.
	Observed	155-mm	CLGP		Destruction	
	Direct fire	105-mm	HEP, HEP-T HEAT		Destruction	
Armored personnel carriers	Observed	All	HE	Prox, time	Suppression	Force vehicles to "button up" and personnel outside to take cover or disperse.
	Observed/ unobserved	155-mm	(AP) ICM (AP, AM) ICM		Neutralization	See paragraph 7-7, FM 6-141-2. Massing is effective.
		8-inch	(AP) ICM (AP, AM) ICM			
	Observed/ unobserved	155-mm	FASCAM			See remarks for tanks.
	Observed	155-mm	CLGP		Destruction	
Trucks	Observed/ unobserved	All	HE	Prox, time	Destruction	ICM is preferred munition.
		155-mm	(AP, AM) ICM		Destruction	
		8-inch	(AP, AM) ICM		Destruction	

Table A-3. Guide for Cannon Attack of Typical Targets—Continued

Type Target	Observation	Weapons	Projectile	HE Fuze	Results Desired	Remarks
Weapons						
Antitank missile	Observed	All	HE	Quick	Suppression	Response time is critical. Intermittent fire may be required. Change to fuze proximity of (AP, AM) ICM for materiel damage if ATGM platform on BRDM is raised.
Air defense ZSU-23-4 SA 6	Observed/ unobserved	All	HE	Prox	Firepower kill	Smoke may also be used to obscure gunner's line of sight to friendly aircraft.
		155-mm	(AP, AM) ICM		Firepower kill	Above remarks apply. ICM is preferred munition. Consider converged sheaf if weapon is point target and accurately located.
		8-inch	(AP, AM) ICM		Firepower kill	
SA 8, 9	Observed	All	HE	Quick	Suppression	Response time is critical. Intermittent fire may be required.
					Firepower kill	Same as above.
Towed FA mortars multiple rocket launcher	Unobserved	All	HE, WP	Prox, time		WP is used to ignite materiel. See personnel targets for results desired.
		All less 175-mm	(AP) ICM			See personnel targets section for results desired. TOT missions are most effective. Massing is usually required.
		155-mm	FASCAM			Use AP scatterable mine projectile in conjunction with HE or ICM for sustained effects.
SP FA	Unobserved	All	HE, WP	Prox, time	Suppression	WP is used to ignite materiel.
		All less 105 & 175-mm	(AP, AM) ICM		Suppression	ICM is preferred munition.
		155-mm	FASCAM			Use AP scatterable mine projectile in conjunction with HE or ICM for sustained effects.

Table A-3. Guide for Cannon Attack of Typical Targets—Continued

Type Target	Observation	Weapons	Projectile	HE Fuze	Results Desired	Remarks
SS missile	Unobserved	All (less 105-mm)	HE	Prox, time	Firepower kill	Use converged sheaf if time and target location accuracy permit. TLE in excess of 200 meters require massing of fires. ICM is preferred munition.
		155-mm	(AP, AM) ICM		Firepower kill	Same as above.
		8-inch	(AP, AM) ICM			
Miscellaneous						
Radar	Unobserved	All	HE	Quick, time prox	Firepower kill	Use converged sheaf if time and target location accuracy permit. TLE in excess of 200 meters require massing of fires. ICM is preferred munition.
		155-mm	(AP, AM) ICM		Firepower kill	Same as above.
		8-inch	(AP, AM) ICM			
Artillery command and obs post	Observed	All	HE	Quick	Suppression	Intermittent fire may be required. HE is preferred munition when response time is critical.
		155-mm	(AP, AM) ICM		Suppression	
		8-inch	(AP, AM) ICM			
Command post	Unobserved	All	HE	Prox, time	Neutralization or Destruction	Use scatterable mines for sustained effects. When target contains personnel and light materiel targets (AP, AM) ICM is preferred munition.
		155-mm	(AP) (AP, AM) ICM			
		8-inch	(AP) (AP, AM) ICM			
Supply installation	Unobserved	All	HE, WP	Quick	Fires	Large target location errors require massing to insure target coverage.

Table A-3. Guide for Cannon Attack of Typical Targets—Continued

Target Type	Observation	Weapons	Projectile	HE Fuze	Results Desired	Remarks
Boats	Observed					Attack as moving personnel target.
Bridges	Observed/ unobserved	All (pref 155-mm or larger)	HE	Quick, CP, delay	Destruction	Direction of fire preferably with long axis of bridge. Destruction of permanent bridges is best accomplished by knocking out bridge support. Fuze quick for wooden or pontoon bridges.
		155-mm	CLGP		Destruction	
Fortifications	Observed	All (pref 155-mm or larger)	HE	CP, delay, quick	Destruction	Use highest practical charge in assault and direct fire.
		155-mm	CLGP		Destruction	
Roads and railroads	Observed	All (pref 155-mm or larger)	HE	Delay, CP	Destruction	Attack critical points: defiles, fills, crossing, culverts, bridges, and narrow portions. Direction of fire should coincide with direction of road.

Notes

[1]Targets, regardless of type, with an estimated target radius of greater than 150 meters, usually require massing for effective attack.

[2]The first objective in firing on moving vehicles is to stop the movement. For this purpose a deep bracket is established so that the target will not move out of the initial bracket during adjustment. Speed of adjustment is essential. If possible, the column should be stopped at a point where vehicles cannot change their route and where one stalled vehicle will cause others to stop. Vehicles moving on a road can be attacked by adjusting on a point on the road and then timing the rounds fired so that they arrive at that point when a vehicle is passing it. A firing unit or several units, if available, may fire at different points on the road simultaneously.

APPENDIX B

INTERNATIONAL STANDARDIZATION AGREEMENTS

Standardization agreements (STANAGs and QSTAGs) are international agreements designed to facilitate allied operations. Upon ratification by the United States, these standardization agreements are binding upon the United States Forces (entirely or with exceptions as noted).

B-1. STANAGs

A STANAG is an international agreement wherein the nations of a specific treaty organization, such as NATO, agree to certain operational actions to enhance the allied operation. The status of STANAGs associated with the field artillery cannon gunnery, which the United States agrees to implement and promulgate, are categorized as in table B-1.

B-2. QSTAGs

A QSTAG is an international agreement wherein the ABCA nations (United States, United Kingdom, Canada, Australia) form a quadripartite alliance and agree to certain operational and procedural techniques to enhance the allied operation. Status of QSTAGs associated with field artillery cannon gunnery, which the United States agrees to implement and promulgate, are categorized in table B-2.

B-3. Implementation

The doctrine, procedures, and techniques promulgated in the listed STANAGs and QSTAGs are implemented in FM 6-40. As ratification details occur, specifically those agreements that have been changed by USAFAS, subsequent implementation and promulgation action will be made accordingly.

Paragraphs B-4 through B-7 are examples of basic cannon gunnery procedures as promulgated in the various QSTAGs and STANAGs and are included here to allow member nation units to operate with United States Army units when this manual is the only reference available.

Table B-1. FA Cannon Gunnery STANAGs

STANAG	SUBJECT
2088	Battlefield Illumination
2144	Call for Fire Procedures
2867	Radio Telephone Procedures for the Conduct of Artillery Fire
2875	Calls for Destruction, Smoke, Illumination and Danger Close Missions

Table B-2. FA Cannon Gunnery QSTAGs

QSTAG	SUBJECT
182	Battlefield Illumination
224	Manual Fire Direction Equipment, Target Classification and Methods of Engagement for Post-1970.
225	Call for Fire Procedures
246	Radio Telephone Procedures for the Conduct of Artillery Fire

B-4. Call for Fire Other Than US (Example)

Serial	General Heading	Specific Example
1	OBSERVERS IDENTIFICATION	20 THIS IS 21
2	WARNING ORDER	FIRE MISSION BATTERY
3	LOCATION OF TARGET INCLUDING DIRECTION	GRID 123456 ALTITUDE 100 DIRECTION 1640
4	TARGET DESCRIPTION	PLATOON DUG IN ON RIDGE 200×50 ATTITUDE 4850
5	METHOD OF ENGAGEMENT	
	a. TYPE OF ENGAGEMENT	DANGER CLOSE
	b. TRAJECTORY	HIGH ANGLE
	c. AMMUNITION	VT IN EFFECT 10 ROUNDS
	d. DISTRIBUTION OF FIRE	OPEN
6	METHOD OF FIRE AND CONTROL	AT MY COMMAND TWO GUNS PLATOON RIGHT ADJUST FIRE

B-5. US Call for Fire (Example)

Serial	General Heading	Specific Example
1	OBSERVERS IDENTIFICATION	A57, THIS IS A71
2	WARNING ORDER	ADJUST FIRE, SHIFT AA7735
3	LOCATION OF TARGET	DIRECTION 5210, LEFT 380, ADD 400, DOWN 25
4	TARGET DESCRIPTION	PLATOON DUG IN ON RIDGE 200×50 ATTITUDE 4850

5	METHOD OF ENGAGEMENT	
	a. TYPE OF ENGAGEMENT	DANGER CLOSE
	b. TRAJECTORY	HIGH ANGLE
	c. AMMUNITION	VT IN EFFECT 10 ROUNDS*
	d. DISTRIBUTION OF FIRE	OPEN
6	METHOD OF FIRE AND CONTROL	TWO GUNS AT MY COMMAND

*US OBSERVER WILL NOT SPECIFY NUMBER OF ROUNDS.

B-6. An Area Target Engaged by a Battery of US Artillery When the Observer is from Another Member Nation (Example)

Serial	Observer's Request	Reports to Observer
1	OBSERVER'S IDENTIFICATION	
2	FIRE MISSION	
3	GRID 321456 ALTITUDE 120	
4	DIRECTION 5100	
5	VEHICLE PARKED IN WOODS 200×100, ATTITUDE 2850	
6	ADJUST FIRE	
7		BATTERY IDENTIFICATION, 6 ROUNDS ZP 7115
8		SHOT
9	RIGHT 100, ADD 400	
10		SHOT
11	DROP 200	
12		SHOT
13	DROP 100	
14		SHOT
15	DROP 50, FFE	
16		SHOT
17		ROUNDS COMPLETE
18	END OF MISSION. THREE VEHICLES BURNING	

B-7. An Area Target Engaged by a Battery of Artillery (Not US) When the Observer is from the United States (Example)

Serial	Observer's Request	Reports to Observer
1	OBSERVER'S IDENTIFICATION	
2	ADJUST FIRE	
3	GRID 321456	
4	SIX ARMORED PERSONNEL CARRIERS	
5		BATTERY IDENTIFICATION 6 ROUNDS
6		SHOT
7	DIR 1680, R120, ADD 400	
8		SHOT
9	DROP 200	
10		SHOT
11	DROP 100	
12		SHOT
13	ADD 50, FFE	
14		SHOT ROUNDS COMPLETE
15	END OF MISSION TWO PERSONNEL CARRIERS DESTROYED	

APPENDIX C

REFERENCES

C-1. Publication Indexes

Department of the Army Pamphlets of the 310-series should be consulted frequently for latest changes or revisions of references given to this appendix and for new publications relating to material covered in this manual.

C-2. Army Regulations (AR)

310-25	Dictionary of United States Army Terms
310-50	Authorized Abbreviations and Brevity Codes

C-3. Department of Army Field Manuals (FM)

3-10	Employment of Chemical Agents
6-2	Field Artillery Survey
6-20	Fire Support in Combined Arms Operations
6-40	Field Artillery Cannon Gunnery
6-50	The Field Artillery Cannon Battery
21-6	How to Prepare and Conduct Military Training
21-26	Map Reading
23-90	81-mm Mortar
23-91	Mortar Gunnery
23-92	4.2-Inch Mortar, M30

C-4. Training Circulars (TC)

6-20-10	The Fire Support Team (FIST)
21-5-3	TEC Management Instruction

C-5. Technical Manuals (TM)

TM 9-6920-361-13 & P	Operator, Organizational, and Direct Support Maintenance Manual, Field Artillery Trainer Kits 14.5-mm, M31 and Kits

C-6. Miscellaneous Publications

ARTEP 6-165	General Support Cannon Units
ARTEP 6-365	Field Artillery, 155 SP, Direct Support Units
ARTEP 7-15	The Infantry Battalion
ARTEP 71-2	Mech Infantry/Tank Task Force
FM 7-2	Naval Gunfire Support

STANAG 2088	Battlefield Illumination
STANAG 2144	Call for Fire Procedures
STANAG 2867	Radio Telephone Procedures for the Conduct of Artillery Fire
STANAG 2875	Calls for Destruction, Smoke, Illumination and Danger Close Missions
QSTAG 224	Manual Fire Direction Equipment, Target Classification and Methods of Engagement for Post—1970
QSTAG 225	Call for Fire Formats
QSTAG 246	Radio-Telephone Procedures for the Conduct of Artillery Fire

C-7. USAFAS Training Support Publications

Field Artillery Catalog of Instructional Material (available by writing: COMDT, USAFAS, ATTN: ATSF-CR-TS, Fort Sill, OK 73503).

USAFAS Correspondence Course Catalog (available by writing: COMDT, USAFAS, ATTN: ATSF-CR-TS, Fort Sill, OK 73503).

INDEX

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FM 6-30

18 AUGUST 1978

By Order of the Secretary of the Army:

BERNARD W. ROGERS
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Brigadier General, United States Army
The Adjutant General

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FIELD MANUAL

No. 6-30

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 18 August 1978

THE FIELD ARTILLERY OBSERVER

TABLE OF CONTENTS

*This publication supersedes Chapters 8, 9, 10, 11, 12 and 13 of FM 6-40, 28 June 1974

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Purpose

The purpose of this manual is to explain:

a. Observed fire procedures used by field artillery cannon units in combat.

b. How observed fire training is conducted in peacetime to meet combat requirements.

1-2. Scope

a. The material presented herein is applicable to both nuclear and nonnuclear warfare. Hereafter, when the term artillery is used, it relates to field artillery unless otherwise stated.

b. Laser rangefinder and FASCAM procedures are incorporated into this text. Future changes to FM 6-30 will be programed to support the development and operation of other field artillery systems (e.g., GLLD/CLGP).

c. This manual does not discuss observed fire procedures under TACFIRE or BCS.

d. This manual covers only technical observed fire procedures. The operational and organizational aspects of employing FIST can be found in FM 6-20, FM 6-21, and TC 6-20-10.

1-3. Target Audience

The target audience for this FM is the fire support team (FIST) personnel and other observers.

1-4. Changes or Corrections

Users of this manual are encouraged to submit recommended changes or comments to improve this manual. Comments should specify page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be forwarded to Commandant, US Army Field Artillery School, ATTN: ATSF-TD-TM, Fort Sill, Oklahoma 73503.

1-5. References

See appendix C for a list of references.

Section II. GUNNERY COMPONENTS/ FIELD ARTILLERY EFFECTIVENESS

1-6. The Field Artillery Gunnery Team (Fig 1-1)

The field artillery gunnery problem is solved through the coordinated efforts of the field artillery gunnery team. The gunnery team consists of the FIST, the fire direction center, and the firing battery linked by an adequate communication system. Field artillery doctrine requires team members to operate with a sense of urgency and continually strive to reduce the time required to execute an effective fire mission.

a. Observer. The observer serves as the eyes of all indirect fire systems. Personnel assigned to a fire support team (FIST) function as observers. The FIST team chief functions as an observer and as the fire support coordinator (FSCOORD) for the maneuver company commander. An observer detects and locates suitable indirect fire targets within his zone of observation. To attack a target, the observer transmits a request for indirect fires and adjusts the fires onto the target when necessary. An observer provides surveillance data of his own fires and any other fires delivered in his zone of observation. See FM 6-20 for detailed duties of the FIST chief as a fire support coordinator.

b. The fire direction center. The fire direction center (FDC) serves as the brain of the artillery system. The FDC receives the call for fire from the observer, plots the target location on the firing charts (or enters target data into FADAC), determines chart and firing data, and converts it to fire commands. The FDC transmits the fire commands to the sections designated to fire the mission. Because of the great distance between units on the battlefield and requirements for improved responsiveness, technical fire direction is normally conducted by the battery FDC. The battalion FDC provides tactical fire direction, monitors all fire nets, and provides technical fire direction assistance to battery FDCs (e.g., fire plan firing data, fire direction backup, GFT setting transfer). FDC procedures are found in FM 6-40.

c. Firing battery. The firing battery serves as the brawn of the artillery system. The firing battery consists of the firing battery

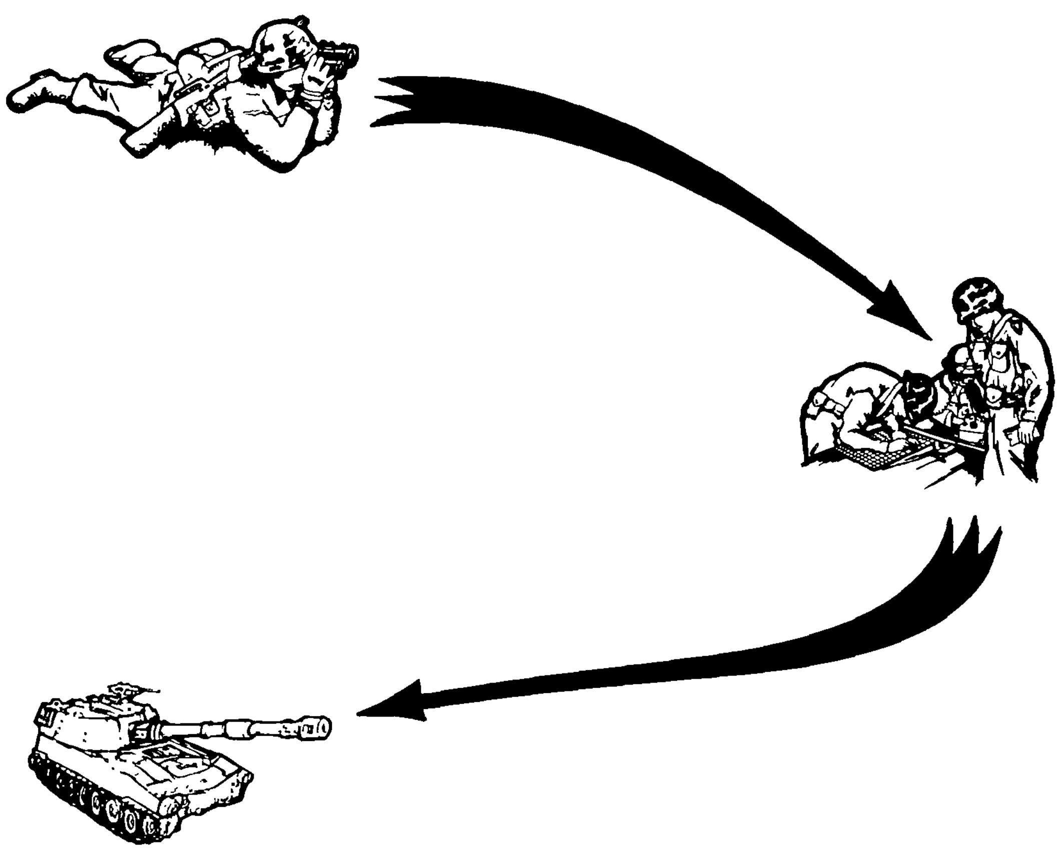


Figure 1-1. The field artillery gunnery team.

CHAPTER 2

DUTIES OF THE FIST AND RESPONSIBILITIES OF THE OBSERVER

2-1. Duties of the FIST

The "eyes" of the artillery are the fire support team (FIST). The FIST is an internal part of all maneuver units and works at company level. Each FIST consists of a headquarters that includes the FA lieutenant (FIST chief) and additional 13F personnel. In all units except the tank company, an FO per platoon is authorized. Specific organization of each FIST can be found in table 2-1. Each FIST headquarters is authorized a vehicle. Platoon FOs will either have their own vehicle or will ride with the platoon leader. Laser designators/rangefinders, digital message devices, and position determining equipment will be provided within the FIST as they become available.

a. The traditional duties of the FA forward observers and mortar observers are handled by the FIST. The FIST will locate targets, request and adjust indirect fire (mortars and artillery), and request and may adjust and control all other forms of fire support available, such as naval gunfire (NGF) and close air support (CAS). Fire support planning by the FIST will support the company commander's development of the scheme of maneuver.

b. The FIST chief is the company fire support coordinator (FSCOORD). As such he will:

(1) Advise the company commander on all fire support matters.

Table 2-1. FIST Personnel Summary

RANK / POSITION \ TYPE UNIT	MECH INF	ARMOR /CAV	INF	ABN	AIR ASSAULT
LT FIST CHIEF	1	1	1	1	1
SSG FS SERGEANT	1	1	1	1	1
SGT FORWARD OBSERVER	3	0	3	3	3
SP4 FS SPECIALIST DRIVER	1	1	1	1	1
PFC RTO (ASS'T FO)	3	2	3	3	3
TOTAL	9	5	9	9	9

(2) Resolve fire support conflicts arising during the planning and execution of operations.

(3) Attack all targets with the most suitable fire support means available.

(4) Coordinate the operations of all platoon observers. Detailed FSCOORD duties are outlined in FM 6-20 and TC 6-20-10.

c. The FIST communications and control are extremely flexible. The FIST chief may organize his team to best accomplish the mission. The platoon observers and FIST chief are capable of calling the artillery or mortars as necessary.

2-2. Responsibilities of the Observer

The primary responsibility of the observer is *to*

LOCATE, CALL FOR, AND ADJUST INDIRECT FIRE ON TO TARGETS

The observer has several secondary responsibilities that amplify his primary responsibility. These responsibilities are knowing the terrain in his area of responsibility and maintaining surveillance of that area, knowing the tactical situation, understanding the enemy, using his communications effectively, and maintaining the security of his party. To fulfill these responsibilities, the observer must:

a. Conduct a detailed terrain-map association. The observer should constantly make a thorough analysis of the terrain and map for his zone of operation. Some techniques the observer can use are:

(1) Locate himself accurately. (He should be able to determine six-place grid of his location at all times.)

(2) Locate all registration points, and likely points of enemy activity. Use of prominent terrain features will help relate a potential target area to a grid location on a map (fig 2-1).

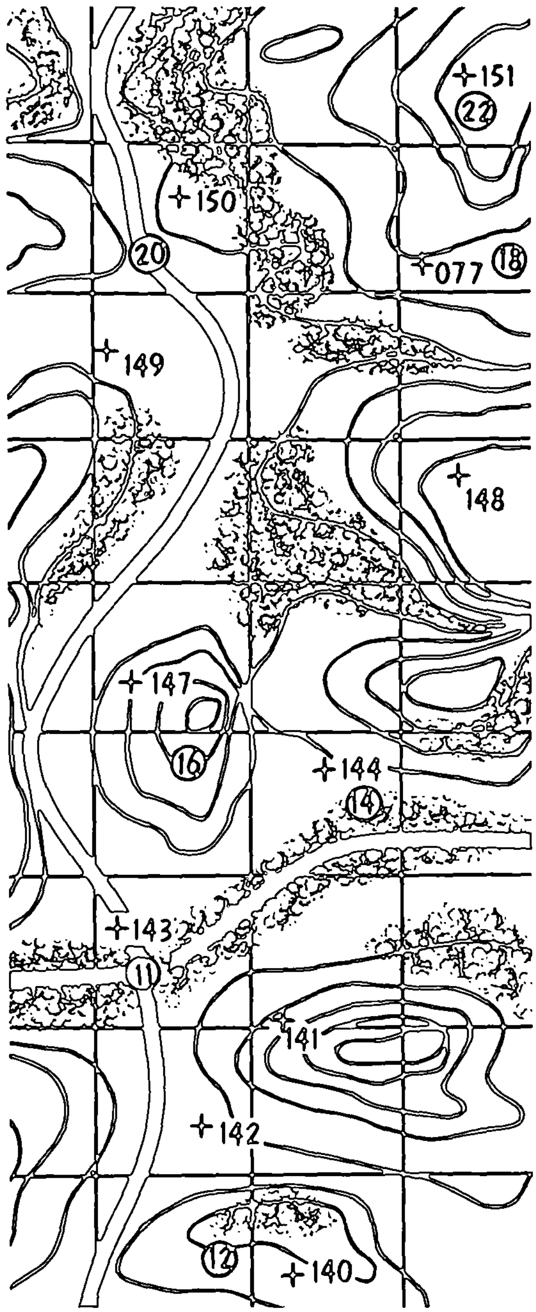


Figure 2-1. Use of prominent terrain features to locate potential targets.

CHAPTER 3

TARGET LOCATION

Section I. REQUIREMENTS FOR LOCATING TARGETS

3-1. Terrain-Map Analysis

To successfully perform his duties, an observer must be proficient in determining a target's position on the ground. The key to accurate target location is a thorough terrain-map analysis. The observer can analyze map and terrain by:

a. Locating himself to an accuracy of 150 meters at all times.

b. Using prominent terrain features to relate potential target areas to grid locations on the map.

c. Making a thorough study of terrain.

d. Associating the direction in which he is looking with a grid direction on the map.

3-2. Target Location Methods

Once a thorough terrain-map study has been conducted, the observer will be well prepared to locate targets. There are three methods of target location available to the observer: By grid coordinates—the observer locates the target by giving the actual grid location; by shift from a known point—the observer describes the target location in relation to a point of known location (known point); and by polar plot—the observer describes the target location in relation to himself.

a. Target location by grid coordinates. If the observer has conducted a good terrain-map study, the grid coordinate method is the most expedient. The observer's location need not be known to the FDC and known points are not necessary. The observer normally locates targets to an accuracy of 100 meters (6-place grid). Normally, this is accomplished by visually interpolating within the appropriate map and grid square. When additional accuracy is required (e.g., registration points or preplanned targets), the observer can locate targets to the nearest 10 meters (8-place grid).

b. Target location by shift from a known point. The observer may have one or more known points. These are identifiable points whose locations are known to the observer and FDC. The observer does not need a map to use this method; he only needs a known point. This method is reasonably accurate, but is the slowest of the three methods. The steps in locating a target by shift from a known point are described below:

(1) Identify the known point to be used.

(2) Determine the observer-target direction (OT dir). This direction can be:

GRID AZIMUTH (10 mils)	"DIRECTION 4360"
CARDINAL DIRECTION	"DIRECTION SOUTHWEST"
GUN-TARGET LINE	"DIRECTION GUN-TARGET"

(3) Determine a lateral shift from the known point to the observer-target (OT) line. If the angular deviation from the observer-known point line to the OT line can be determined, a shift in meters can be computed by use of the following formula:

$$W = R \times m$$

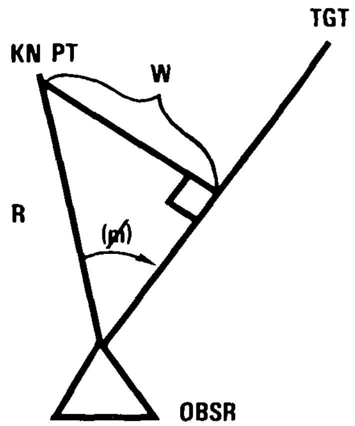


Figure 3-1. Mil relation formula.

Where W is the shift in meters, R is the observer-known point distance (expressed in number of thousands to the nearest hundred), and m is the angular deviation in mils (to the nearest 1 mil). This formula is based on the assumption that the width of 1 meter will subtend an angle of 1 mil at a distance of 1000 meters. It is called the MIL RELATION FORMULA (fig 3-1).

> Example (fig 3-2).
>
> The observer knows that the distance from his location to the church is 2,500 meters. He also knows the direction is 850 mils. With his binoculars, he measures an angular deviation of 62 mils from the church to the target. He calculates the lateral shift as follows:
>
> 2500
> 1000 = 2.5
> (2500 is already expressed to the nearest 100)
>
> $W = R \times m$
>
> $W = 2.5 \times 62$
>
> $W = 166 \text{ meters} \approx 160 \text{ meters}$
>
> "LEFT 160"

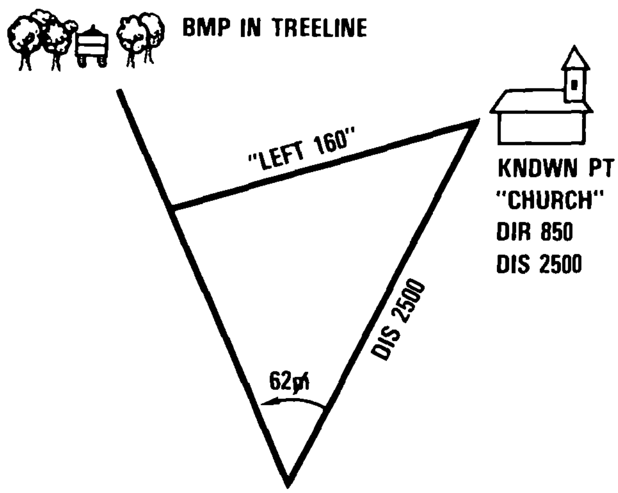


Figure 3-2. Lateral shift.

THE LATERAL SHIFT IS EXPRESSED TO THE NEAREST 10 METERS

Note. When a shift greater than 600 mils must be made, the accuracy of computing the lateral shift will decrease.

(4) Determine a range change along the OT line. The observer must determine whether the target is at a greater or lesser distance than the known point. The lateral shift puts the observer at a point on the OT line the same distance from him as the known point. If the target is farther away than the known point, then the observer must ADD the estimated distance from the known point to the target. If the target is closer, the observer must DROP the estimated distance (fig 3-3).

THE DIFFERENCE IN DISTANCE BETWEEN THE KNOWN POINT AND THE TARGET IS EXPRESSED TO THE NEAREST 100 METERS

(5) Determine a vertical shift, if significant. If there is a significant difference in altitude between the known point and the target, the observer must include it in his target location. If the target is at a higher altitude than the known point, then the observer must go UP the difference in altitudes (fig 3-4). If the target is at a lower

provide direction to the nearest mil. The heading indicator in aircraft can be used by the aerial observer.

The target is 40 mils to the LEFT of the reference point. The direction to the target is 2060 mils (2100m̸ – 40m̸ = 2060m̸).

(The vertical scale on right of lens is not used by the FO in determining data for his call for fire. It is used primarily by the infantry for sighting automatic weapons).

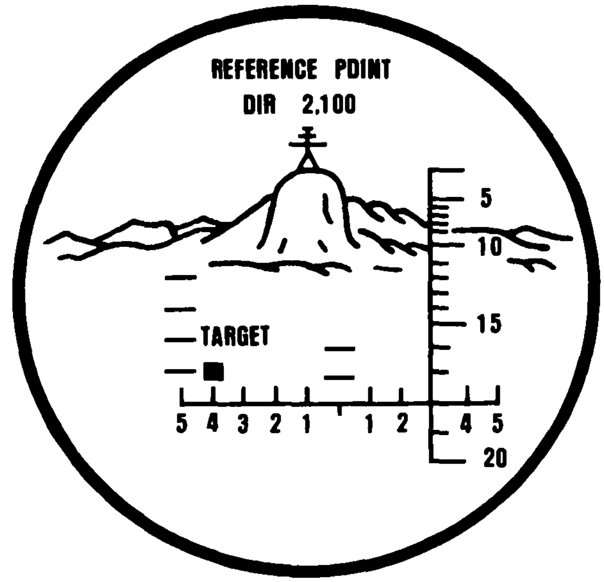


Figure 3-6. Measuring angular deviations with binoculars.

Section II. AIDS TO TARGET LOCATION

There are many techniques that should be used to aid the observer in target location. The following paragraphs discuss only several of the more common ones.

3-4. Observed Fire Fan

a. The observed fire fan (fig 3-7) allows the observer to identify on the map, the terrain he sees on the ground. The OF fan is a transparent protractor that can be used to show OT direction and distance on the map. OT direction is shown by the use of radial lines that are 100 mils apart and cover a total of 1600 mils. OT distance is shown by use of arcs marked on the fan every 500 meters starting at 1000 and extending to 6000 meters.

b. To prepare the OF fan:

(1) Place the vertex of the fan over the observer's location.

(2) Place the center radial in the direction of the center of the observer's sector of responsibility.

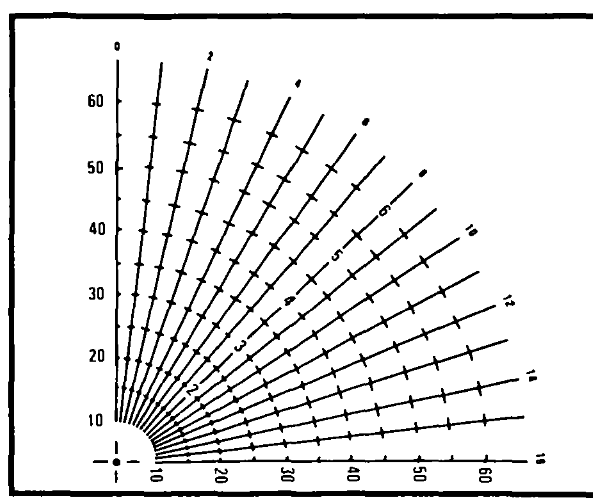


Figure 3-7. Observed fire (OF) fan.

(3) Move the fan slightly until one radial line is parallel to a grid line. The direction of that radial is the same as the grid line.

(4) With a grease pencil, number the radial of known direction by dropping the

last two zeros (1600 would be 16). Then label every second radial with the appropriate direction (labeling each radial is unnecessary and makes the fan too cluttered).

c. To determine target location, the observer first must determine a polar plot location by quick use of the compass or other means of determining direction, and estimate the OT distance. He then plots the data on the OF fan by finding the two radials between which the OT direction falls and visually interpolating between the two to determine the OT direction. The observer then moves out along this interpolated radial until he has moved the estimated distance. He then marks this point. The observer then compares the terrain near the target with the terrain of his estimated point on the map. If they agree, he can use the polar plot location or read the grid from the map. If they do not agree, he can search along the radial until he finds terrain that matches (see figure 3-8).

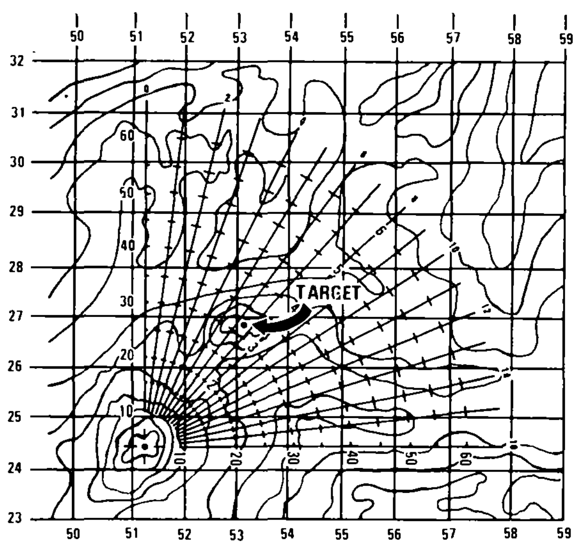


Figure 3-8. Target location using OF fan.

Note. In the figure above the target is located approximately 3000 meters from the observer in a direction of approximately 680 mils. The grid location is approximately 531 269.

d. When the FO is rapidly changing position, he can orient his OF fan over the next prominent terrain or manmade feature he will cross and note the direction to a known point or feature in the target area. In this manner he can maintain the relative orientation of his OF fan to aid in determining direction and target location.

3-5. Terrain Sketch

Another aid in target location is the terrain sketch (fig 3-9). This is a rough panoramic sketch of the terrain as seen by the observer. It should include valleys, hill masses, streams, woods, and roads. Other features such as manmade objects, reference points, and targets should be shown in their approximate positions. Directions and distances, when known, should also be included to help determine target locations.

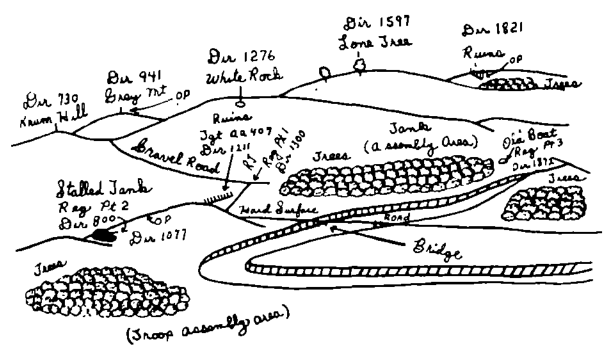


Figure 3-9. Terrain sketch.

3-6. Hand Measurement of Angular Deviation

a. When it is necessary to measure angles to determine direction quickly, the observer may use his hand and fingers as a measuring device (fig 3-10).

b. Every observer should calibrate his hand and fingers to determine the values of the angles for the various combinations of finger and hand positions shown.

c. When calculating and using his hand or fingers in measuring angles, the observer should fully extend his arm so that his hand and fingers will always be at the same distance from his eyes.

CHAPTER 4

CALL FOR FIRE

Section I. ELEMENTS OF THE CALL FOR FIRE

4-1. Introduction

a. A call for fire is a concise message prepared by the observer containing all information needed by the FDC to determine the method of target attack. The call for fire must be sent rapidly but with enough clarity that it can be understood, recorded, and read back without error by the FDC radio telephone operator (RTO). The observer should tell the RTO that he has seen a target so the RTO can start the call for fire while the target location is being determined. Information is sent as it is determined rather than waiting until a complete call for fire is prepared.

b. Regardless of the method of target location used, the normal call for fire will be transmitted in a maximum of three parts, with a break and readback after each part. The three parts are:

(1) Observer identification and warning order.

(2) Target location.

(3) Description of target, method of engagement, and method of fire and control.

c. The six elements of the call for fire are listed below in the sequence in which they are transmitted and are discussed in paragraphs 4-2 through 4-7.

(1) Observer identification.

(2) Warning order.

(3) Target location.

(4) Target description.

(5) Method of engagement.

(6) Method of fire and control.

4-2. Observer Identification

This element of the call for fire lets the FDC know who is calling for fire and clears the net for the fire mission.

4-3. Warning Order

The warning order informs the FDC of the type mission and the type of target location that will be used. The warning order consists of the type of mission, the size of the element to fire, and the method of target location.

a. Type of mission.

(1) Adjust fire (AF). When the observer feels that an adjustment must be conducted (due to questionable target location or lack of registration corrections), he announces ADJUST FIRE.

(2) Fire for effect (FFE). The observer should *always* strive for first round FFE. The accuracy required to FFE depends on the target and the ammunition being employed. When the observer is certain that the target location is accurate and the first volley would have effect on the target so that little or no adjustment is required, he announces FIRE FOR EFFECT.

(3) Suppress (S). To rapidly bring fire on an on-call target (that is not currently active), the observer announces SUPPRESS (followed by the target identification).

(4) Immediate suppression (IS). When engaging a planned target or target of opportunity that has taken maneuver or aerial elements under fire, the observer announces IMMEDIATE SUPPRESSION (followed by target identification).

b. Size of element to fire. The observer may request the size of the unit to fire for effect; e.g., BATTALION. When the observer says nothing about the size of the element to fire, it is assumed to be a battery.

c. Method of target location.

(1) Polar plot. If the target is located using the polar plot method of target location, the observer announces POLAR; e.g., ADJUST FIRE, POLAR.

(2) Shift from a known point. If the target is located using the shift from a known point method of target location, the observer announces SHIFT (followed by the known point); e.g., ADJUST FIRE, SHIFT 166.

(3) Grid. If neither POLAR nor SHIFT is announced, the observer indicates that the grid method of target location is being used. The word "grid" is not announced.

Examples.

(1) *Adjust fire mission.*

GRID:

A57, THIS IS A71, ADJUST FIRE, OVER.

(2) *Fire for effect mission.*

POLAR PLOT:

A57, THIS IS A71, FIRE FOR EFFECT, BATTALION, POLAR, OVER.

SHIFT FROM A KNOWN POINT:

A57, THIS IS A71, FIRE FOR EFFECT, SHIFT 176, OVER.

(3) *Suppression mission.*

THIS IS F72, SUPPRESS CHECKPOINT 10, OVER.

(4) *Immediate suppression mission.*

THIS IS F72, IMMEDIATE SUPPRESSION, 176, OVER.

4-4. Target Location

This element enables the FDC to plot the location of the target in order to determine firing data.

a. In a grid mission, six-place grids are normally sent. Eight-place grids should be sent for registration points or other points for which greater accuracy is required. The OT direction normally will be sent after the entire call for fire is completed since the FDC does not need it to locate the target. A known point may be used as a quick way of sending the target location; e.g., ROAD JUNCTION R7 tells the FDC exactly where the target is.

b. In a shift from a known point mission, the point from which the shift will be made is sent in the warning order. The observer then sends the OT direction (normally direction to the target will be sent to the nearest 10 mils; however, FDCs will be able to handle mils, degrees, or cardinal directions whichever is specified by the observer). The lateral shift (how far LEFT or RIGHT the target is from the known point to the nearest 10 meters), the range shift (how much further (ADD) or closer (DROP) the target is in relation to the known point to the nearest 100 meters), and the vertical shift (how much the target is above (UP) or below (DOWN) the altitude of the known point to the nearest 5 meters) are sent next. Unless there is an obvious difference, the vertical shift is ignored (fig 4-1).

c. In a polar plot mission, the word POLAR in the warning order alerts the FDC that the target will be located with respect to the observer's position. The observer then sends the DIRECTION (to the nearest 10 mils) and DISTANCE (to the nearest 100 meters). A vertical shift to the nearest 5 meters tells the FDC how far the target is located above (UP) or below (DOWN) the observer's location.

4-5. Target Description

The observer must describe the target in sufficient detail so the FDC can determine the amount and type of ammunition to use. The FDC would use different ammunition for different type targets. The observer should be

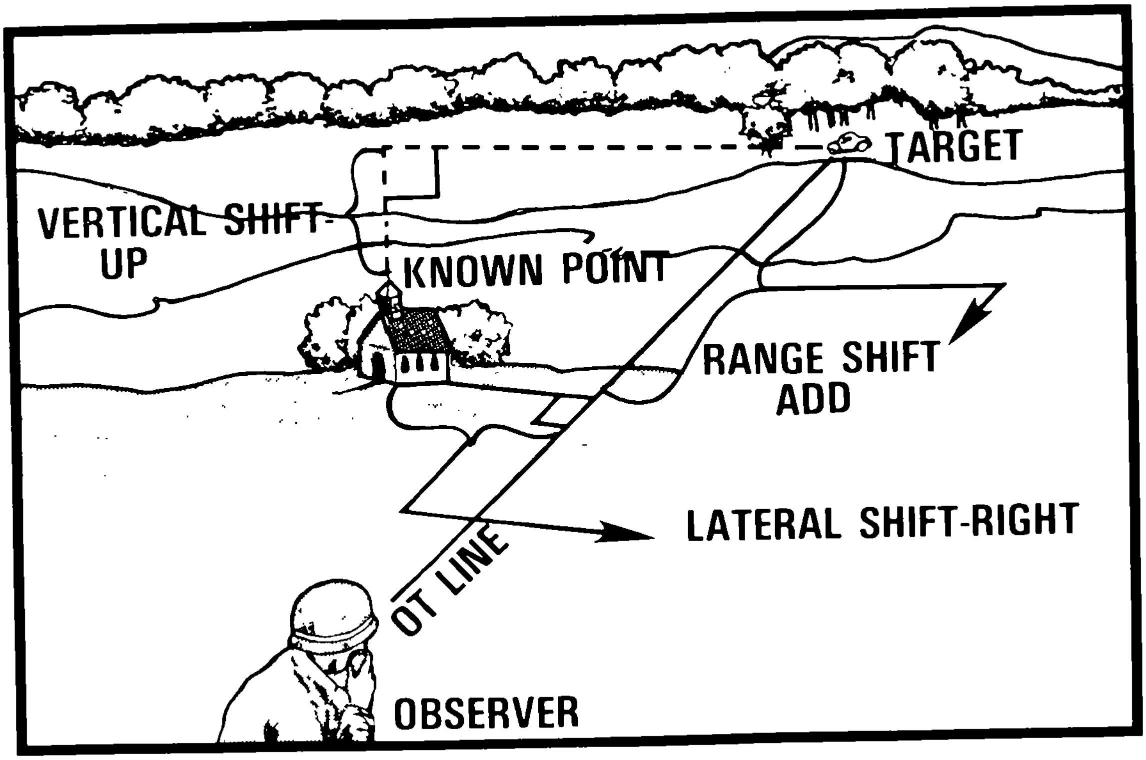


Figure 4-1. Shift from a known point.

brief but accurate. The description should contain the following:

a. What the target is (troops, equipment, supply dump, trucks, etc.).

b. What the target is doing (digging in, in an assembly area, etc.).

c. The number of elements in the target (squad, platoon, three trucks, six tanks, etc.).

d. The degree of protection (in open, in foxholes, in bunkers with overhead protection, etc.).

e. The target size and shape if these are significant. When the target is rectangular, the length and width in meters and the attitude (azimuth of the long axis) to the nearest 50 mils should be given (e.g., 400 by 200, ATTITUDE 2850). When the target is circular, the radius (e.g., RADIUS 200) should be given. Linear targets may be described by two or more grids or by grid, length, and attitude.

4-6. Method of Engagement

The observer must indicate how he wants to attack the target. This element consists of the type of adjustment, trajectory, ammunition, and distribution. These are discussed below.

a. Type of adjustment. Two types of adjustment may be employed—precision or area. Unless precision fire is specified, area fire will be employed.

(1) Precision fire is conducted with one piece on a point target. It is used to either obtain registration corrections or destroy a target. When the mission is a registration, it is initiated with a message to observer. If the target is to be destroyed, the observer will announce DESTRUCTION.

(2) Area fire is used to attack a dispersed target. Since many area targets are capable of movement, the adjustment should be as rapid as possible, consistent with accuracy, to prevent the target from escaping. A well-defined point at or near the center of the area

to be attacked should be selected and used as an aiming point. This point is called the adjusting point. To achieve surprise, fire may be adjusted on an auxiliary adjusting point, and, after adjustment is completed, shifted to the actual target area. Normally, adjustment on an area target is conducted with one adjusting piece. Two pieces fire when the height of burst for fuze time is being adjusted.

(3) The term DANGER CLOSE will be included in the method of engagement when the target is within 600 meters of any friendly troops with artillery, 750 meters with 5-inch or less naval gunfire, 1000 meters with naval gunfire greater than 5-inch, and 400 meters with mortars.

b. Trajectory. If high angle fire is desired, it is requested immediately after the type of adjustment. If high angle is not specified, low angle will be used.

c. Ammunition. If the type of ammunition is not specified in the call for fire, shell HE with fuze quick will be fired during the adjustment and fire for effect phases. If a different type of ammunition or fuze action is desired during either the adjustment or the fire for effect phase, the observer requests it. (See section II.)

(1) Projectile. Examples of requests for other than HE projectile are ILLUMINATION, ICM, and SMOKE.

(2) Fuze. Most missions are fired with fuze quick during the adjustment phase. When requesting a projectile that has only one fuze, the fuze is not indicated. Illumination, ICM, and smoke projectiles are fuzed with time fuzes; therefore, when the observer requests ILLUMINATION, ICM, or SMOKE, he does not announce TIME.

(3) Volume of fire. The observer may request the number of rounds to be fired by the weapons firing in effect; e.g., 3 ROUNDS indicates a battery 3 volleys.

d. Distribution. The observer may control the pattern of bursts in the target area. This pattern of bursts is called a sheaf. Unless otherwise requested, the battery will fire a parallel sheaf, all guns will fire the same data, and the pattern of bursts will resemble the position of the guns in the battery area. A converged sheaf places all rounds on a specific point and is used for small, hard targets. Special sheafs of any length may be requested; e.g., SHEAF 150 METERS.

4-7. Method of Fire and Control

The method of fire and control element indicates the desired manner of attacking the target, whether or not the observer desires to control the time of delivery of fire, and whether or not he can observe the target. Methods of fire and control are announced by the observer by use of the terms below.

a. Method of fire. In area fire, the adjustment normally is conducted with one of the center platoon howitzers or center section mortars. If for any reason the observer determines that PLATOON RIGHT (LEFT) will be more appropriate, he may request it. The normal interval of time between rounds fired by a platoon or battery right (left) is 5 seconds. If the observer wants some other interval, he may so specify.

b. Method of control.

(1) At my command. If the observer wishes to control the time of delivery of fire, he includes AT MY COMMAND in the method of control. When the pieces are ready to fire, the FDC announces:

BATTERY (BATTALION) IS READY, OVER.

The observer announces FIRE when he is ready for the pieces to fire. AT MY COMMAND remains in effect throughout the mission until the observer announces:

CANCEL AT MY COMMAND, OVER.

(2) Cannot observe. CANNOT OBSERVE indicates that the observer cannot see the target (because of vegetation, terrain, weather, or smoke); however, he has reason to believe that a target exists at the given location and that it is of sufficient importance to justify firing on it without adjustment.

(3) Time on target. The observer may tell the FDC when he wants the rounds to impact around the target by requesting:

TIME ON TARGET ______ MINUTES FROM . . . NOW, OVER.

or

TIME ON TARGET 0859, OVER.

The FO must insure 0859 on his watch is 0859 on the FDC's watch by conducting a time check.

(4) Fire when ready. If nothing is specified regarding method of control, each cannon section will FIRE WHEN READY.

4-8. Corrections of Errors

a. Errors are sometimes made in transmitting data or by the FDC personnel in reading back the data. If the observer realizes that he has made an error in his transmission or that the FDC has made an error in the readback, he announces CORRECTION and transmits the correct data.

Example.

The observer has transmitted:

SHIFT REGISTRATION POINT 2, OVER, DIRECTION 4680 . . .

He immediately realizes that he should have sent DIRECTION 5680. He announces:

CORRECTION, DIRECTION 5680, OVER.

After receiving the correct readback, he may continue to send the remainder of the call for fire.

b. When an error has been made in a subelement and the correction of that subelement will affect other transmitted data, the word CORRECTION is announced and then the correct subelement and all affected data are transmitted in the proper sequence.

Example.

The observer transmitted:

LEFT 200, ADD 400, UP 40, OVER.

He then realizes that he should have sent DROP 400. To correct this element, he sends:

CORRECTION LEFT 200, DROP 400, UP 40, OVER

because the LEFT 200 and UP 40 may be canceled if they are not included in the corrected transmission.

4-9. Calls for Fire From Headquarters Higher Than Battalion

Calls for fire from higher headquarters and calls for fire from the observer are similar in format. The call for fire from higher headquarters may specify the unit to fire for effect, where the observer's call for fire can only request the fire unit. An example of a call for fire from higher headquarters is as follows:

Warning order	FIRE FOR EFFECT, BATTALION, OVER.
Target location	TARGET F120 (or GRID 432789, ALT 520)
Method of engagement	VT, 3 ROUNDS
Control	TIME ON TARGET IS 10 MINUTES FROM...NOW, OVER.

4-10. Message to Observer (MTO)

a. After the FDC receives the call for fire, it will determine how the target will be attacked. That decision is announced to the observer in the form of a MESSAGE TO OBSERVER. The message to observer consists of three items:

(1) Unit(s) to fire—the battery or batteries that will fire the mission. If the battalion is firing in effect with one battery adjusting, the FDC will designate the fire for effect unit (battalion) and the adjusting unit (bravo).

Example.

"ALPHA . . . " or "BATTALION, BRAVO . . ."

(2) Changes to the call for fire—any changes to what the observer requested in the call for fire.

Example.

The observer requested ICM in effect and the FDO decides to fire VT in effect:

"ALPHA, VT IN EFFECT . . ."

(3) Number of rounds—the number of rounds per tube in fire for effect.

Example.

Continuing the above example, the FDO will fire a battery 4 rounds:

"ALPHA, VT IN EFFECT 4 ROUNDS"

b. The additional information shown below will normally be transmitted separately from the message to the observer.

(1) Probable error in range (PE_R). If PE_R is greater than or equal to 38 meters during a normal mission, the FDC will inform the observer. If PE_R is greater than or equal to 25 meters in a precision registration, the observer will be informed.

(2) Angle T. Angle T is sent to the observer when it is greater than or equal to 500 mils or when requested.

(3) Time of flight. Time of flight is sent to an air observer, during a moving target mission, aerial observer mission, or when requested.

c. A target number will not be assigned to a target of opportunity unless the observer so requests and FDO agrees or the FDO or the FSO directs that it be recorded as a target. The target number will be sent to the observer at the completion of the mission.

Observer: LEFT 10, ADD 10, RECORD AS TARGET, END OF MISSION, ESTIMATE 6 CASUALTIES, OVER.

FDO: LEFT 10, ADD 10, RECORD AS TARGET, END OF MISSION, ESTIMATE 6 CASUALTIES, TARGET 801, OVER.

Observer: TARGET 801, OUT.

Note. THE FDC WILL SEND THE REPLOT GRID AS SOON AS IT IS AVAILABLE.

d. MTOs for registrations are shown in chapter 4 of FM 6-40.

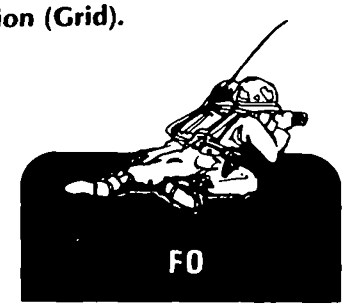
4-11. Authentication

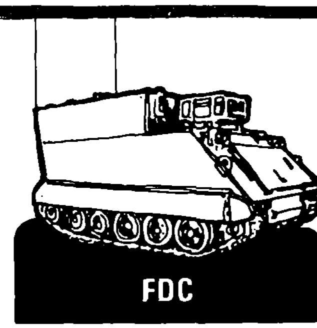
Excluding unique FA support operations (e.g., dedicated battery, suppressive fires posture), challenge and authentication is considered a *normal* element of initial requests for artillery fire. The FDC inserts the challenge in the last readback of the fire request (see examples in para 4-12). The FO transmits the correct authentication reply to the FDC immediately following the challenge. Authentication replies exceeding 15-20 seconds are automatically suspect and a basis for rechallenge. Subsequent adjustment of fire or immediate engagement of additional targets by the FO originating the initial fire request normally would not require continued challenge by the FDC.

4-12. Sample Missions

The following are sample calls for fire and FDC responses for various type missions:

Fire Mission (Grid).





Initial Fire Request

Z57, THIS IS Z71, ADJUST FIRE, OVER.

Z71, THIS IS Z57, ADJUST FIRE, OUT.

GRID 180513, OVER.

GRID 180513, OUT.

INFANTRY PLATOON IN THE OPEN,
VT IN EFFECT, OVER.

INFANTRY PLATOON IN THE OPEN,
VT IN EFFECT, AUTHENTICATE
PAPA BRAVO, OVER.

I AUTHENTICATE CHARLIE, OUT.

Message to Observer

BRAVO, 2 ROUNDS, OVER.

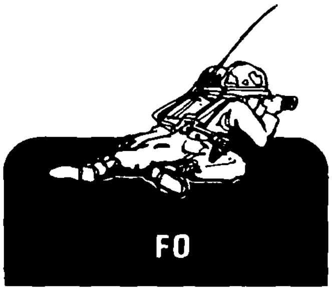
BRAVO, 2 ROUNDS, OUT.

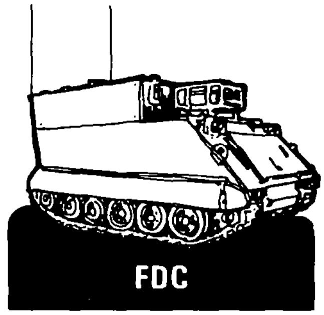
Direction (must be sent before or with first correction)

DIRECTION 1650, OVER.

DIRECTION 1650, OUT.

Fire Mission (Shift From a Known Point).





Initial Fire Request

H66, THIS IS H44, ADJUST FIRE, SHIFT 732, OVER.

THIS IS H66, ADJUST FIRE, SHIFT 732, OUT.

DIRECTION 5210, LEFT 380, ADD 400, DOWN 25, OVER.

DIRECTION 5210, LEFT 380, ADD 400, DOWN 25, OUT.

COMBAT OP IN OPEN, ICM, OVER.

COMBAT OP IN OPEN, ICM, AUTHENTICATE LIMA FOXTROT, OVER.

I AUTHENTICATE PAPA, OUT.

Message to Observer

CHARLIE, 1 ROUND, OVER.

CHARLIE, 1 ROUND, OUT.

Section II. SHELL/FUZE COMBINATIONS

4-13. Desired Effects

Once the observer has located a target, he must decide how he wants to attack the target to get maximum effect. A thorough knowledge of the ammunition available to him will allow a rapid selection of the correct type of shell and fuze to use against the target. If not specified by commander's guidance, the first decision the observer must make is what type of effect he desires. He has three choices: destruction, neutralization, or suppression.

a. Destruction puts a target out of action permanently. Thirty percent or more casualties will normally render a unit combat ineffective. Direct hits with HE or CP shells are required to destroy hard material targets. Destruction usually requires large expenditures of ammunition and is not considered an economical mission.

b. Neutralization knocks a target out of action temporarily. Ten percent or more casualties will neutralize a unit. Neutralization can be achieved using any type shell/fuze combination suitable for attacking a particular type target. Neutralization does not require an extensive expenditure of ammunition and is the most practical type mission.

[redacted]

c. Suppression of a target limits the ability of the enemy personnel in the target area to perform their jobs. Firing HE/VT or smoke creates apprehension and confuses the enemy. The effect of suppressive fires usually lasts only as long as the fires are continued. Suppression requires a low expenditure of ammunition; however, its inability to place lasting effect on a target makes it an unsuitable type mission for most targets.

d. To decide whether to use impact fuze action (produces ground bursts) or time fuze action (produces airbursts); the observer should consider:

(1) The nature of the target.

(2) The cover available to the enemy.

(3) The mobility of the target.

(4) Whether or not adjustment is required.

e. See appendix A for a thorough discussion of munitions effects and examples of optimum shell/fuze combinations for particular targets.

4-14. Shell HE and Fuzes

Shell HE (high explosive) is the standard shell used by the observer. Shell HE can be used with impact, time, or proximity (VT) fuzes for various effects.

a. Shell HE, fuze quick. Shell HE, fuze quick bursts on impact. It is used against

[redacted]

Shell HE, fuze quick loses its effect if troops are in trenches, or uneven ground, in frame buildings, or on earthworks.

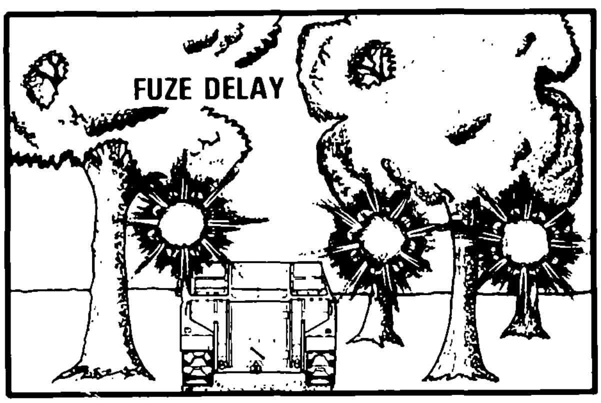


Figure 4-2. Fuze delay.

b. Shell HE, fuze delay (fig 4-2). A 0.05-second delay can be set on the quick fuze to allow either ricochet fire or penetration. If the observer is firing into dense woods, against light earthworks or buildings, or against unarmored vehicles, he should use fuze delay for penetration. If a very high charge is fired at a small angle of impact on a very hard surface, a ricochet may occur. These limitations restrict the use of ricochet fire.

c. Shell HE, fuze time. Shell HE, fuze time bursts in the air at a given time along the trajectory. Its fragmentation pattern is shown in figure 4-3. It is used against:

Troops in the open
Troops in trenches
Troops in deep foxholes
Troops in vehicles.

Fuze time must be adjusted to the proper height of burst. Therefore, consideration should be given to another shell/fuze combination if time is critical and airbursts are desired. Fuze time should not be used for high angle missions.

d. Shell HE, fuze VT. The VT fuze (or proximity fuze) is a radio activated fuze that detonates at a predetermined height of burst. A VT fuze provides the same effect as fuze time but does not have to be adjusted. Therefore, it is excellent to fire with shell HE for surprise and unobserved fires. Also, it is very effective in high angle fires. It is used against:

ALL TARGETS THAT YOU CAN ATTACK WITH FUZE TIME

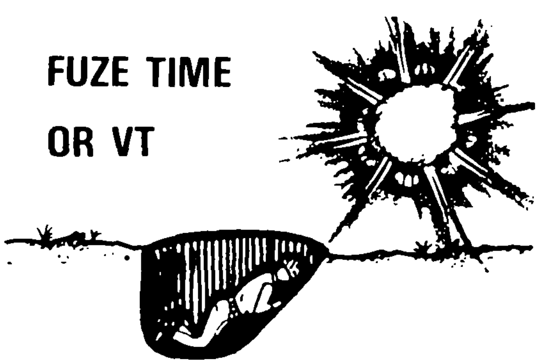


Figure 4-3. Fuze time or VT.

Note. VT fuzes M513 and M514 series should not be used in the rain or on targets that are on water, snow, or ice. The M728 VT fuze is not sensitive to water, snow, ice, or rain and may be used. Model M728 VT fuze detonates at approximately 7 meters height of burst (HOB) and can easily be misspotted as a graze burst. M513 and M514 model fuzes detonate at approximately 20 meters HOB.

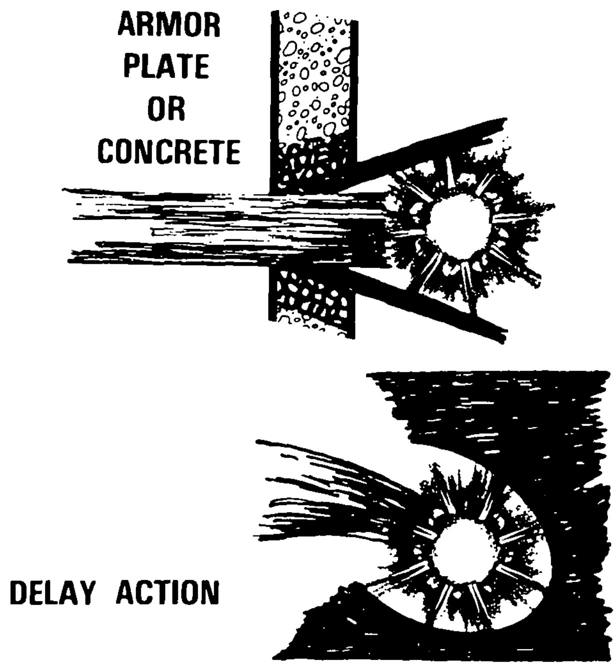


Figure 4-4. Fuze concrete piercing.

e. Shell HE, fuze concrete piercing (CP). The CP fuzes are used with shell HE against concrete targets. There are two types of CP fuzes: a nondelay (used primarily for spotting, or for clearing rubble and shattering concrete) and a delay (used to destroy the concrete target) (fig 4-4).

4-15. Improved Conventional Munitions (ICM)

Shell ICM is a high explosive, base-ejection projectile that consists of a mechanical time fuze and a body assembly containing grenades. When the fuze functions, the grenades are dispersed and cover a large area. The dual purpose ICM (DPICM) round is used against personnel and also has a shaped charge that is effective against lightly armored vehicles. The DPICM may also be used in a registration mode. Because of the large area covered, limited use is recommended close to unprotected friendly troops. It is used against TROOPS AND LIGHT VEHICLES IN THE OPEN.

4-16. Shell WP, Fuze Quick

Shell WP (white phosphorus) has three uses: incendiary, marking, and screening. It can be used to destroy the enemy's equipment or to obscure his vision. It is used against:

Vehicles and POL

Enemy observers

Also, shell WP can be used as an aid in target location and navigation.

"MARK CENTER OF SECTOR WITH WP, OVER."

4-17. Shell Smoke

Shell smoke is a base-ejection projectile that is filled with canisters containing smoke. It is more effective than white phosphorus as a screening agent because it lasts longer and has less tendency to pillar. The direction of the wind must be considered in the employment of any smoke shell (WP or canister). Further employment considerations can be found in chapter 6.

4-18. Shell Illumination

The illumination shell is a base-ejection projectile containing a flare attached to a parachute. Shell illumination is normally employed to illuminate areas of known or suspected enemy activity, or to adjust artillery fire at night. Depending on caliber, an illumination shell can provide light for up to 2 minutes and illuminate an area of up to 2000 meters in diameter (see chapter 6).

CHAPTER 5
ADJUSTMENT OF FIRE

Section I. SUBSEQUENT CORRECTIONS

An observer's prime concern is the placement of accurate surprise fires on targets presented to him. If an observer can locate the target accurately, he will request FIRE FOR EFFECT (FFE) in his call for fire. Failure to locate the target accurately may result from poor visibility, deceptive terrain, poor maps, or difficulty on the part of the observer in pinpointing the target. When the observer cannot locate the target with sufficient accuracy to warrant FFE, he must conduct an adjustment. Even with an accurate target location, if current firing data corrections are not available, the fire direction officer (FDO) may direct that an adjustment be conducted. Normally, one gun is used in adjustment. Special situations where more than one gun is used are so noted throughout the text.

When it is necessary for the observer to adjust fire, he must select an adjusting point. In the conduct of a registration or destruction mission (precision fire), the adjusting point is the target itself. In area missions, the observer must select a well-defined point near the center of the target area on which to adjust the fire. The point selected is called an adjusting point (fig 5-1) and the location of this point is included in the target location element of the call for fire in an area fire mission.

5-1. Spottings

A spotting is the observer's determination of the location (or the mean point of impact of a group of bursts) with respect to the adjusting point as observed along the observer-target (OT) line. Spottings are made for deviation (i.e., the number of mils right or left of the OT line), for range (i.e., whether the burst occurred beyond or short of the target), and, in time fire, for the height of burst (HOB) (i.e., the number of mils the burst is above the target). Spottings must be made by the observer the instant the bursts occur, except when the spottings are delayed deliberately to take advantage of drifting smoke or dust. The observer is usually required to announce his spottings during his early training; in combat, he makes spottings mentally. The observer should consider spottings in the order that gives the most difficult spotting first. The sequence and accuracies of spottings are HOB to the nearest 1 mil, range over or short, and deviation to the nearest 5 mils.

Figure 5-1. Adjusting point in an area fire mission.

a. HOB spottings.

(1) *AIR*. A round or group of rounds that bursts in the air is spotted as AIR and the number of mils above the target.

(2) *GRAZE*. A round or group of rounds that bursts on impact is spotted as GRAZE.

(3) *MIXED*. When an equal number of airbursts and graze bursts are obtained in the same group of rounds, the HOB spotting for the group is MIXED.

(4) *MIXED AIR*. A group of rounds resulting in both airbursts and graze bursts is spotted as MIXED AIR when the majority of the bursts are airbursts.

(5) *MIXED GRAZE*. A group of rounds resulting in both airbursts and graze bursts is spotted as MIXED GRAZE when the majority of the bursts are graze bursts.

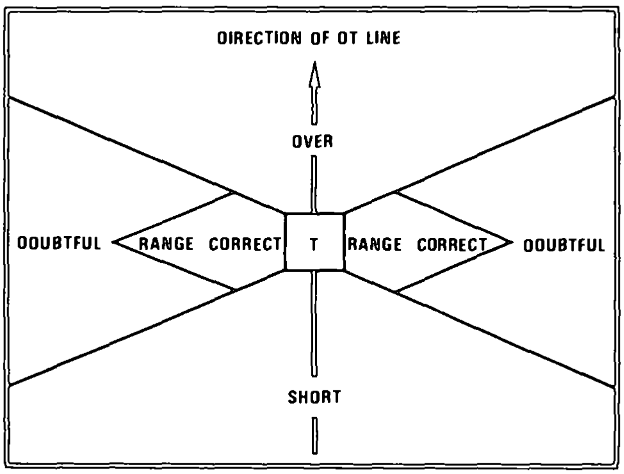


Figure 5-2. Range spottings.

b. Range spottings. Definite range spottings are required to make a proper range adjustment. Any range spotting other than DOUBTFUL or LOST (UNOBSERVED) is definite. Normally, a burst on or near the OT line gives a definite range spotting. Figure 5-2 is a guide showing approximate areas for various range spottings. An observer may make a definite range spotting when the burst is not on or near the OT line by using his knowledge of the terrain, drifting smoke, shadows, and wind. However, even experienced observers must use caution and good judgment when making such spottings. Possible range spottings are as follows:

(1) *OVER*. A burst that appears beyond the adjusting point is spotted as OVER for range.

(2) *SHORT*. A burst that appears between the observer and the adjusting point is spotted as SHORT for range.

(3) *TARGET*. An impact burst that hits the target is spotted as TARGET. This spotting is used only in precision fire (registration or destruction missions).

(4) *RANGE CORRECT*. A burst that appears to be at the correct range is spotted as RANGE CORRECT.

(5) *DOUBTFUL*. A burst that can be observed but cannot be spotted as OVER, SHORT, TARGET, or RANGE CORRECT is spotted as DOUBTFUL.

(6) *LOST*. A burst is spotted as LOST when its location cannot be determined.

(7) *LOST OVER (SHORT)*. A burst that is not observed but that is definitely known to be beyond or short of the adjusting point is spotted as LOST OVER or LOST SHORT.

(8) *UNOBSERVED*. A burst that is not observed.

c. Deviation spottings. A deviation spotting is the angular amount and direction of the deviation as seen from the observer's position. During the conduct of a fire mission, the observer measures the deviation, in mils, with an angle-measuring instrument, usually his binoculars. Possible deviation spottings are LINE when the burst is on the OT line or (so many mils) RIGHT or LEFT. For example, an observer sees a burst to the right of the OT line. He measures the angular deviation as 20 mils. His deviation spotting is 20 RIGHT. Deviation measurements are taken from the center of a single burst, or, in the case of platoon or battery fire, from the center of the group of bursts and should be measured to the nearest 5 mils. During precision registration, deviation is measured to the nearest mil.

Example (fig 5-3).

If the adjusting point is at the center of the binocular reticle pattern, the observer would spot this round for deviation as 20 left.

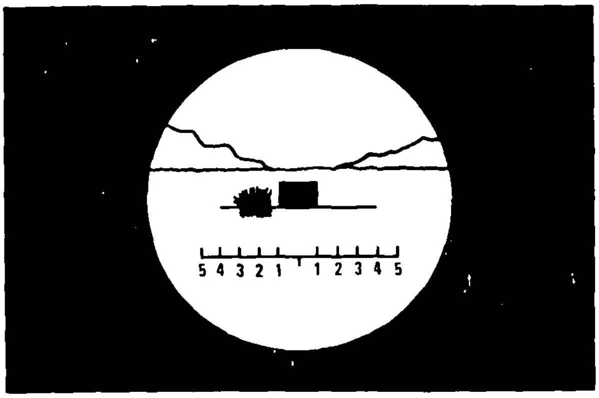


Figure 5-3. Deviation spotting, 20 left.

> Example (fig 5-4).
>
> The observer would spot this round for deviation as LINE.

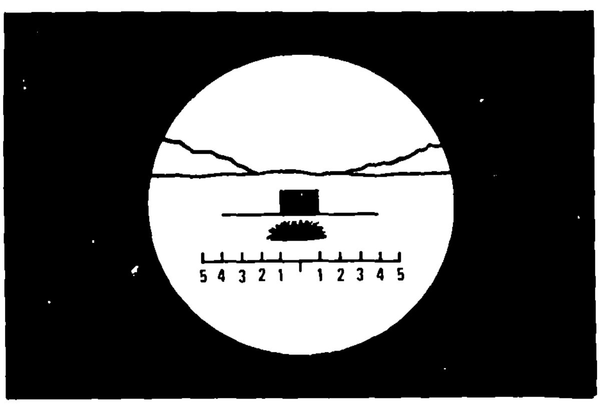


Figure 5-4. Deviation spotting, line.

d. Unobserved/lost spottings. Under certain conditions the observer may be able to make a spotting even though he is unable to see the burst. For example, if the observer hears but does not see a burst and the only possible place where the burst could occur and not be visible to the observer is in a ravine beyond the adjusting point, then he should assume that the burst is beyond the adjusting point and is LOST (OVER).

(1) If visibility is temporarily impaired (e.g., if the FO has to take cover from incoming enemy fire or if target area visibility is obstructed by smoke, dirt, etc.), or if the observer is unable to obtain an accurate spotting (e.g., if the FO cannot determine which burst among several is his), he reports UNOBSERVED, REPEAT.

(2) If the observer is unable to identify the burst, the round is spotted as LOST.

(3) A round may be lost for various reasons: it may be a dud, resulting in no visual or audible identification; the terrain may prevent the observer from sighting the round or its smoke; the weather may prevent the observer from hearing or seeing it; the FO may simply have failed to spot the round; and errors by the observers, FDC, or the firing piece may cause the round to be lost.

(4) When dealing with a lost round, the FO must consider his own experience, the level of FDC/cannon section training, and the location of friendly elements with respect to the target. The observer should take corrective action based on his confidence in the target location, the accuracy of fire on previous missions, whether the lost round is an initial round or a subsequent round, and the urgency of the mission.

(5) When a round is lost, positive action must be taken. The observer can initiate a number of corrective procedures, such as one or more of the following:

(a) Initiate a data check throughout the system starting with his target location data and his call for fire.

(b) Request WP round, smoke round, or a 200-meter airburst with HE on the next round.

(c) Repeat.

(d) End the mission and initiate a new mission.

(e) Make a bold shift. The observer should exercise caution before making a bold range or deviation change when the target plots in the vicinity of friendly troops.

5-2. Types of Corrections

After a spotting determination has been made, the observer will send corrections, in meters, to the FDC to move the burst of the round. The corrections are sent to the FDC in reverse of the order used in making spottings (i.e., deviation, range, HOB).

a. Deviation corrections.

(1) The distance in meters that the burst is to be moved is determined by multiplying the observer deviation in mils (the deviation spotting) by the OT distance in thousands of meters (the OT factor). Deviation corrections are expressed to the nearest 10 meters. A deviation correction of 20 meters or less is considered a minor deviation and will be ignored during any area fire mission, except when providing final refinement data.

(2) For determining the OT factor when the OT distance is greater than 1000 meters, the distance is rounded to the nearest thousand and expressed in thousands.

Example.

OT distance = 4200 meters
OT factor = 4

For an OT distance less than 1000 meters, the distance is rounded to the nearest 100 meters and expressed in thousands.

Example.

OT distance = 800 meters
OT factor = .8

(3) The computed deviation correction is announced to the fire direction center as LEFT (RIGHT) (so much), the direction of the correction being opposite that of the spotting.

(4) Determination of deviation corrections is illustrated in figure 5-5.

(5) When the angle between the OT line and GT line (angle T, fig 5-6) is 500 mils or greater, the fire direction center will notify the observer of this fact. When the observer has been told that angle T is 500 mils or greater, his initial action is to continue to use his OT factor to make his deviation corrections. However, if he observes that he is getting much more of a correction than he asked for, he should consider cutting his corrections proportionately and continuing the mission.

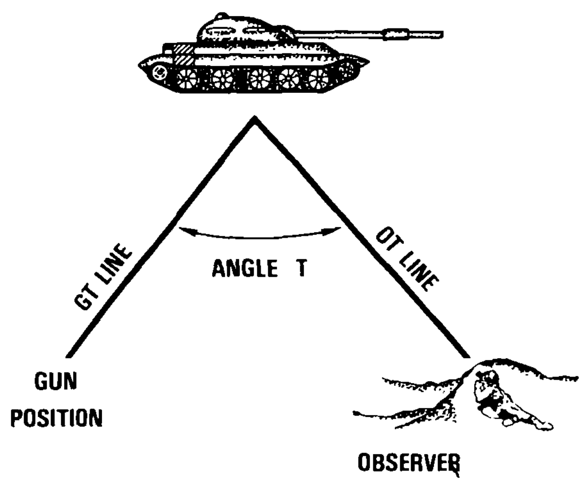


Figure 5-6. Angle T.

b. Range corrections.

(1) In conducting an adjustment on a target, the observer should establish a range bracket as early in the adjustment as

EXAMPLE	OT DISTANCE (METERS)	OT FACTOR	SPOTTING	DEVIATION CORRECTION
1	4,000	4	40R	LEFT 160
2	2,500	2	100L	RIGHT 200
3	3,400	3	50L	RIGHT 150
4	1,500	2	20R	LEFT 40
5	800	0.8	40L	RIGHT 30

Figure 5-5. Determination of deviation corrections.

possible. When the first definite range spotting is made, the observer should make a range correction that will cause the next round to be spotted opposite that of the previous round. For example, if the first definite range spotting is SHORT, the observer should ADD a sufficient amount to obtain an OVER spotting on the next round. Likewise, if the spotting is OVER, he should DROP a sufficient amount to obtain a SHORT on the next round. The observer then cuts each range correction in half, successively moving each round closer to the target.

(2) For inexperienced observers, range changes should be made in multiples of even 100 meters (200, 400, 800, etc.) to facilitate establishing and splitting range brackets. In the final analysis, the observer must base his corrections on his estimation of the location of the bursts. After establishing a range bracket, the observer splits the existing bracket until fire for effect is appropriate. The observer normally enters fire for effect when splitting a 100-meter bracket, or when he obtains a spotting of RANGE CORRECT.

(3) Throughout the adjustment phase, it is essential that the observer exercise good judgment rather than automatically split the range bracket. For example, the observer adds 800 meters after an initial range spotting of SHORT. The second range spotting is OVER, but the burst is much closer to the adjusting point than the initial burst. A range change of DROP 200 rather than DROP 400 would be appropriate. The observer must be aggressive in his conduct of the adjustment phase of an adjust fire mission and must use every opportunity to shorten that phase. He should make every effort to correct the initial round onto the target and enter fire for effect as soon as possible. Successive bracketing procedures should be used only when time is not critical.

c. HOB corrections (fig 5-7).

(1) A cannon platoon (2 guns) is used when adjusting time fuze. When firing fuze time, the HOB is adjusted (after a 100-meter bracket has been established using fuze quick) by the observer to obtain a 20-meter HOB in fire for effect. He does this by

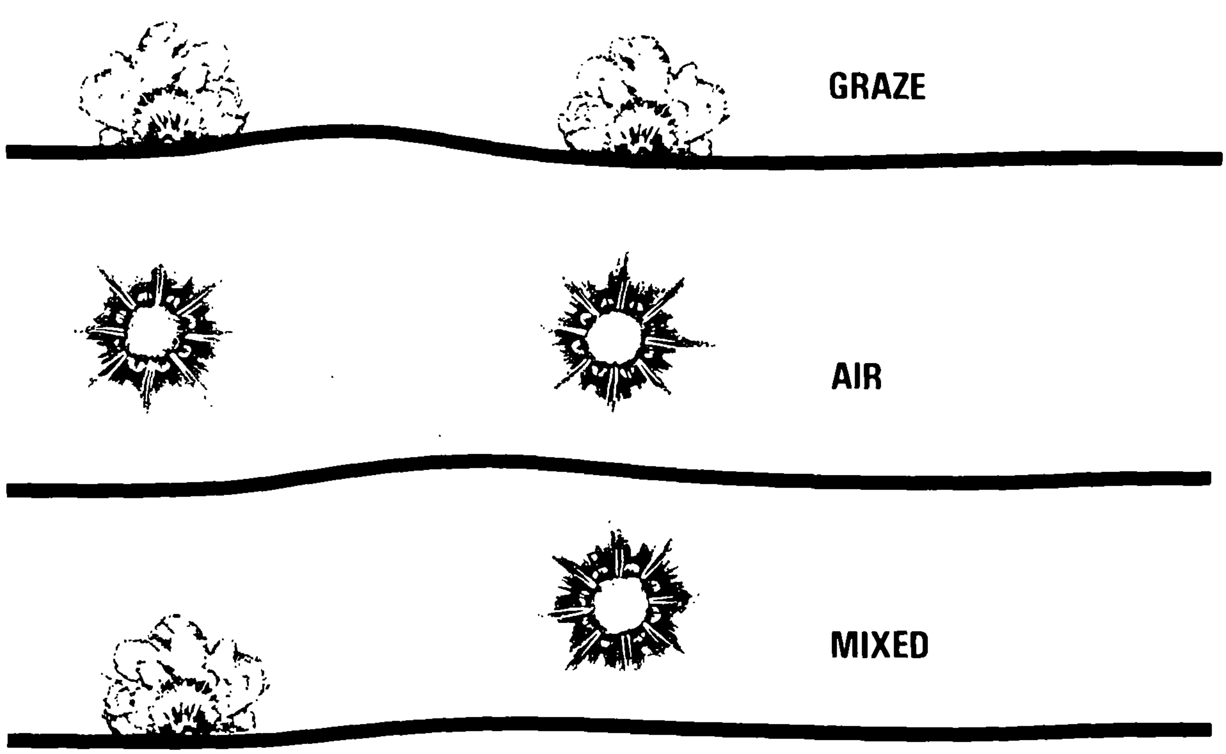


Figure 5-7. Height of burst (HOB) corrections.

announcing a correction of UP (DOWN) (so much).

(2) When the spotting of the initial rounds is GRAZE, an automatic correction of UP 40 is given. When the initial rounds are spotted as MIXED, an automatic correction of UP 20 is given. When the rounds are all airbursts, the mean HOB of the rounds (in meters) is computed (observed vertical angular deviation in mils above the adjusting point multiplied by the OT factor). The appropriate HOB correction is given (to the nearest 5 meters) to obtain the desired HOB.

(3) Fire for effect is entered only when a correct HOB (i.e., 20 meters) is assured. Therefore, fire for effect is never begun when the last bursts observed resulted in all graze bursts. When the last rounds before entry into fire for effect are spotted as MIXED, the correction of UP 20 will be given when requesting fire for effect. If the initial rounds in fire for effect are spotted as MIXED (50 percent airbursts and 50 percent graze bursts), the subsequent surveillance report will normally include the correction UP 20.

(4) The procedures described above are the normal procedures; however, because of dispersion, terrain, and errors, departures from these procedures based on judgment, may be appropriate.

5-3. Sequence of Subsequent Corrections

a. After the initial burst(s) appears, the observer transmits subsequent corrections until the mission is completed. These corrections include appropriate changes in elements previously transmitted and the necessary corrections for deviation, range, and HOB. Elements that may require correcting and the order in which corrections are announced are as follows:

(1) Observer-target direction.

(2) Danger close.

(3) Trajectory.

(4) Method of fire.

(5) Distribution.

(6) Projectile.

(7) Fuze.

(8) Volume.

(9) Deviation.

(10) Range.

(11) Height of burst.

*(12) Control.

(13) Splash.

(14) Repeat.

* Note. Target description is sent before control correction during immediate suppression missions and when attacking a new target without sending a new call for fire.

b. Any element for which a change or correction is not desired is omitted.

c. The following guidelines are given for subsequent corrections:

(1) Change in observer-target direction. A change in the observer-target direction is made when it deviates from the announced direction by more than 100 mils. For example, an observer began an adjustment on several self-propelled guns, using a tree at direction 5620 as the adjusting point. During the adjustment, the self-propelled guns moved to a new position an appreciable distance from the initial adjusting point. The observer selects a new adjusting point and measures a direction of 5840 to the new point. Since the difference between the directions to the old and new adjusting points exceeds 100 mils, the first element in the observer's next correction is DIRECTION 5840.

(2) Danger close. If the adjustment of FA fires will cause the rounds to impact within 600 meters of friendly troops (400 meters for mortars 750 meters for NGF), the observer must inform the FDC of this fact by transmitting DANGER CLOSE. When DANGER CLOSE has been announced, each gun to fire for effect will be fired during the adjustment. Corrections by the observer will be made from the round closest to friendly troops using creeping fire (para 5-7). If the adjustment of fire moves the rounds more than 600 meters from friendly troops, the observer transmits CANCEL DANGER CLOSE.

(3) Change in trajectory. The observer requests a change in the type of trajectory when it becomes apparent that high angle fire is necessary during a low angle adjustment or when it becomes apparent that high angle fire is no longer necessary during a high angle adjustment. For example, an observer is making an adjustment on some armored personnel carriers. During the adjustment, the vehicles move into deep gullies for protection. The observer knows from previous firing that high angle fire will be necessary to bring effective fire into the gullies. On the basis of this information, the observer makes a change in the type of trajectory by transmitting the correction HIGH ANGLE. Conversely, the observer changes from high angle to low angle fire when the high angle trajectory is no longer required. For example, an observer began an adjustment on a group of vehicles halted along a street between high buildings. During the adjustment, the vehicles moved to the edge of town. As soon as he notes the vehicles moving from the area of tall buildings, the observer decides that high angle fire is no longer required. He makes the change to low angle trajectory by transmitting the correction CANCEL HIGH ANGLE.

(4) Change in method of fire. The observer transmits any correction he desires to make in the method of fire. For example, if the observer desires to change from one gun to two guns firing in order from left to right, he transmits the correction PLATOON LEFT. If he desires to change to two guns firing in order from right to left, he transmits the correction PLATOON RIGHT.

(5) Change in distribution (figures 5-8, 5-9). When an observer desires to change the distribution of fire from a parallel sheaf to another type of sheaf, he transmits the sheaf desired (e.g., CONVERGE, OPEN, or SHEAF 100 METERS). Conversely, if the observer desires to change from a specific sheaf to a parallel sheaf, he transmits the correction CANCEL followed by the type of sheaf being used (e.g., CANCEL CONVERGE (OPEN) SHEAF).

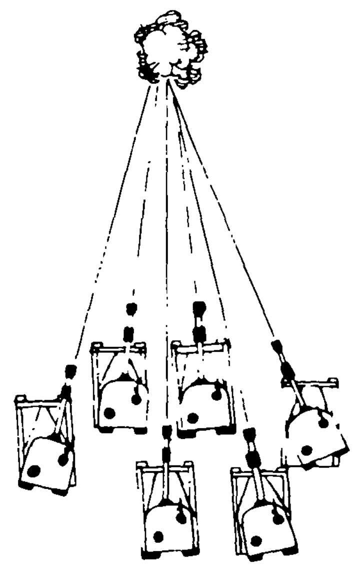


Figure 5-8. Converged sheaf.

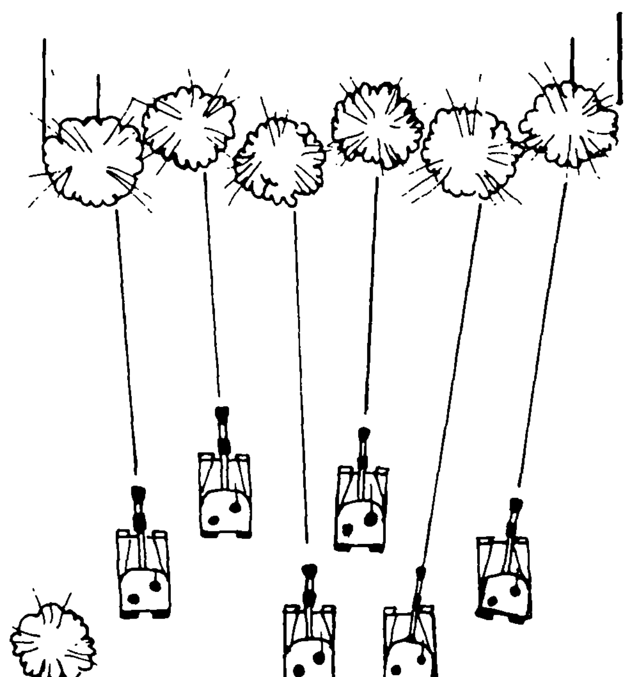


Figure 5-9. Open sheaf.

(6) Change in projectile. When the observer desires to change the type of projectile, he announces the desired change (e.g., SMOKE, WP).

(7) Change in fuze. When the observer desires to change the type of fuze or fuze action, he announces the desired change (e.g., DELAY, VT).

(8) Change in volume. When the observer desires to change the volume of fire, he announces the desired change (e.g., TWO ROUNDS or THREE ROUNDS).

(9) Correction for deviation. When the burst hits to the right or left of the OT line, the observer determines the correction required, to the nearest 10 meters, to bring the burst to the OT line. To make the correction, the observer transmits RIGHT (LEFT) (so much). If there is no deviation correction, the deviation element is omitted from the subsequent corrections.

(10) Correction for range. Range corrections are transmitted as ADD (DROP) (so much). If the burst appears beyond the target from the observer's position, the observer's correction is DROP (so much). If the burst appears between the observer and the target, the range correction is ADD (so much). If the observer does not desire a range correction, the range element is omitted from subsequent corrections.

(11) Correction for HOB. The observer transmits HOB corrections to the nearest 5 meters with the correction UP (DOWN) (so much). The desired HOB is 20 meters. In an area mission, HOB corrections are made after the deviation and range have been corrected to within 50 meters of the target, using fuze quick in adjustment.

(12) Change in control. When the observer desires to change the method of control, he transmits the desired method of control (e.g., FIRE FOR EFFECT). When the method of control being used includes AT MY COMMAND, his correction is CANCEL AT MY COMMAND. If there is no correction to be made in the method of control, the observer omits this element from his subsequent corrections.

(13) Splash. If an observer in a tactical situation is having difficulty identifying or observing his rounds because he has to remain down in a concealed position a large portion of the time, or due to other fire missions being conducted in the area, he may request assistance from the FDC by requesting SPLASH. The FDC will inform the observer that his round is about to impact by announcing SPLASH 5 seconds prior to impact. The observer may terminate this help by announcing CANCEL SPLASH.

(14) Repeat. Repeat is used when the observer desires a subsequent round or group of rounds fired with no corrections to deviation, range, or HOB (e.g., TIME, REPEAT). REPEAT is also used by the observer to indicate that he wants fire for effect repeated with or without changes or corrections to any of the elements (e.g., ADD 50, REPEAT).

Section II. AREA FIRE (ADJUSTMENT AND FFE)

There are four techniques that can be used to conduct area adjustment fires: successive bracketing, hasty bracket, one round adjustment, and creeping fire. The successive bracket technique is best suited for inexperienced observers or when precise adjustment is required, such as precision registrations and destruction missions. It mathematically insures that FFE rounds will be within 50 meters of the target. Hasty bracketing is best when responsive fires are required and the observer is experienced in the adjustment of fire. One round adjustment provides the most responsive fires, but is generally the least accurate. Creeping fire is used when firing danger close missions. When completed, all missions require refinement data and surveillance.

5-4. Successive Bracketing

After the first definite range spotting, the observer should send a range correction to the FDC to establish a bracket around his adjusting point. For example, if the first round landed over the adjusting point, the observer should send a drop correction sufficient to bring the next round short of the adjusting point (see fig 5-10).

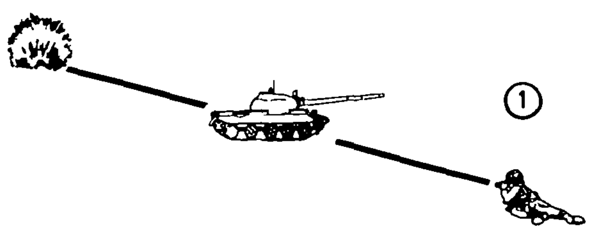


Figure 5-10. Round over adjusting point.

Once the bracket has been established, the observer will successively split the bracket until he is assured of being within 50 meters of the adjusting point when he fires for effect. Normally range changes of 100, 200, 400, or 800 meters are used to make splitting the bracket easier.

ENTER FFE WHEN YOU ARE WITHIN 50 METERS OF THE ADJUSTING POINT.

a. In this case, the observer sent a DROP 400 (-400) after observing his first round, and the next round came out short of the adjusting point as illustrated (fig 5-11).

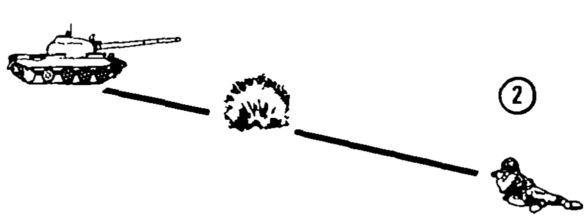


Figure 5-11. Round short of adjusting point.

b. The observer has just established a range bracket in that he now has a round over and one short of the adjusting point, separated by 400 meters.

c. Using the successive bracketing technique, the observer would now send ADD 200 (+200) (fig 5-12).

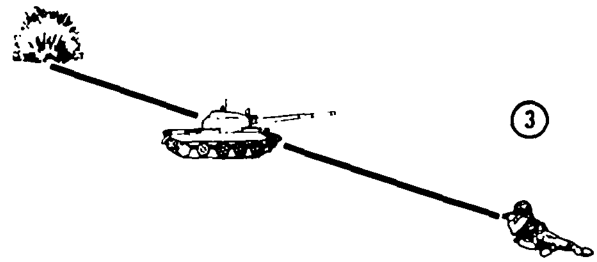


Figure 5-12. Round over adjusting point.

d. If the third round came out over the adjusting point, the observer has a 200-meter bracket because round 2 was short of the adjusting point, and the distance between the two rounds was 200 meters. Splitting his bracket, the observer would send DROP 100 (-100).

e. If the fourth round came out short, the observer has established a 100-meter bracket, so he now sends ADD 50, FIRE FOR EFFECT, to the FDC and the fire for effect rounds must be within 50 meters of the adjusting point (fig 5-13).

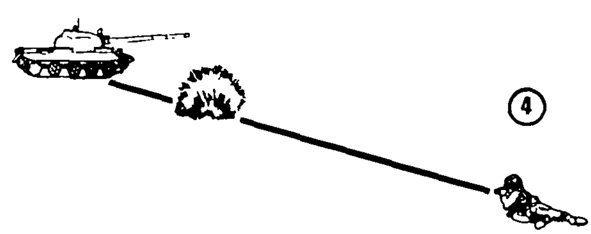


Figure 5-13. Round short of adjusting point.

5-5. Hasty Bracket Adjustment

Experience has shown that effectiveness on the target decreases as the number of rounds used in adjustment increases. An alternative to successive bracketing is the hasty adjustment technique. While successive bracketing assures the observer that the adjusting point will mathematically be within the appropriate distance upon entering FFE, it is a slow and unresponsive technique. Therefore, if the nature of the target dictates that effective fires are required in less time than the successive bracketing technique would require, the hasty adjustment technique should be employed. The success of hasty bracket adjusting is dependent on a good terrain analysis that provides the observer an accurate initial target location. The observer obtains a bracket on his first correction similar to the successive bracketing technique. Once the observer has this initial bracket, he uses it as a yardstick to determine his subsequent correction. He then sends the FDC the correction to move the rounds to the target and FIRE FOR EFFECT.

Example.

a. The first round impacted and the observer spotted it as SHORT 35R. With an OT factor of 4, the observer sends L140 ADD 200 (fig 5-14).

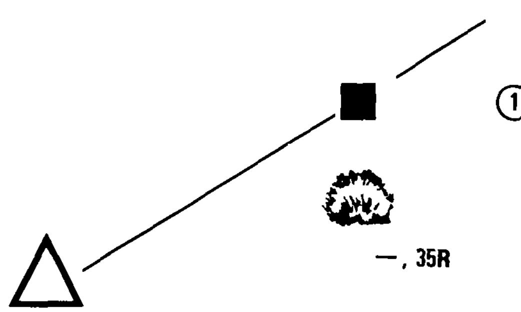


Figure 5-14. Short 35 Right.

b. The next round lands OVER 10L. The observer looks at the round and decides that he needs to go right 40 meters (10 × OT factor of 4) and DROP 50 and he will be on his adjusting point. Therefore, he sends R40 DROP 50 FIRE FOR EFFECT (fig 5-15).

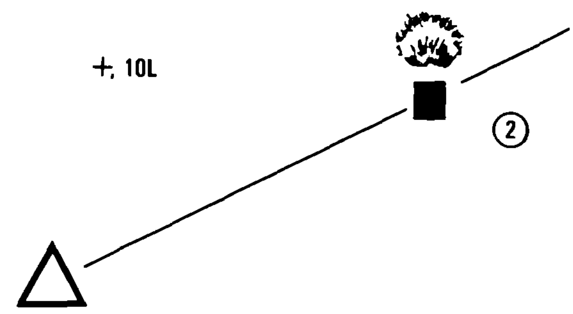


Figure 5-15. Over 10 Left.

The hasty adjustment technique improves with observer experience and judgment. Each observer must strive to improve his abilities in order to increase responsiveness on the battlefield.

5-6. One Round Adjustment

Unlike the preceding two adjustment techniques, this method does not require the establishment of a bracket. The observer spots the location of the first round, calculates, and transmits to the FDC the corrections necessary to move the burst of the round to the adjusting point, and fires for effect. This technique requires either an experienced observer or an observer provided with accurate distance measuring equipment such as the GVS-5.

5-7. Creeping Fire (Danger Close)

The creeping method of adjustment will be used exclusively during danger close missions. The observer should make range changes by creeping the rounds to the target, using corrections of 100 meters or less, rather than making large range corrections.

a. The observer must keep in mind the positions of all nearby friendly troops. Care must be taken to insure that a correction will not cause rounds to endanger friendly troops.

b. Normally, all weapons that will fire for effect will be used in adjustment.

c. For battalion missions, firing elements should be adjusted individually. The battalion danger close fire mission would is made after a 200-meter bracket is established, the last round fired and all previous rounds cannot be considered as usable rounds for determining range and deviation refinement data.

(2) When the 50-meter range bracket has been established, two rounds must be fired with data 25 meters in the direction opposite that of the last range spotting. If both rounds result in spottings of SHORT (OVER), an ADD (DROP) 25 meters is sent and firing is continued until two definite range spottings have been obtained at the opposite end of the 25-meter range bracket.

(3) When the requirement of two OVERS and two SHORTS with the same data or data fired 25 meters apart has been met, the impact registration is ended with necessary refinement data. Refinement data may include either a range correction or a lateral correction, or both, to the nearest 10 meters.

(4) When determining refinement data for range, the location of the registration point is determined with respect to the two sets of spottings and then refinement data determined and announced. The criteria for determining range refinement data are as follows:

If the registration point is nearer the spotting(s) of the last round(s) fired, NO REFINEMENT is necessary (fig 5-17).

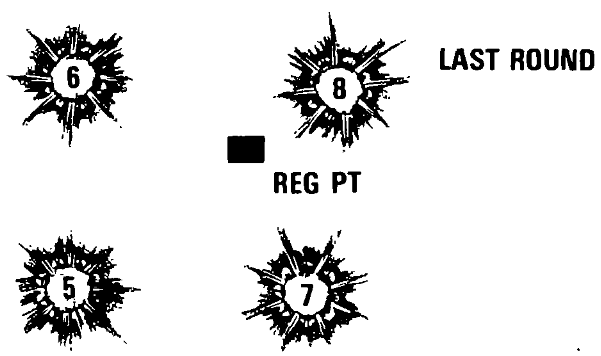


Figure 5-17. No refinement necessary.

If the registration point is equidistant between the two sets of bursts, the observer determines the range refinement to be an ADD or DROP 10 from the last data fired (fig 5-18).

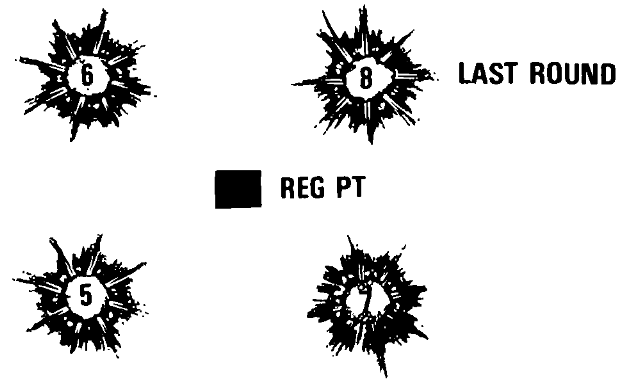


Figure 5-18. Drop 10.

If the registration point is nearer the pair of bursts at the opposite end of the bracket, the observer determines the range refinement to be a DROP 20 (fig 5-19).

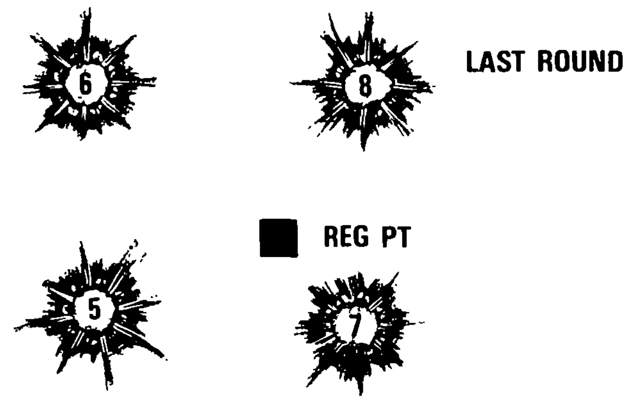


Figure 5-19. Drop 20.

The observer must keep track of the rounds and how they are spotted in relation to the registration point. This is most easily accomplished by drawing a picture and numbering the rounds.

(5) The deviation refinement is determined by adding the spotting deviations of the rounds establishing the two OVERS and two SHORTS (this may include two, three, or four deviation spottings). This total is then divided by the number of rounds (two, three, or four) to get an average deviation expressed to the nearest mil. The average

deviation times the OT factor equals the correction.

Example 1.

Rd	Spotting
1	+6R
2	-8R
3	-5R
4	+7R

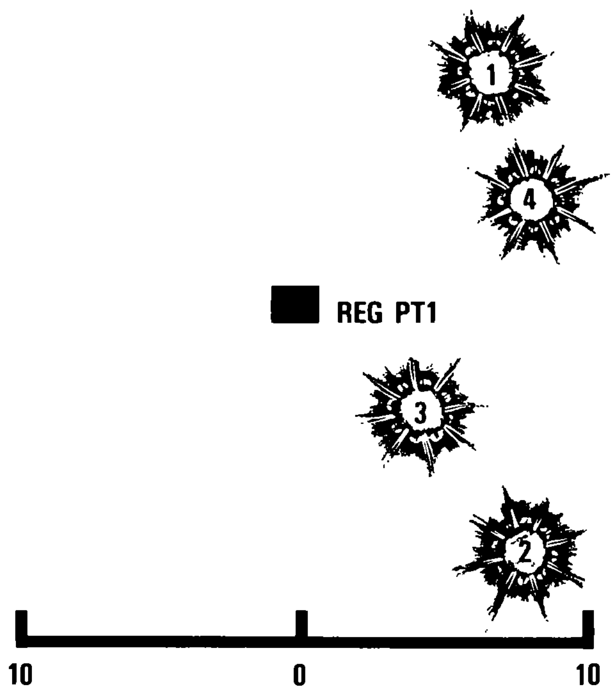
SUM OF DEVIATIONS
6R + 8R + 5R + 7R = 26R

AVERAGE DEVIATION
26R ÷ 4 rds = 6.5R ≈ 6R

OT = 3
MPI is 3 × 6R = 18M R ≈ 20M R

CORRECTION IS:

LEFT 20, DROP 10, RECORD AS REGISTRATION POINT 1, END OF MISSION, OVER.



Example 2.

Rd	Spotting
1	Target
2	+7R
3	-3L

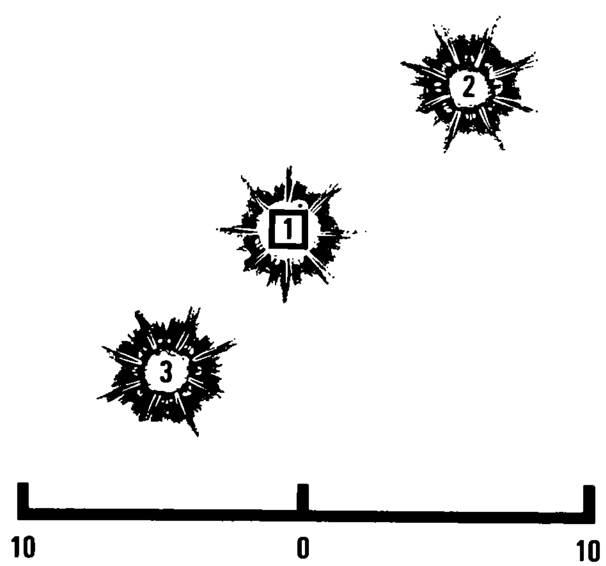
SUM OF DEVIATIONS
0 + 7R + 3L = 4R

AVERAGE DEVIATION
4R ÷ 3 rds = 1.33R ≈ 1R

OT = 2
MPI is 2 × 1R = 2M R ≈ 0

CORRECTION IS:

ADD 10, RECORD AS REGISTRATION POINT 1, END OF MISSION, OVER.



c. Time registration. If a time registration is required after the impact registration has been completed, the observer determines and announces refinement data and commands the time registration.

Example.

RIGHT 10, ADD 10, RECORD AS REGISTRATION POINT 1, TIME REPEAT, OVER.

(1) The objective of the time portion of the precision registration is to correct the mean height of burst of four rounds fired with the same data to 20 meters above the registration point. If the first round is GRAZE, a correction UP 40 is given. Once an airburst has been obtained, the command is 3 ROUNDS REPEAT. When four rounds have been fired with the same data, the registration is ended with the appropriate correction to achieve a 20-meter HOB.

(2) When four airbursts are spotted, the HOB IS CORRECTED TO 20 METERS in 5-meter increments. The mean HOB is determined by adding the four spottings in mils, dividing by 4, expressing to the nearest mil, then multiplying by the OT factor (the same technique used in determining deviation corrections).

Example.

UP 10 RECORD AS TIME REGISTRATION POINT 1, END OF MISSION, OVER.

(3) When three air and one graze are spotted, the HOB IS CORRECT.

(4) With two air and two graze, the HOB IS CORRECTED BY UP 10.

(5) With one air and three graze, the HOB IS CORRECTED BY UP 20.

(6) Check rounds may be fired to verify the validity of the time registration; however, it is not necessary. If the first airburst is extremely high, the observer may make a DOWN correction and fire one round. If that round is at a measurable height of burst, he can then fire the additional three rounds.

d. Contingency considerations. Tables 5-1 through 5-3 address some of the contingencies that may confront the observer. They are intended as aids to learning, not as "crutches" that the observer must have in order to conduct a registration. Each table represents a separate precision registration. The instructions for using each table are as follows:

(1) Each table is a continuation of the mission described on the left side of each table.

(2) The round that splits the appropriate range bracket or provides a range correct/target hit spotting in the adjustment phase is the first round of the table.

(3) The round number(s), spotting(s), and the observer's correction are given for each step of the table. In table 5-1, for example, RD 5 (-)②+ 25 indicates that the observer's spotting for round 5 was SHORT and his correction was:

2 ROUNDS, ADD 25, OVER.

(4) Some of the contingencies that may occur following the observer's correction are presented after each step. The user of the table simply picks the contingency that he is concerned with, determines the appropriate observer correction, and then moves on to the listed contingencies after this latest correction. This process continues until the impact registration is terminated.

(5) It should be noted that each completed mission is terminated by the words RECORD AS REG PT_____. (Use spottings from rounds (so and so).) Each completed mission is terminated in this manner for simplicity; in most missions refinement data would be required prior to the observer's command to record as registration point; for example:

RIGHT 10, ADD 10, RECORD AS REG PT 2, EOM, OVER.

If a time registration is also to be conducted:

RIGHT 10, ADD 10, RECORD AS REG PT 2, TIME REPEAT, OVER.

Table 5-1. Add 25 at Round 5

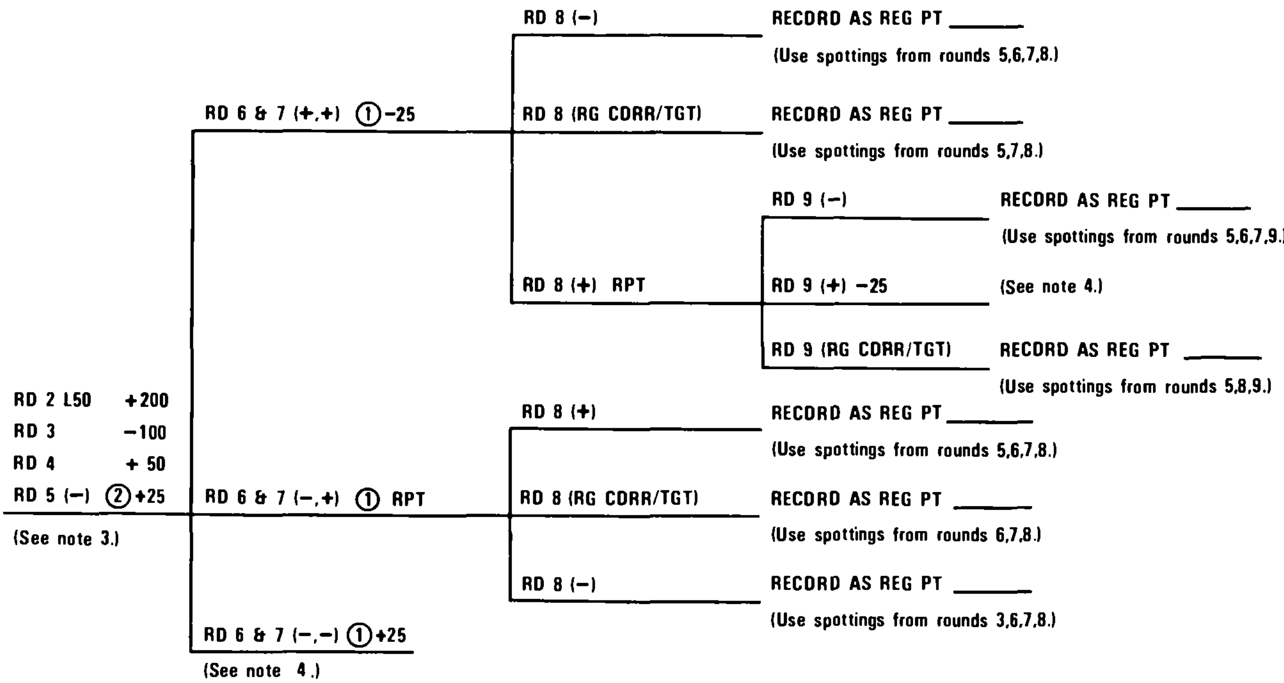


Table 5-2. Drop 25 at Round 5

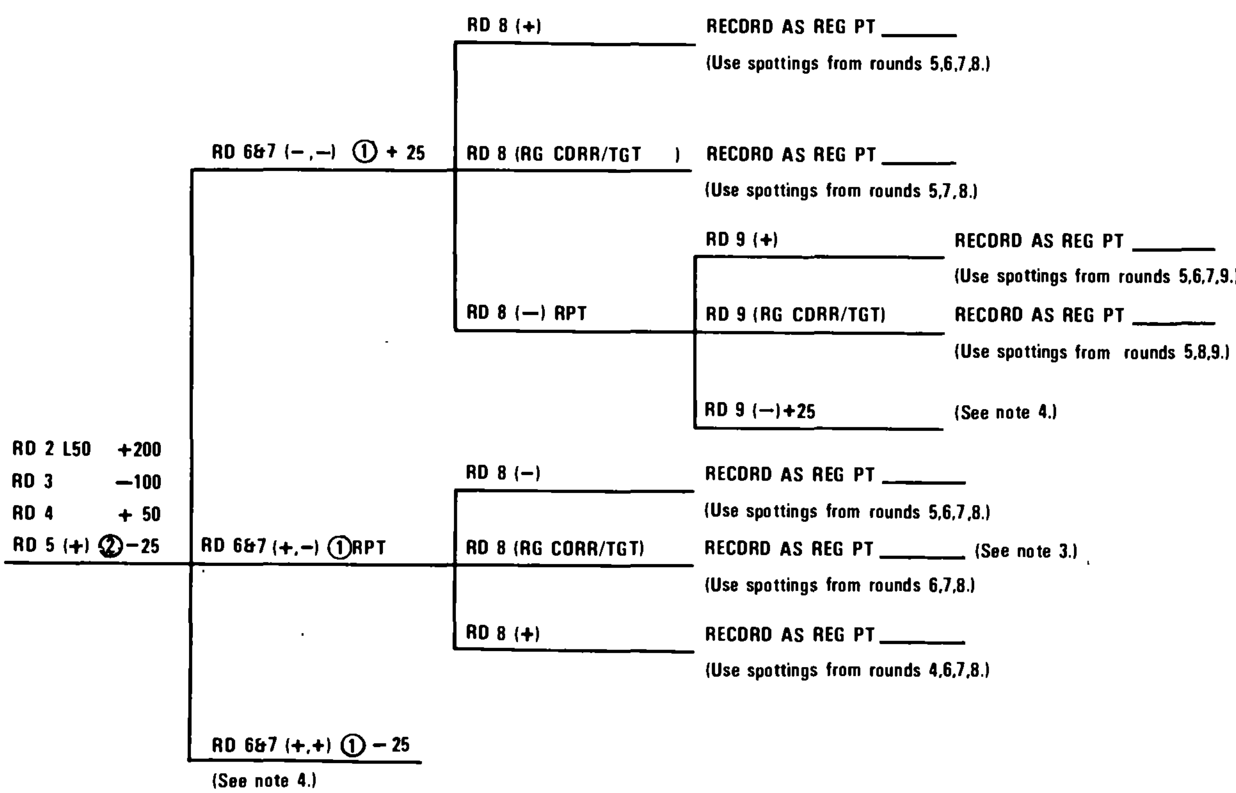


Table 5-3. Range Correct/Target During Adjustment

RD 2 L50 +200 RD 3 (TGT) RPT (See notes 1 & 3.)	RD 4 (+)−25	RD 5 (+)−25	(See note 4.)
		RD 5 (−)	RECORD AS REG PT ______ (Use spottings from rounds 3,4,5.)
		RD 5 (RG CORR/TGT)	RECORD AS REG PT ______ (See note 5.) (Use spottings from rounds 3,5.)
	RD 4 (RG CORR/TGT)	RECORD AS REG PT ______ (See note 3.) (Use spottings from rounds 3,4.)	
	RD 4 (−)+25	RD 5 (−)+25	(See note 4.)
		RD 5 (+)	RECORD AS REG PT ______ (Use spottings from rounds 3,4,5.)
		RD 5 (RG CORR/TGT)	RECORD AS REG PT ______ (See note 5.) (Use spottings from rounds 3,5.)

Notes.

1. If a round is spotted as range correct or target during the adjustment phase, that round is considered as the first round in fire for effect and the observer continues fire for effect with REPEAT from round 3 in table 3.

2. If the spotting of the round as a result of the observer's correction of ADD or DROP 50 is in the same sense as that of the previous round, the observer uses the spottings and corrections beginning at round 5 and continues in the normal manner.

3. A round spotted as range correct or target may be equivalent to a pair of rounds at the same data bracketing the registration point.

4. The observer continues range corrections in 25-meter increments until a spotting of range correct, target, or a spotting in the opposite sense is obtained and then orders corrections, as appropriate, to obtain a verified bracket. If two or three 25-meter range corrections result in spottings the same as the preponderance, the observer may assume that he obtained a false bracket before entering fire for effect. The observer should continue the adjustment with appropriate range corrections until the proper range is obtained and then reenter fire for effect.

5. The observer ends the registration, since the equivalent of two pairs of rounds fired at data 25 meters apart bracketing the registration point has been obtained.

e. Second lot registrations. Second lot registrations are conducted in much the same manner as are first lot registrations. After the first lot impact registration has been completed, a time registration is conducted if required. The FDC must announce to the observer OBSERVE SECOND LOT REGISTRATION. The observer must reestablish the appropriate range bracket and complete the second lot registration by using the same procedures as for the first lot. The time portion of the registration is not fired with the second lot.

Example.

Message to observer for two lot registration:

FDC to FO: H18, THIS IS H44, REGISTER ON REG PT 2, QUICK AND TIME, TWO LOTS, OVER.

(Read back by FO)

At the completion of first lot registration:

FO to FDC: RECORD AS TIME, REG PT 2, OVER.

FDC to FO: OBSERVE SECOND LOT REGISTRATION.

f. Abbreviated registrations.

(1) There may be occasions when the tactical situation or ammunition constraints prohibit conducting a full scale precision registration. Although not as accurate, an abbreviated precision registration can provide adequate compensation for the effects of nonstandard conditions. The decision to conduct an abbreviated registration rests with the fire direction officer. For this type registration, the observer merely shortens the standard procedures. He may:

(a) Obtain only one round OVER and SHORT instead of two.

(b) Establish a 50-meter bracket, then send refinement data that will move the last round to the registration point.

(c) Use any other abbreviated technique.

THE ABBREVIATED REGISTRATION TECHNIQUE USED MUST BE COORDINATED WITH THE FDO, AS IT WILL AFFECT ACCURACY!

(2) If a time registration has also been requested, the observer announces TIME REPEAT instead of END OF MISSION. Once an airburst has been observed, he may use one or two more rounds to establish a mean height of burst. He then sends his refinement as usual.

5-11. Destruction Missions

A destruction mission is simply a continuation of an impact registration. Once the observer has made his refinement for the impact portion, he continues to fire additional rounds. After every third round, an additional refinement is made and firing is continued until the target is destroyed or the mission is stopped for some operational reason. Corrections may be made after every round if desired.

Example (fig 5-20).

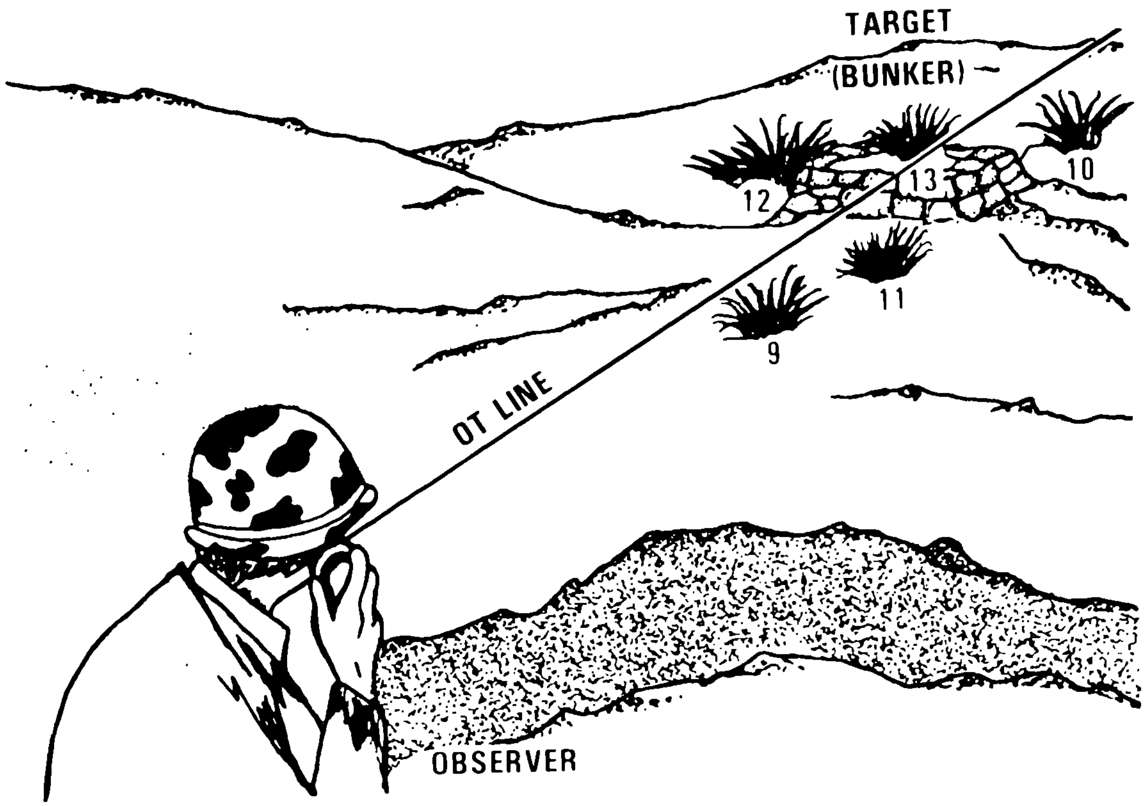
The FO makes his refinement. OT FACTOR = 2.

Section IV. HELPFUL NOTES FOR THE OBSERVER

1. Initial rounds can frequently be located more quickly with the naked eye than with fieldglasses.

2. For observers who wear glasses, the protective plastic lens cap on the binoculars can be removed to increase the field of vision. Masking tape can be used on the metal retaining ring to prevent scratching the glasses.

3. The doppler adjustment ring can be taped in the correct position so that the observer does not have to adjust the doppler setting every time he uses his binoculars.



ROUND	SPOTTING	CORRECTION
		ADD 10[1]
9	– 4R	REPEAT
10	+ 5R	REPEAT
11	– 4R	LEFT 10[2]
12	RC 1L	REPEAT
13	TGT	EM BUNKER DESTROYED[3]

[1] TARGET WAS MIDWAY BETWEEN THE 4 SPOTTING ROUNDS

[2] PREPONDERANCE WAS $\frac{4R+5R+4R}{3} = \frac{13R}{3} = 4.3R \approx 4$ Rx2 (OT FACTOR)=8M R≈(CORRECTION) L 10M

[3] MISSION ENDED SINCE TARGET WAS DESTROYED.

Figure 5-20. Destruction mission.

4. For adjust fire missions, angular deviations measured with the binoculars are measured to the nearest 5 mils.

5. The observer should memorize the width (in mils) of his fingers and hand so that, when shifts of 100 mils or more are required, he can use his hand instead of binoculars for determining shifts to place fire in the vicinity of the adjusting point as quickly as possible.

6. The OT factor must be applied to obtain corrections for HOB as well as for deviation.

7. A good terrain sketch provides an observer a means for conducting a good terrain-map association.

8. An observer can use the direction and flash-to-bang time of an impact burst to determine its grid location.

9. The observer must take appropriate immediate action if communication is not working properly.

10. The importance of surprise fire (fire for effect) cannot be overemphasized. The enemy will change posture (dig in, or move) if he knows that he is being fired upon.

11. The observer must take the initiative if delays occur.

12. A sketch can aid in determining usable rounds on a precision registration.

CHAPTER 6

SPECIAL SITUATIONS

Section I. ICM

6-1. Characteristics

Improved conventional munitions (ICM) are base ejection projectiles. The projectiles are fired with a time fuze and are filled with a number of submunitions. The submunitions, grenades, are ejected through the base of the projectile and scattered in the target area. There are two types of ICM rounds: the antipersonnel (AP) round and the dual purpose (DP) round.

a. The AP round is most effective against unwarned, exposed personnel. When the fuze functions, a black powder expelling charge forces the grenades out through the base of the projectile. Small vanes on the grenade flip upward, arming the grenade and stabilizing it in flight. When the striker plate (on the base of the grenade) contacts the ground, the steel ball is hurled upward 5 to 6 feet in the air and detonates.

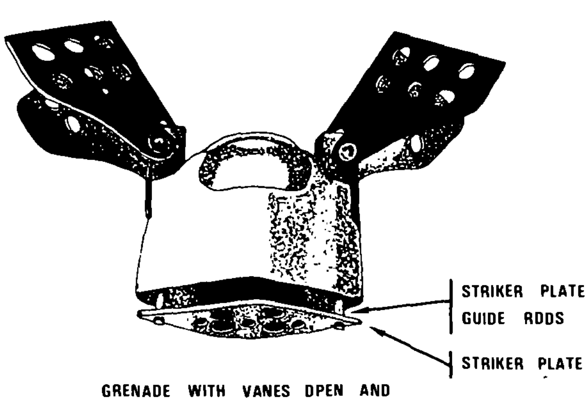


Figure 6-1. The antipersonnel (AP) round.

b. The DP round is most effective against lightly armored vehicles and other materiel; however, it is also effective against personnel. A ribbon streamer arms and stabilizes the grenade. Upon impact, a shaped charge capable of piercing light armor is detonated. Additionally, fragments are expelled.

c. The following table shows the number of grenades in the various ICM rounds.

6-2. Delivery Techniques

Improved conventional munitions (ICM) may be fired using three procedures

a. Transfer (FFE) using current corrections. Transfer using current corrections is most desirable because surprise and the best effects can be achieved with this technique.

b. Adjustment with HE firing ICM in effect. When current corrections are not available, the observer should adjust with HE onto a point near the target and then shift and fire for effect with ICM on the target.

c. Adjustment with ICM. The least preferable procedure is to adjust with ICM, because of the increased amount of ICM ammunition expended and the loss of surprise, which decreases the effectiveness of the ICM munition.

6-3. Call for Fire and Adjustment

The call for fire for ICM is the same as the

Table 6-1. Number of Grenades in Each ICM Round

WEAPON	PROJECTILE	NUMBER OF GRENADES
105mm	M444	18
155mm	M449 Family	60
8 inch	M404	104

ICM DUAL PURPOSE (DP)

WEAPON	PROJECTILE	NUMBER OF GRENADES
155mm	M483A1	88
8 inch	M509	195

regular call for fire. Procedures for adjustment of ICM are similar to the procedures used for a normal HE adjustment.

a. Range and deviation. Range and deviation are adjusted from the center of the effects pattern. Since ICM is most effective when delivered as surprise fires, the observer should make a bold shift from the center of the initial effects pattern and fire for effect. Due to the size of the effects pattern, deviation shifts of less than 50 meters and range corrections of less than 100 meters should not be made.

b. Height of burst (HOB). Height of burst is adjusted in increments of 50 meters. There are no specific rules for the amount an observer should correct the height of burst; this determination is made based on the observer's experience.

(1) If a large number of duds are observed or the effects pattern is too small, the observer should give an UP correction. The UP correction should not exceed 100 meters until the observer becomes familiar with the result of height of burst corrections.

(2) A height of burst that is too high is normally not critical.

NORMALLY ATTEMPTS TO ADJUST THE HOB SHOULD NOT BE MADE

c. Danger close. When adjusting close-in fires with ICM, the observer must start the adjustment at least 600 meters from friendly troops, depending on the relative locations of weapons, target, and friendly troops. Special consideration must be given to the direction and speed of the wind in the target area. The adjustment should be made with the entire battery and corrections should be made from the near edge of the effects pattern.

6-4. Sample Missions

a. Fire for effect with ICM.

P51, THIS IS P87, FIRE FOR EFFECT, OVER.

GRID 372461, OVER.

PLATOON ASSEMBLY AREA, ICM, OVER.

b. HE adjustment, ICM in effect.

P51, THIS IS P87, ADJUST FIRE, OVER.

GRID 933876, OVER.

INFANTRY COMPANY HALTED, ICM IN EFFECT, OVER.

c. ICM adjustment, ICM in effect.

P51, THIS IS P87, ADJUST FIRE, OVER.

GRID 361290, OVER.

COMPANY ASSEMBLY AREA, ICM, OVER.

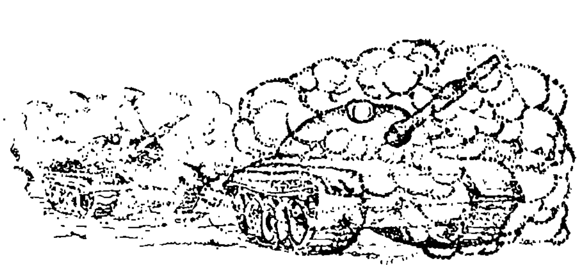
Section III. SMOKE

6-10. Characteristics

Smoke generally is not equated to combat power because it is not lethal. Nevertheless, when used correctly, it can significantly reduce the enemy's effectiveness both in the daytime and at night. Smoke, combined with other suppressive fires, will provide increased opportunities for maneuver forces to deploy and aircraft to attack frontline targets, thus enhancing the chances of mission accomplishment without catastrophic losses. Smoke attenuates laser beams and inhibits the use of optically-guided missiles, such as the SAGGER. Smoke may be used to reduce the ability of the enemy to deliver effective fires, to hamper hostile operations, and to deny the enemy information on friendly positions and maneuver. The effective delivery of smoke by the field artillery at the critical time and place will help the combined arms team accomplish its mission (see table 6-3). Smoke is used to obscure or screen.

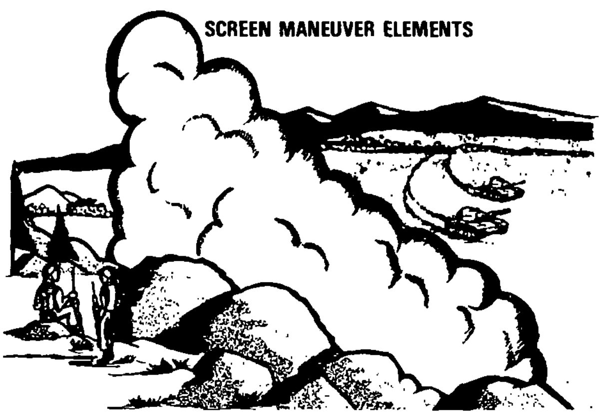
OBSCURING SMOKE—EMPLOYMENT AND EFFECT OF A SMOKE SCREEN PLACED DIRECTLY ON OR NEAR THE ENEMY WITH THE PRIMARY PURPOSE OF SUPPRESSING OBSERVERS AND MINIMIZING HIS VISION.

OBSCURE ENEMY VISION



SCREENING SMOKE—A SMOKE CURTAIN EMPLOYED ON THE BATTLEFIELD BETWEEN ENEMY OBSERVATION POINTS AND FRIENDLY UNITS TO MASK MANEUVERS OR TO DECEIVE AND CONFUSE THE ENEMY AS TO THE NATURE OF FRIENDLY OPERATIONS.

SCREEN MANEUVER ELEMENTS



Do not neglect the use of smoke at night. Enemy direct fire weapons, such as the SAGGER, are equipped with night vision devices. Darkness can bring on a FALSE sense of security which can be fatal to the maneuver elements.

WHETHER USED IN OFFENSIVE OR DEFENSIVE OPERATIONS, SMOKE CAN MINIMIZE VULNERABILITY AND MAXIMIZE EFFECTIVENESS.

a. Obscuring smoke is used to—

(1) Defeat flash ranging; restrict the enemy's counterfire program.

(2) Obscure artillery OPs; reduce the accuracy of enemy observed fires.

(3) Obscure enemy direct fire weapons, including wire-guided missiles, to reduce their effectiveness up to 90 percent.

(4) Obscure enemy lasers to reduce their effectiveness.

Table 6-3. Field Artillery Smoke Capabilities and Effects.

Delivery System	Type Round	Nomenclature	Fuze	Time to Build Effective Smoke	Average Burning Time	Average Obscuration Length (Meters) Per Round — Wind Direction: Cross	Average Obscuration Length (Meters) Per Round — Wind Direction: Head/Tail
155mm	WP	M110A2	M557	½min	1-1½ min	100	50
	HC	M116B1	M501A1	1-1½ min	4 min	350	75
105mm	WP	M60A1	M557	½ min	1-1½ min	75	50
	HC	M84B1	M501A1	1-1½ min	3 min	250	50

(5) Instill apprehension; increase enemy patrolling.

(6) Slow enemy vehicles to blackout speeds.

(7) Increase command and control problems; prevent effective visual signals and increase radio traffic.

(8) Defeat night observation devices and reduce the capability of most IR devices.

b. Screening smoke is used for—

(1) Unit maneuvers. Smoke draws fire. Deceptive screens cause the enemy to disperse his fires and expend his ammunition.

(2) Flank screening. Smoke may be used to screen exposed flanks.

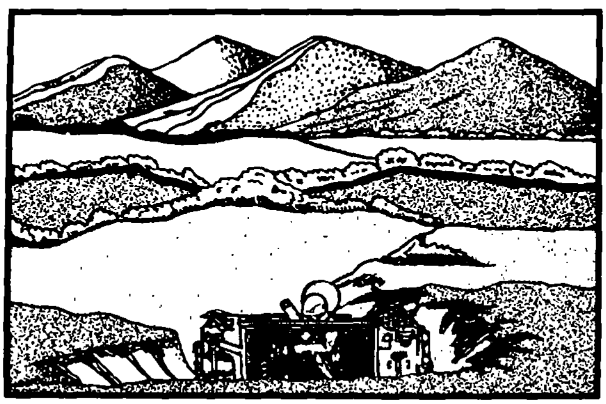
(3) Areas forward of the objective. Smoke assists the maneuver units in consolidating on the objective unhindered by enemy ground observers.

(4) River-crossing operations. Screening the primary crossing site denies the enemy information, and deceptive screens deceive the enemy as to the exact location of the main crossing.

c. Non-field-artillery smoke ammunition and delivery means.

(1) Mortars. Mortars can provide good initial smoke coverage with WP ammunition because of their high rates of fire. Mortar smoke information is shown in table 6-4.

(2) Tanks. Tanks firing from overwatch positions can suppress antitank guided



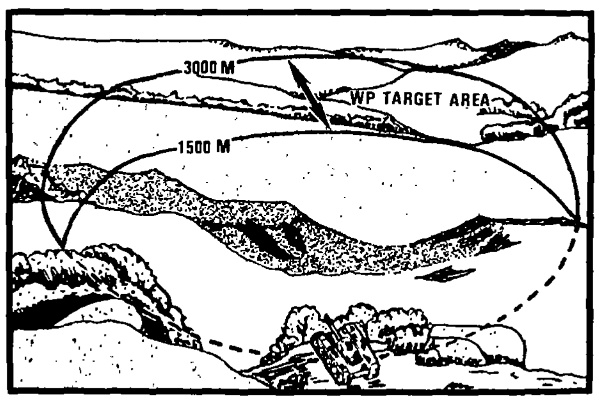


Table 6-4. Mortar Smoke Information.

Mortar Delivery System	Number/Bn	Sustained Rate of Fire	Type Round	Time to Build Effective Smoke	Average Burning Time	Average Obscuration Length (M) Per Round — Wind Direction: Cross	Average Obscuration Length (M) Per Round — Wind Direction: Head/Tail
4.2-inch ★	4	3 Rds/min	WP	1/2 min	1 min	100	40
81mm	9	8 Rds/min	WP	1/2 min	1 min	200	40

★ The 4.2-inch mortar is a better smoker than the 105mm howitzer firing WP.

Table 6-5. Field Artillery Smoke Delivery Techniques.

DELIVERY TECHNIQUE	TYPE OF TGT	NO OF GUNS	TYPE OF AMMO	SHEAF	OBSCURATION TIME	COMMAND AND CONTROL
IMMEDIATE SMOKE * (POINT/ SUPPRESSION)	POINT OR SMALL AREA 150M OR LESS	1 PLT ** (2 GUNS)	1ST RD'S WP-HC 20 RD'S HC	PARRALLEL OR TERRAIN GUN POSITION CORRECTIONS	1/2-5 MIN	BY SOP AND/OR APPROVAL OF MANEUVER COMPANY COMMANDER
QUICK SMOKE (SMALL AREA/ SUPPRESSION)	SMALL AREA 150 TO 600M ***	1-2-3 PLT **	HC OR WP	PARALLEL OR TERRAIN GUN POSITION CORRECTIONS	4-15 MIN	APPROVAL OF MANEUVER BATTALION COMMANDER

* THE IMMEDIATE SMOKE TECHNIQUE CAN BE USED IN AN IMMEDIATE SUPPRESSION MISSION ON A TARGET OF OPPORTUNITY; BY UNIT SOP, A MIX OF WP AND HC NORMALLY WILL FOLLOW THE INITIAL SUPPRESSION ROUNDS WHEN IMMEDIATE SMOKE IS REQUESTED

** RESPONSIVENESS DICTATES THAT BOTH IMMEDIATE AND QUICK SMOKE MISSIONS BE FIRED BY PLATOON

*** FOR LARGER AREAS, CONSIDER MULTIPLE AIMPOINTS USING THE QUICK SMOKE TECHNIQUE

missile gunners at 1500-3000 meters with WP ammunition. The basic load for tanks in Europe includes some WP ammunition.

6-11. Delivery Techniques

Using different amounts of smoke on the battlefield against targets of various sizes requires different gunnery techniques. The use of the two delivery techniques outlined below does not preclude the use of smoke on other occasions or for different objectives. The objective of the two prescribed techniques is to obscure the enemy's vision or screen the maneuver element. The two delivery techniques are outlined in table 6-5 and are discussed in detail in paragraphs 6-13 and 6-14.

6-12. Employment Considerations (Fig 6-6)

a. Weather. The observer is the normal source of wind component data for the target area; he determines the data (headwind, tailwind, or crosswind) based on what he sees and feels. Atmospheric stability, wind direction, and windspeed are the major factors influencing the effectiveness of smoke.

(1) Atmospheric stability. The weather conditions, the time of day, and the windspeed all affect atmospheric stability. Although determined by the FDC, the observer must be aware of the effect of the three temperature gradients that are discussed in FM 6-40, chapter 10.

(2) Wind direction and speed (table 6-6). The movement of smoke depends on the speed and direction of the wind. Windspeeds ranging from 4 to 14 knots are best for the production of smoke screens. Optimum speeds vary with the type of smoke used. Wind direction influences the desired location of smoke in the target area. To determine an approximate windspeed, the observer can use either the equivalent wind scale table below or the grass drop (expedient) method. With the grass drop (expedient method), extend arm downwind and drop grass from hand. Point extended arm at dropped grass on ground. Divide the angle in degrees between the arm and the body by 4 to determine the approximate wind velocity in knots. To determine wind direction in target area, observe drifting of smoke or dust, bending of grass or trees, and ripples on water. Determine the wind direction in relation to the maneuver-target line for obscuration. Only the wind direction in terms of crosswind or tailwind/headwind need be determined.

(3) Temperature. A rise in temperature may increase the rate of evaporation, causing the smokescreen to dissipate more rapidly.

(4) Humidity and precipitation. Humidity and precipitation may enhance the effectiveness of smoke.

b. Ammunition. The amount of smoke ammunition in basic loads is limited. Expenditures of smoke ammunition vary considerably with each specific mission. All users must know the amount of ammunition

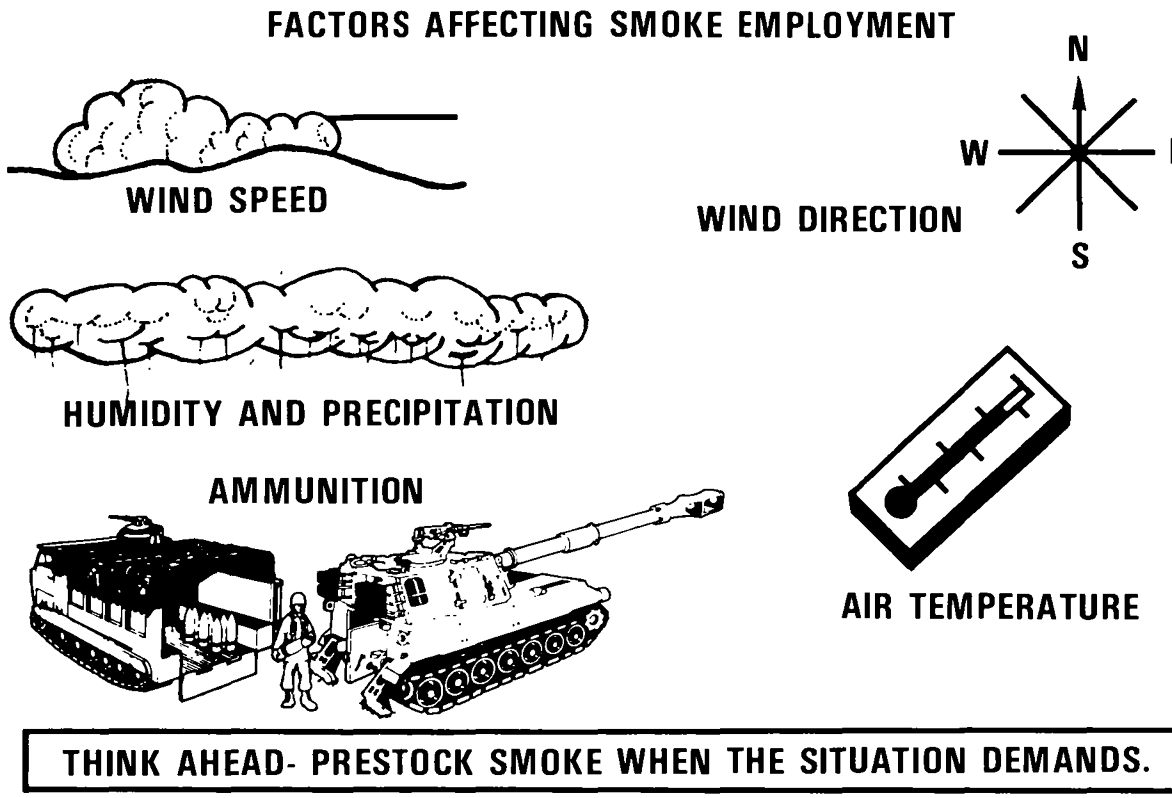


Figure 6-6. Weather factors which affect smoke employment.

available and how much smoke it will provide. Large requirements for smoke may require redistribution of the basic loads of several units or issue of additional smoke ammunition for a specific operation. Combat experience has shown that smoke ammunition will not be available to support all smoke requests.

c. Available means. Prior to firing a smoke mission, the observer, FDO, and FSO must consider the means available. The FIST chief recommends to the maneuver commander whether mortars or artillery should fire. The FDO decides which weapons will fire or whether to have a reinforcing unit, if available, support the mission. The FSO provides tactical information that could affect the fire support available. All assets are limited and for each mission the decision must be made: WHO CAN BEST FULFILL THE REQUIREMENTS?

Table 6-6. Equivalent Wind Scale.

KNOTS	OBSERVATION
1	SMOKE, VAPOR FROM BREATH, OR DUST RAISED BY VEHICLES OR PERSONNEL RISES VERTICALLY/NO LEAF MOVEMENT
1-3	DIRECTION OF WIND SLIGHTLY SHOWN BY SMOKE, VAPOR FROM BREATH OR DUST RAISED BY VEHICLES OR PERSONNEL SLIGHT INTERMITTENT MOVEMENT OF LEAVES
4-6	WIND SLIGHTLY FELT ON FACE/LEAVES RUSTLE
7-10	LEAVES AND SMALL TWIGS IN CONSTANT MOTION
11-16	WIND RAISES DUST FROM GROUND/LOOSE PAPER AND SMALL BRANCHES MOVE
17-21	SMALL TEEES WITH LEAVES SWAY/COASTAL WAVELETS FORM ON INLAND WATERS
22-27	LARGE BRANCHES ON TREES IN MOTION/WHISTLE HEARD IN TELEPHONE OR FENCE WIRES
28-33	WHOLE TREES IN MOTION/INCONVENIENCE FELT WALKING AGAINST WIND

d. Terrain. The terrain affects the employment of smoke. The following rules should be applied.

(1) Smoke tanks in defile; they lose their sense of direction.

(2) Remember that smoke seeks low spots.

(3) Remember that firing smoke on dry vegetation may start fires.

(4) Do not fire smoke on deep mud, water, or snow; the smoke round normally will not function properly.

(5) Do not fire HC smoke on steep slopes; canisters roll downhill.

e. Enemy. Know and anticipate the enemy.

(1) Fire smoke on enemy artillery OPs/gunners to greatly reduce the effectiveness of his artillery.

(2) Fire smoke and HE on the enemy when he deploys from column to line formation. The HE will keep him buttoned up. The smoke will cause maximum confusion.

(3) Fire smoke and HE on minefields to cause maximum confusion.

(4) Understand the effects of smoke on effectiveness. Smoke used without sufficient thought and planning will reduce the user's effectiveness more than that of the enemy.

f. Command and control. The maneuver commander for whom the smoke is planned must approve its employment. When he issues his plans and concepts for an operation, he should state the guidelines on the amount of smoke that can be used, along with any restriction on its use. To insure that smoke is responsive, the FIST chief, FSO, and/or FSCOORD must request this smoke planning guidance if it has not been stated. The maneuver commander responsible for the operation must coordinate smoke operations with all units participating in or potentially affected by the operation. The operation officer (S3/G3) is responsible for the integration of smoke into the plan of maneuver. The FSO/FSCOORD must keep the maneuver commander advised on the availability of munitions and delivery systems. Combat arms troops must be well trained in smoke operations and comprehensive SOPs must be available and known to all. This will shorten reaction time.

6-13. Immediate Smoke (Fig 6-7)

a. Description. The objective of immediate smoke is to obscure the enemy's vision. Suppression of a small location can be achieved by use of immediate smoke to reduce the enemy's ability to observe. Immediate smoke can be planned, as other planned suppressive fires, or can be used after immediate suppressive fire has been found to be ineffective. When immediate smoke is planned, the immediate smoke target will be sent to the FDC as part of the target list. Weather conditions must be considered in planning immediate smoke, since a change in wind direction could make the planned smoke ineffective. If immediate suppressive fire is ineffective because of inaccurate target location, the observer has the option of giving a bold shift and requesting that the smoke be fired.

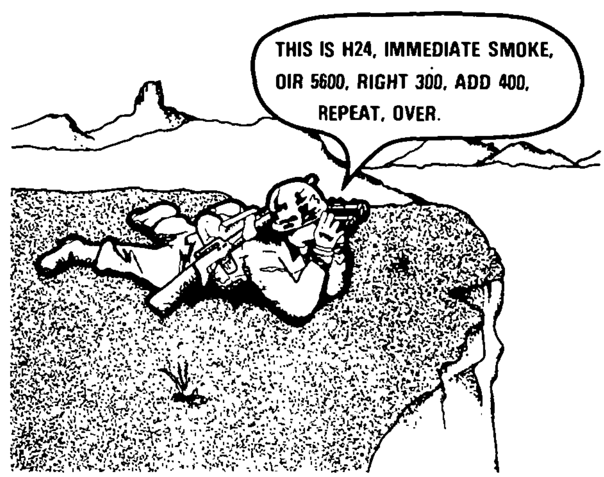
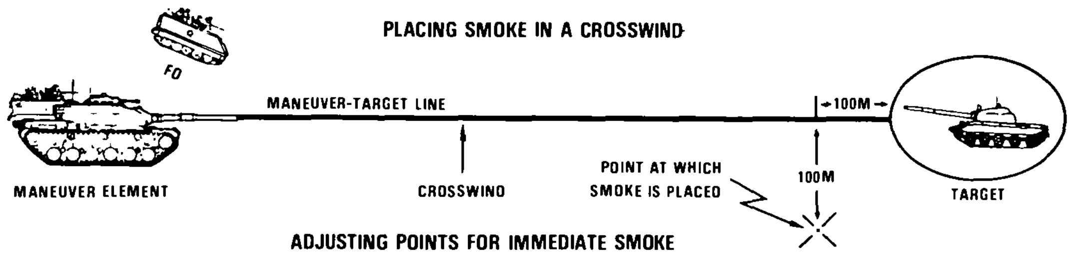


Figure 6-7. Immediate smoke.

b. Employment considerations.

(1) Immediate smoke should not be requested initially if HE is in the loading tray by SOP. Rather than change the ammunition, the observer should request a fire mission that will expend the SOP suppression rounds (use them as adjusting rounds) and then call for immediate smoke. Before firing immediate smoke, the observer



ADJUSTING POINTS FOR IMMEDIATE SMOKE

DELIVERY TECHNIQUE	WIND DIRECTION			ADJUSTING POINT WITH RESPECT TO
	CROSS	HEAD	TAIL	
IMMEDIATE (WP & HC) POINT/SUPPRESSION	100S-100UW	100S	200S	POINT TO OBSCURE ON MT LINE

S-SHORT UW-UPWIND 105MM AND 155MM HOWITZER

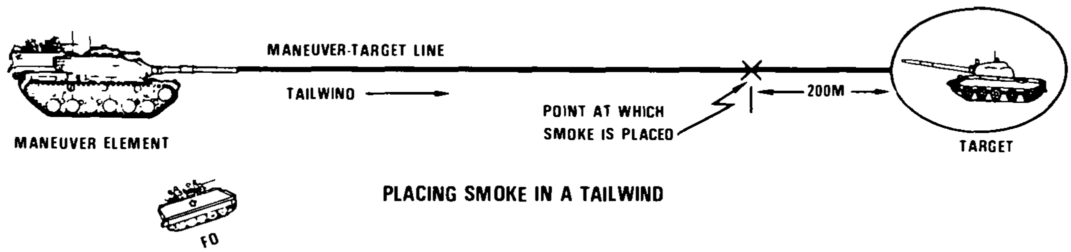


Figure 6-8. Placement of smoke.

must realize that suppression by smoke will not be as immediate as suppression by HE since it takes time for the smoke to build up, but inaccurately placed smoke may still provide obscuration, whereas inaccurately placed HE may not give the desired results. Although immediate smoke will provide suppression (by obscuration) for a longer period of time than will HE, it is effective only against a pinpoint target or small area target less than 150 meters in diameter.

(2) The type of ammunition to be fired should be dictated by SOP. A suggested mix is one platoon (two guns) with one gun firing WP (for quick buildup) and with the other gun firing HC on the first volley, followed by both guns firing HC on subsequent volleys.

(3) Since immediate smoke normally is used on a planned suppressive target or when shifting after immediate suppression with HE has been found to be ineffective because of positioning, corrections for deviation, range, and height of burst must be made. The minimum correction for deviation should be 50 meters and for range should be 100 meters. The height of burst can be adjusted as follows:

Ground burst: UP 100.

Canisters bouncing excessively: UP 50.

Canisters too spread out: DOWN 50.

(4) When a mixture of HC and WP is fired, it can be expected that the smoke will be effective 30 seconds after the shells land and that it will last approximately 4-5 minutes. If the smoke is required for a longer period of time, additional volleys of HC should be requested.

(5) The point at which the smoke is placed depends on weather conditions (fig 6-8). Under normal circumstances, the point at which it is directed should be approximately 100 meters short on the maneuver-target line and 100 meters upwind of the enemy location. If the wind is a crosswind (blowing across maneuver-target line), the smoke is placed upwind so that it obscures the enemy's vision along the maneuver-target line. If the wind is a headwind (blowing away from the target), the smoke is placed 100 meters short on the maneuver-target line.

CARE MUST BE USED WITH HEADWINDS, SINCE THE SMOKE MAY BE BLOWN ONTO THE MANEUVER ELEMENT.

When the wind is a tailwind (blowing toward the target), the smoke is placed at least 200 meters short of the target to preclude the smoke from landing beyond the target.

6-14. Quick Smoke

a. Description. The objective of quick smoke is to obscure the enemy's vision or screen maneuver elements. The quick smoke mission equates to the normal HE adjust fire mission: obscuring the enemy is required, but the urgency of the situation does not dictate immediate smoke procedures. The mission is begun by adjusting with HE, shifting to smoke when near the adjusting point, then firing for effect with smoke.

b. Employment considerations.

(1) The quick smoke mission is used to obscure an area up to 600 meters in width. For areas larger than 600 meters, the observer can fire multiple quick smoke missions. HC smoke may be effective up to 1500 meters downwind.

(2) When preparing a quick smoke mission, the observer first determines the nature of the target and the location of the adjusting point, determines the size of the area, and then determines the wind direction in relation to the maneuver-target line (fig 6-9).

(3) To select the HE adjusting point, the observer needs to determine the wind direction and whether WP or HC is to be fired in effect.

(4) If the smoke is required for an extended period of time (more than 2 minutes for WP and 5 minutes for HC), the FDC must be informed of the target length, the wind direction, and the length of time the smoke is required. This information is sent to the FDC as early as possible (prior to commanding FIRE FOR EFFECT). The observer also has the option of extending the time of effective smoke by requesting subsequent volleys.

(5) If the smoke must be effective beginning at a specific time, the observer requests AT MY COMMAND and the time of flight. To determine when to order the smoke fired, the observer adds the time of flight to the average buildup time of 30 seconds for WP and 60 seconds for HC.

(6) If the smoke is ineffective, the observer must decide whether to shift the smoke or fire HE. If the decision is to shift, there may be a break in the screen while new data is being computed.

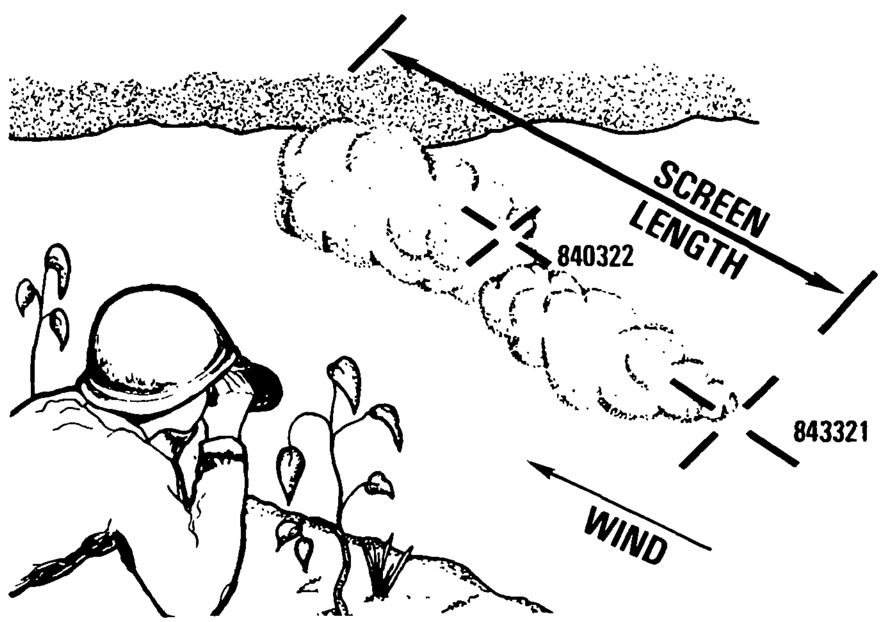


Figure 6-9. Screen emplacement.

6-15. Sample Missions

a. Immediate smoke as a continuation of an immediate suppression mission:

THIS IS H24, IMMEDIATE SMOKE, DIRECTION* 5600, RIGHT 200, ADD 400, REPEAT, OVER.

*If direction is not sent previously in IS mission.

b. Immediate smoke as the initial CFF:

THIS IS H24, IMMEDIATE SMOKE, GRID 628543, OVER.

c. *Smoke (HC) with duration 5 minutes or less:*

THIS IS H24, AF, SHIFT, REG POINT 1, OVER.

DIRECTION 2400, RIGHT 100, ADD 200, OVER.

SUSPECTED PLATOON LOCATION, SMOKE IN EFFECT, OVER.

d. Smoke greater than 5 minutes duration:

THIS IS H24, AF, OVER.

GRID 432895, OVER.

SCREEN TREELINE, 200 METERS, CROSSWIND, DURATION 8 MINUTES, SMOKE IN EFFECT, OVER.

e. Smoke, multiple aiming points: Observer fires a quick smoke mission, observes effects, and announces to FDC:

SECOND AIMING POINT, RIGHT 500, DROP 200, REPEAT, OVER*.

*Had the observer simply desired to move the quick smoke to another point, he would have made a normal subsequent correction and said:

RIGHT 500, DROP 200, REPEAT, OVER.

SECOND AIMING POINT (or a local SOP term) informs the FDC that the observer desires to fire on a second point at this time and that the battery should be prepared to replenish smoke on either point. By observing how long the smoke remains effective near either aiming point, the observer can determine a time interval at which to replenish his smoke should he desire to do so.

INTERVAL = EFFECTIVE SCREEN TIME - BUILDUP TIME

He can pass this information to the FDC by saying:

CONTINUE SMOKE AT 3-MINUTE INTERVALS FOR 15 MINUTES, OVER.

f. Smoke: Observer calls for multiple aiming points at the beginning of the mission:

H18, THIS IS H24, FIRE FOR EFFECT, OVER.

GRID 843321 AND GRID 840322, OVER.

TRENCH LINE, 800 METERS, CROSSWIND DURATION 12 MINUTES, SMOKE, OVER.

Section IV. SPECIAL OBSERVER MISSIONS

6-16. Air Observer Missions

Because of the helicopter's speed, range, and ability to bypass obstacles, the aerial observer (AO) has the ability to provide observation for indirect fire at extended distances from ground units.

a. If possible, the AO and the pilot should be given a detailed preflight briefing by the battalion FSO and the battalion S3/S2. The preflight briefing should cover the following points:

(1) The location of battery position areas, registration points, targets, reference lines used in making corrections (if the GT line is not used), suspected targets, and areas to be searched.

(2) The tactical situation, to include coordinating measures, frontlines, and zones of action of the support troops.

e. Target location is indicated by grid or shift from a known point. The announced direction of the shift is with respect to the spotting line. If any spotting line other than the gun-target line (GT) is used, it must be identified (e.g., FROM TGT 123, SPOTTING LINE NORTH-SOUTH HIGHWAY, RIGHT 440, ADD 800).

f. When adjusting fire, the AO will probably use one of two techniques: stationary hover or popup.

(1) Stationary hover. The pilot positions the aircraft behind trees or other vegetation that provides concealment for the aircraft and still permits observation of the target.

(2) Popup. The pilot will "unmask" the aircraft 2 to 3 seconds prior to the impact of the round. The AO will observe the burst and the pilot will then return the aircraft to the hide position or move to another hide position. The observer sends his corrections as the pilot is "remasking" the aircraft. Use of the time of flight may become necessary. This allows the pilot to position the aircraft properly if "splash" time is not sufficient. Set patterns of movement should be avoided to enhance survivability.

g. Sample calls for fire are discussed below.

(1) An example of a call for fire in which the air observer uses grid coordinates as the means of locating the target follows:

H18, THIS IS H90, ADJUST FIRE, OVER.

GRID 421791, OVER.

INFANTRY PLATOON AND 10 TRUCKS IN THE OPEN, ICM IN EFFECT, OVER.

When adjusting rounds on a grid fire mission, the spotting line must be identified prior to subsequent corrections, or the FDC will plot the corrections along the gun-target line.

(2) An example of an air observer's initial call for fire in which the target location is based on a shift from a known point and the gun-target line is used as the spotting line follows:

H18, THIS IS H90, ADJUST FIRE, SHIFT, REGISTRATION POINT 1, OVER.

RIGHT 400, ADD 800, OVER.

INFANTRY PLATOON AND 10 TRUCKS IN THE OPEN, ICM IN EFFECT, OVER.

No reference is made to the line to be used as the reference line. When the spotting line is not identified in the call for fire for a shift mission, the fire direction center uses the gun-target line.

(3) An example of an air observer's call for fire in which the target location is based on a shift from a known point and a line of known direction is used as the spotting line follows:

H18, THIS IS H90, ADJUST FIRE, SHIFT, 806, OVER.

REFERENCE LINE WESTERLY RAILROAD, RIGHT 400, DROP 800, OVER.

INFANTRY PLATOON AND 10 TRUCKS IN THE OPEN, ICM IN EFFECT, OVER.

When a spotting line other than the GT line is to be used, the spotting line must be identified in the air observer's call for fire.

(4) An example of an air observer's call for fire in which the target location is indicated by cardinal direction follows:

H18, THIS IS H90, ADJUST FIRE, SHIFT REGISTRATION POINT 1, OVER.

400 METERS NORTHEAST, OVER.

4 TRUCKS STALLED AT FORD, OVER.

(5) An example of an air observer's call for fire in which he requests ranging rounds follows:

H18, THIS IS H90, ADJUST FIRE, SHIFT, ROAD JUNCTION 1630, OVER.

DIRECTION 1200, RIGHT 800, DROP 1600, OVER.

TANK RETRIEVER AND STALLED TANK, RANGING ROUNDS, OVER.

Subsequent correction is made from either near or far round (in relation to guns).

6-17. High Angle Fire (Fig 6-13)

Fire delivered at elevations greater than the elevation for maximum range is called high angle fire. High angle fire is often required when the weapons fire out of deep defilade, from within built-up areas, or over high terrain features near friendly troops. High angle fire may also be required when the targets are located directly behind hill crests, in jungles, or in deep gullies or ravines and cannot be reached by low angle fire.

Generally, those weapons with a maximum elevation substantially in excess of 800 mils have the capability to fire high angle. All US artillery weapons are capable of high angle fire. The observer procedure for the adjustment of high angle fire is the same as that for the adjustment of low angle fire. The observer must realize that small deviation corrections during adjustment may be unnecessary and time consuming because of the increased dispersion experienced during high angle fire. Since the time of flight is long in both adjustment and fire for effect, the FDC will announce SHOT when the round(s) is fired and will announce SPLASH 5 seconds before the burst(s) occurs.

6-18. Final Protective Fires (FPF)

a. FPF are a prearranged barrier of fire designed to protect friendly troops. Basically it is an entire battery or mortar section firing so that the rounds are arranged on line. The size of the FPF depends on the type of weapon.

Weapon	Size of FPF
81-mm mortar	100 meters
107-mm mortar	200 meters
105-mm howitzer	180 meters
155-mm howitzer	300 meters

Note. Individual 81-mm mortars may be assigned an FPF (34 meters × 50 meters). Two 107-mm mortars may be assigned an FPF (100 meters × 50 meters).

b. The location of the FPF is normally designated by the maneuver commander for which it is being planned. It may be any distance from the friendly position, but is normally within 200-400 meters (danger close). The importance of accurate defensive fires, and the danger close situation require that each weapon firing the FPF be adjusted into place.

c. The call for fire is similar to the normal call for fire in an adjust fire mission with some exceptions.

(1) The target location initially sent is not the location of the center of the FPF, but a grid a safe distance (400-600 meters) from friendly troops. Because this grid is part of a final defensive plan, it should be encoded. The altitude or direction of the long axis of the FPF is also announced.

(2) In place of a target description, the phrase "FINAL PROTECTIVE FIRES" is announced.

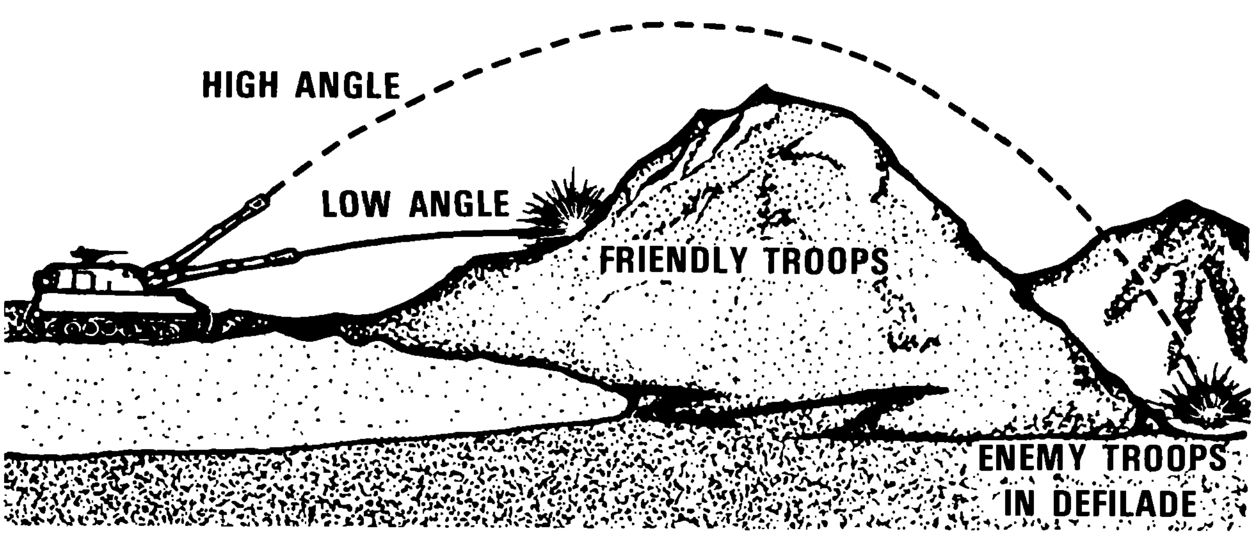


Figure 6-13. High angle fire.

The observer may call for a marking round(s) to be fired on a registration point, previously fired target, or a prominent terrain feature (e.g., MARK REGISTRATION POINT 1 or MARK HILL 37). As a last resort, the observer may call for a round(s) to be fired into the center of the target area (e.g., MARK CENTER OF SECTOR). The observer usually calls for a type of projectile that is easily identifiable, such as white phosphorus, or for a high airburst, or both. (The unit may have an SOP for SHELL/FUZE combination.) The FDC prepares data that will place the round at the point of impact or point of burst requested by the observer. If the observer fails to see the round, the FDC prepares data that will move the next round to a different point of impact or that will raise the burst higher in the air. This procedure is continued until the observer positively identifies the round. He then orders a shift from the point of impact (burst) of the identified round to a target or an object that is permanent or semipermanent in nature such as a road junction or the ruins of a building. Once this point has been located by adjustment of fire and has been plotted at the FDC, the observer may use it as a known point from which shifts can be made to subsequent targets.

6-24. Irregularly Shaped Targets

When calling for fire on an irregularly shaped target, the observer must locate the target in sufficient detail to allow the FDO to make a decision as to the best method of attack.

a. The observer can send a grid, size, and attitude of the target. The grid sent by the observer is the grid location of the center of the target. The target attitude is best described as a clockwise angle in mils measured from grid north to a line passing through the long axis of the target (fig 6-19).

E22, FFE, OVER.
GRID 847751, OVER.
INF PLT IN TRENCH LINE, SHEAF 50 × 200, ATTITUDE 2600, OVER.

b. The observer can send the target by sending two grids. The grids sent are the two

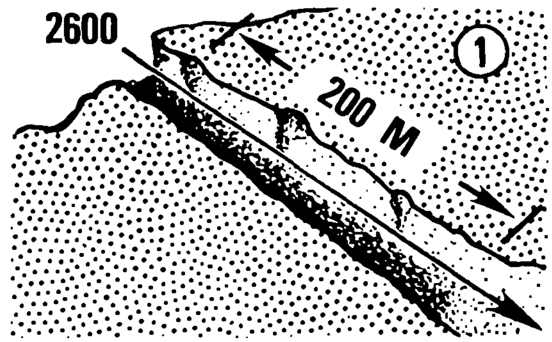


Figure 6-19. Target attitude.

end grids (fig 6-20).

E22, FFE, OVER.
GRIDS 168198 AND 171196, OVER.
3 BTR 60s HALTED IN TREELINE, OVER.

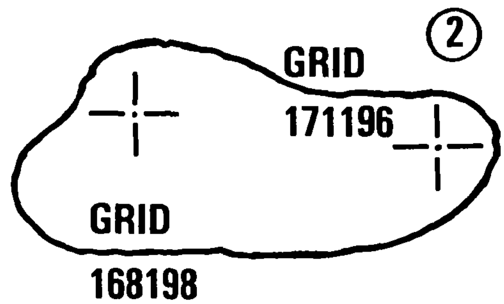


Figure 6-20. Target identified by two end grids.

c. If the target cannot be described by a straight line between two grids, the observer can send three grids. For example, if the target is in a treeline that is V shaped, the observer sends the grids of the two ends and the grid of the turning point (fig 6-21).

E22, FFE, OVER.
GRIDS 168197 AND 169198 AND 170197, OVER.
INF CO IN TREELINE, OVER.

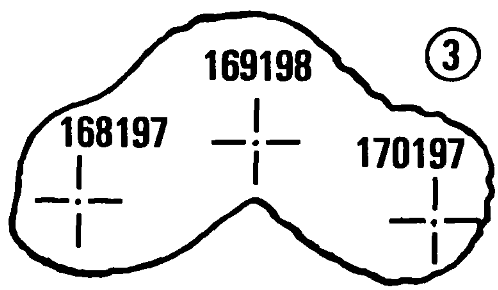


Figure 6-21. Target identified by three grids.

d. The target might best be described as a circle. The observer would send the grid of the circle center and the radius of the circular target (fig 6-22).

E22, FFE, OVER.
GRID 642377, OVER.
SAGGER MISSILE CLUSTER, RADIUS 150, OVER.

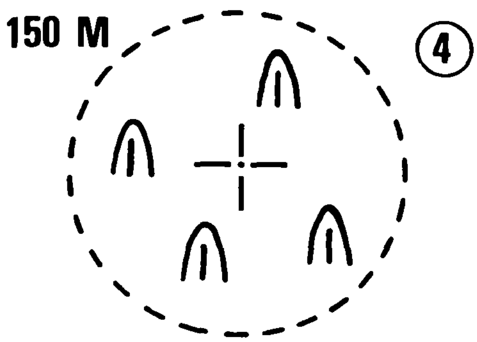


Figure 6-22. Circular target.

6-25. Emergency Observer Procedures (Fig 6-23)

a. In an emergency situation when no FDC is available, the observer may determine and send fire commands directly to the battery. Initial data are determined using the following steps:

(1) Estimate the range from the battery to the target.

(2) Determine the charge using the rule:

105-mm: Charge equals range in thousands plus 1 (Rg 5000; charge is 6)

155-mm: Charge equals range in thousands (Rg 5000; charge is 5)

8-inch: Charge equals range in thousands minus 1 (Rg 5000; charge is 4)

(3) Determine approximate deflection to target or fire common deflection.

(4) Fire quadrant 240 mils.

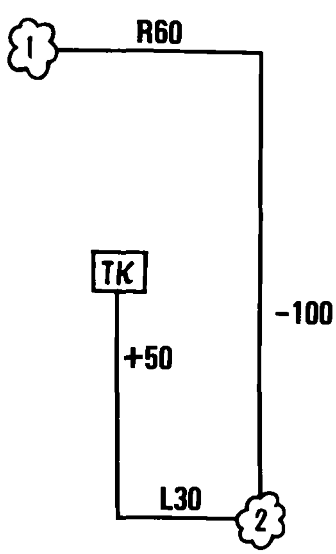
b. Subsequent corrections are done with respect to the gun-target line.

(1) Determine 100/R: 100/R equals 100 divided by the range in thousands to the nearest hundred. (Rg 4600: 100/R = 100/4.6≈22)

(2) Correction in deflection in mils equals the change in meters times 100/R.

(3) Determine the number of mils change to quadrant that will give a 100-meter range change (C factor) using the table below.

Weapon	C Factor
105-mm M101A1	13 minus charge
105-mm M102	12 minus charge
155-mm M114A1	12 minus charge
155-mm M109/M114A2/M109A1	11 minus charge
8-inch M110/M110A1	10 minus charge



Initial Data
Def 3200 (Common Deflection)
DE 240

100/R = 100 ÷ 4000/1000 = 100 ÷ 4 = 25
DEV CORR = CORR/100
C FACTOR FOR 155mm = 11-Charge = 7
DE Corr = Range Change/100 × C FACTOR

ROUND 2

Dev. Corr = R60
Df Corr = .6 × 25 = R15 mils = 3200 - 15 = 3185
Range Corr = -100
DE Corr = -100/100 × 7 = -7mils = 240 - 7 = 233

ROUND 3 (FFE Data)

Dev. Corr = 630
Df Corr = .3 × 25 = R7.5≅8mils = 3185 + 8 = 3193
RANGE Corr = +50
QE Corr = +50/100 × 7 = 3.5≅4 = 233 + 4 = 237

Figure 6-23. Emergency observer procedures.

(4) Change in quadrant is expressed in mils (range change in hundreds of meters times C factor).

(5) Determine fuze setting by estimation.

(6) Adjust height of burst arbitrarily.

c. This system is only valid for charges 3, 4, and 5 of all weapons systems.

6-26. AN/GVS-5 Laser Rangefinder (Fig 6-24)

a. The AN/GVS-5 is a lightweight, hand-held, laser rangefinder that can accurately determine the range to a target within 1 second after the FIRE button has been depressed. The device emits an invisible laser burst and detects its return when the burst is reflected from a distant object. The time lapse between emission of the beam and return is converted to meters and displayed in the eyepiece on the range to target display. The entire AN/GVS-5 package, including battery, weighs 5 pounds. When accurately aimed, the AN/GVS-5 will provide a range that is accurate to within plus or minus 10 meters of the target.

b. To use the AN/GVS-5, an observer simply aims the device by superimposing the circle at the center of the reticle pattern over the target and depresses the FIRE button. The range will be displayed in the range-to-target window and will remain there as long as the FIRE button is depressed. The observer should not automatically consider the displayed range to be the correct range to the target. On the contrary, clutter in front of or behind the target may, on occasion, produce false ranges. The observer must continually associate the displayed range with a terrain-map analysis and his own range estimate to decide whether or not the reading is accurate. When, in the observer's opinion, all of these figures do not correlate, he should consider the following:

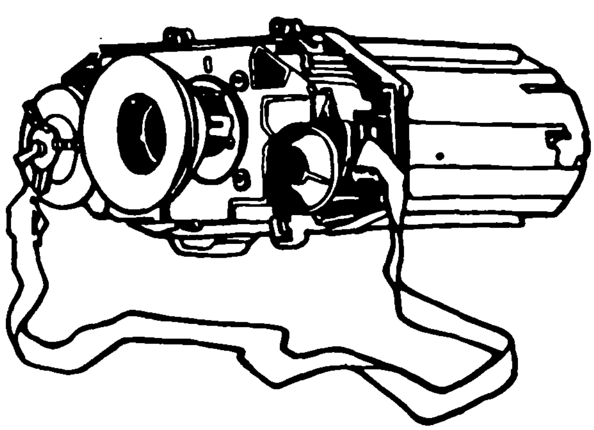


Figure 6-24. AN/GVS-5.

(1) Multiple firings. To insure that the observer is aiming at the correct target, he should take a series of readings on the same target. Three consistent readings generally indicate that the observer has aimed in the same place each time.

(2) Minimum range set. Although the emitted laser beam is relatively narrow, it is sufficiently wide to reflect from more than one target or object. The AN/GVS-5 is equipped with a "multiple target" warning light inside the eyepiece that illuminates when more than one return signal is received. When multiple target readings are indicated, the range displayed will be the range to the first object from which the beam is reflected. To prevent obtaining a false reading from an intermediate object between the observer and the target, the AN/GVS-5 is equipped with a minimum range set (MIN RG SET). Ranges to the nearest 10 meters and up to 5000 meters may be set on the MIN RG SET using the variable control. The range set indicates that range within the AN/GVS-5 will not register a return, thereby eliminating receiving false readings from intermediate objects once the MIN RG SET is properly established. The observer must continue a trial and error process of eliminating false ranges by adjusting the MIN RG SET until the range read in the display correlates with the observer's own range estimate based on map and terrain analysis. The observer can save time in this process by establishing on the MIN RG SET the maximum range beyond which he is certain the target lies before he begins ranging a target.

(3) Self-location. The AN/GVS-5 can aid the observer in locating himself by giving him accurate distances to two known points. The observer can report these distances to his fire direction center who will in turn, using graphical or computer means, provide him his location. Self-location may also be

obtained by providing the FDC distances to two burst locations of rounds that have been fired after the unit has completed registration. A combination of one round and one known point may also be used for self-location.

(4) Adjustment of fire. Lateral and vertical shifts in the adjustment of fire are computed using the mil relation in the same way as adjustment of fire using binoculars. Range adjustments are made by taking the difference in range between the target and the burst and making the correction in the appropriate direction.

(5) Target location. The distance provided by the AN/GVS-5 should always be used with the most accurate direction to the target available and a quick, but thorough, map analysis. The observer should remember that the AN/GVS-5 is designed to help the observer estimate distance. As such, the distances determined by the device should always be correlated with known information before a target location is produced.

Section V. SEARCHLIGHT MISSIONS

6-27. Searchlight Characteristics

There are very few searchlight units in use today; however, searchlights can provide good direct and indirect light. The primary use of searchlights by the observer is for illumination surveillance of artillery fire from air or ground observation posts. Searchlights are also used to guide friendly elements, mark coordinating lines, mark targets for close air support mission, and illuminate objectives in an attack (FM 6-115). Direct or indirect illumination may be used (see para 6-28*a*(5)(a)). The number of lights used in any mission will depend on the number available and the situation at that particular time. Normally, when direct illumination is used, a single light will suffice.

6-28. Searchlight Call for Fire

a. Elements of the illumination request are the same as a regular call for fire.

(1) Identification of observer. Identification of the observer in an illumination request is the same as that in a call for fire.

(2) Warning order. The warning for a searchlight mission is ILLUMINATION MISSION. Since this term is used only for a searchlight mission, it alerts all personnel involved to pass the mission to the searchlight light direct center (LDC).

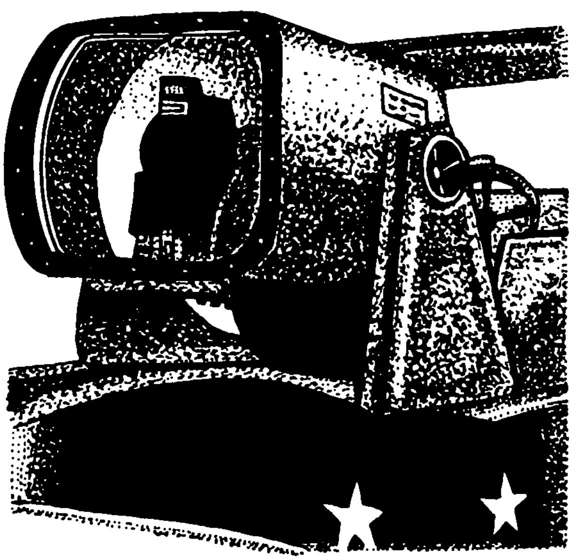


Figure 6-25. 23-inch Xenon searchlight.

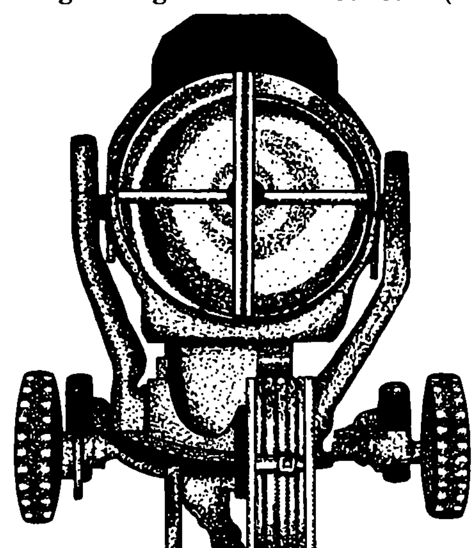


Figure 6-26. 80-inch Xenon searchlight.

CHAPTER 7

ADJUSTMENT OF OTHER FIRE SUPPORT MEANS

Section I. MORTARS

7-1. Mortar Employment

The 107-mm (4.2-inch) mortars are employed as a platoon (four guns). The 81-mm and 60-mm are employed as a section of three guns. Portions of these elements may be employed to engage targets as necessary. Table 7-1 lists information pertinent to mortars.

7-2. Call for Fire and Adjustment

The call for fire and observer procedures for mortar fire are the same as those for artillery fire. Certain differences in the conduct of specific missions will be discussed below.

7-3. Registration

a. Precision registration procedures for mortars are identical to the impact registration procedures for artillery except that once a 100-meter range bracket has been split and the last fired round is within 50 meters of the target, refinement corrections are sent to the FDC, and the mission is ended. Range corrections are made to the nearest 25 meters. The last two transmissions to the FDC appear in figure 7-1.

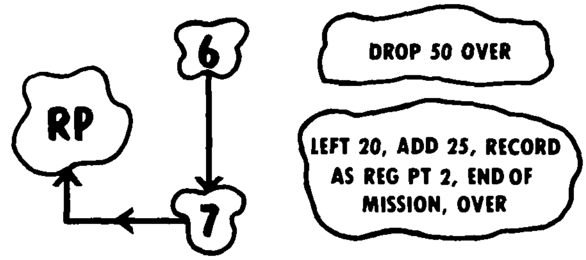


Figure 7-1. Mortar registration.

Mortars do not conduct time registration.

b. One additional step that is not done for artillery, but may be required for mortars, is adjusting the sheaf. This may be done any time during a fire mission, but may be directed by the FDC after a registration. If this is directed, the FDC will send:

PREPARE TO ADJUST THE SHEAF, OVER.

The purpose of adjusting the sheaf is to get all mortars firing parallel. The mortars will be positioned with numbers 1-3 for 81-mm or 1-4 for 107-mm from right to left. To start adjustment of the sheaf, the observer requests:

Table 7-1. Mortar Capabilities

Weapons	Min Range	Max Range	Chemical—time (107-mm only)
107-mm	920 meters	5650 meters	Shell—Fuze
			HE—quick, delay, VT
			WP—quick
81-mm	70 meters	4600 meters	Illum—time

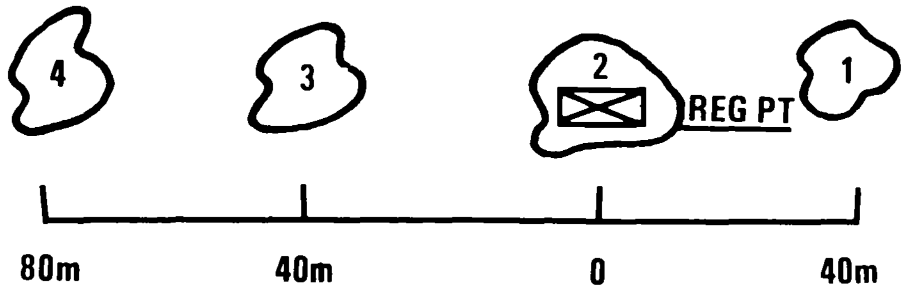


Figure 7-2. Adjusted mortar sheaf.

SECTION RIGHT (LEFT) REPEAT, OVER.

The entire section will then fire, in order, starting at the right (or left), with 10-second intervals between rounds. The mortar that was used to register will not fire. If the observer requests:

SECTION RIGHT, REPEAT, OVER

for a 107-mm section, numbers 1, 3, and 4 will fire, in that order. To adjust the sheaf, all rounds must be adjusted on line at approximately the same range (within 50 meters) and with 40 meters lateral spread between rounds. Lateral refinement corrections are made to the nearest 10 meters, but corrections less than 50 meters are not fired. Once refinement corrections for all mortars have been determined, the sheaf has been adjusted. An adjusted sheaf for a 107-mm section is shown in figure 7-2:

Example.

The sheaf of a 107-mm section is being adjusted. The observer has requested:

SECTION RIGHT, REPEAT, OVER.

The rounds fired look like figure 7-3:

All rounds are within 50 meters of the correct range, and only number 3 is more than 50 meters out in lateral adjustment, so the adjustment for number 3 is sent first, then the refinement data for numbers 1 and 4.

NUMBER 3, LEFT 60, REPEAT, OVER

NUMBER 1, LEFT 20, NUMBER 1 IS ADJUSTED, NUMBER 4, RIGHT 30, NUMBER 4 IS ADJUSTED.

Number 3 is now fired, and the round impacts as indicated in figure 7-4.

The observer would then send:

NUMBER 3 RIGHT 10, NUMBER 3 IS ADJUSTED, SHEAF IS ADJUSTED, END OF MISSION, OVER.

7-4. Other Missions

a. Other indirect fire missions, such as illumination, smoke, and the firing of FPFs, are adjusted for mortars in the same manner as for artillery. For smoke missions, the

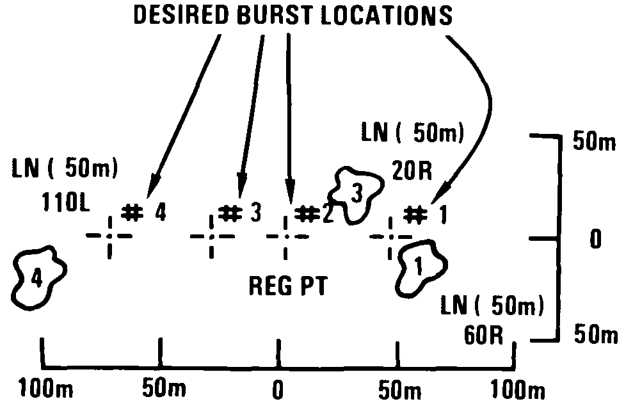


Figure 7-3. Section right, repeat.

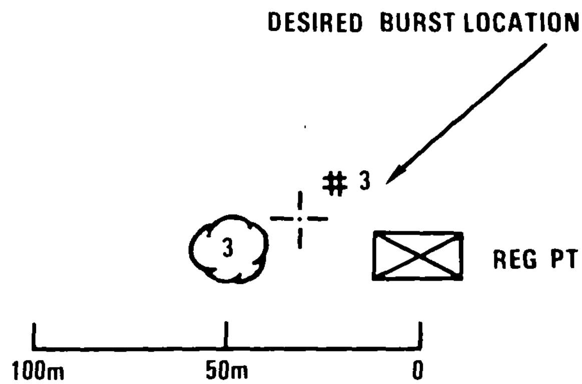


Figure 7-4. Number 3 is adjusted.

amount of coverage and duration of mortar fire are limited by the fact that only WP is available in mortar ammunition. A large amount of ammunition and a great deal of planning are required to maintain a smoke screen with mortars over any sizable area or for any length of time.

b. Mortar illumination is very effective and can be employed as one-gun illumination, or as a range or lateral spread. The 81-mm coverage is similar to the 105-mm howitzer; the 107-mm covers an area approximately 1500 meters in diameter.

Section II. CLOSE AIR SUPPORT

7-5. Types of Requests

There are two types of close air support requests: preplanned and immediate. Preplanned requests follow the format outlined in FM 6-20. The initial request for CAS may be made by the FIST chief or the FSO. Immediate requests may be initiated at any level and must include the following elements:

a. Observer identification.

b. Warning order (request close air support).

c. Target location (grid coordinates).

d. Target description.

(1) Type and number.

(2) Activity or movement.

(3) Point or area target.

e. Results desired (neutralize, destroy, or harass).

f. Desired time on target (TOT).

7-6. Employment

a. Processing. The battalion S3 air, FSO, and air liaison officer (ALO) will determine if the target is appropriate for a CAS mission. If so, the ALO will submit an immediate CAS request. If no Air Force forward air controller (FAC) is available and the aircraft are equipped with FM radios, the FIST chief will control the mission. Aircraft equipped with FM radios are USAF A-10, A-7, A-37, and USMC A-4, and AU-8A Harrier. The ALO in this case will prepare mission data and attack information and transmit these data to the FIST chief. (Example is given in c below.) After the FIST chief makes initial radio contact with the flight leader, he will ask the flight leader to transmit the lineup information. This will be the same format as the mission data and will reflect actual air assets allocated for the mission. There are three control measures for CAS missions with which the FIST chief will be concerned:

(1) Contact point (CP). The point at which the aircraft will make initial radio contact with the ground controller (FIST chief).

(2) Initial point (IP). The point from which the aircraft starts the timed run toward the pullup point.

(3) Pullup point (PUP). The point at which an aircraft at low level begins a climb to identify the target and gain altitude for the strike on target.

Example. Depicted in figure 7-5.

(a) Mission data:

Mission number—1210027

Fighter call sign—HAMMER 11

Type/number aircraft—two A-7s

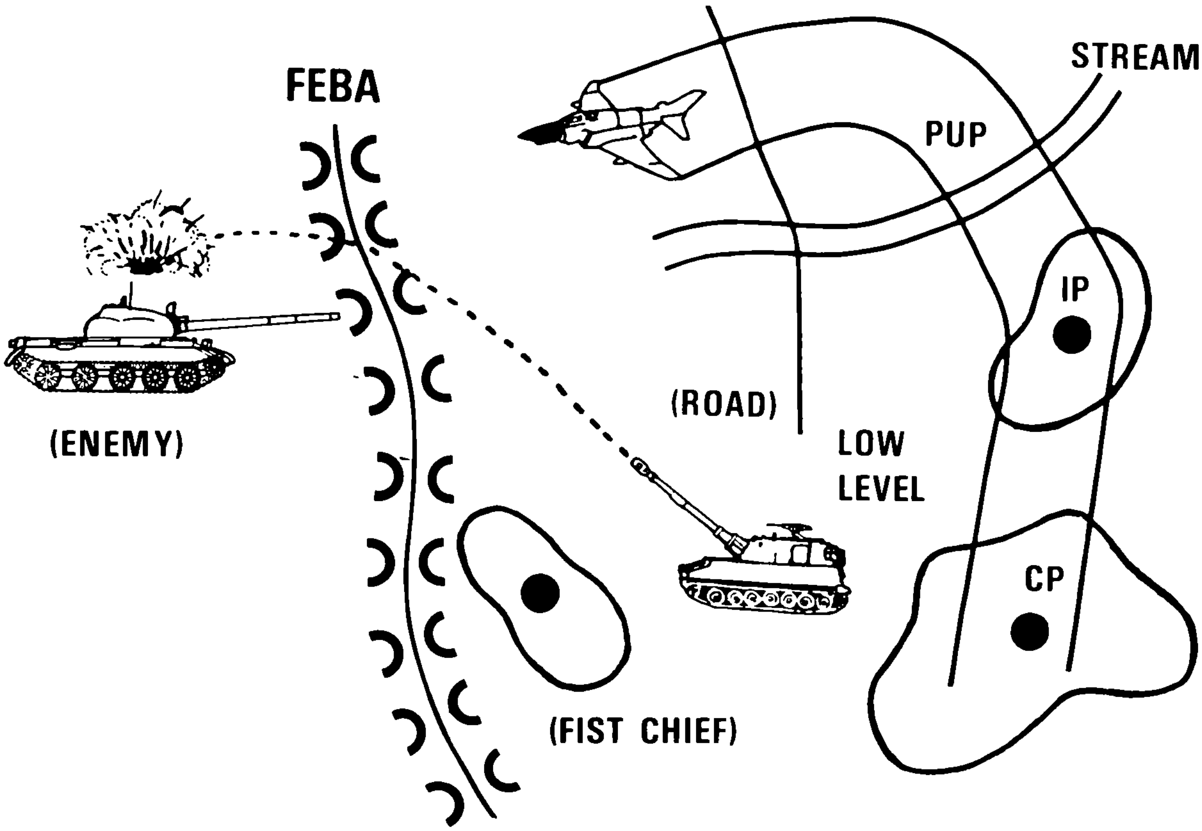


Figure 7-5. CAS mission.

Ordnance—six Mavericks (antitank missile) and 20-mm

On station time—30 minutes

FAC call sign—K12

IP location—hilltop at grid 459854

Frequency—45.50

(b) Attack information:

Target description—five T-62s

Target location—grid 132968

PUP location—intersection of road and stream at grid 150955

Run-in—IP to PUP

Heading—305°

Distance—16 nautical miles

Air speed—500 knots

Time—2 minutes

Attack heading—240°

Target marking—WP

Location of friendly troops—east of road from grid 1475 to 1496

Release clearance—K12

Reattack—affirmative

Attack restrictions—none

Threat—ZSU-23s 2 km west of target

Weather/winds—fair/light and variable

THE FIST CHIEF MUST TRANSMIT THE ATTACK INFORMATION TO THE AIRCRAFT IF THEY ARE NOT AWARE OF THE FORMATION WHEN HE CONTACTS THEM.

b. Marking. The preferred method of marking a target for a CAS mission is with artillery smoke or artillery or mortar white phosphorus (WP). The round, to be most

FLIGHT LEADER (HAMMER 11)	FIST CHIEF (K12)	BATTERY (K28)
	K28, THIS IS K12, FIRE, OVER.	
		THIS IS K28, SHOT, OVER.
	HAMMER 11, THIS IS K12, I HAVE YOU IN SIGHT. DO YOU SEE SMOKE AT YOUR 10 O'CLOCK? OVER.	
THIS IS HAMMER 11, AFFIRMATIVE, OVER.		
	THIS IS K12, YOUR TARGET IS THE GROUP OF T-62s ON THE RIDGE 200 METERS NORTHWEST OF THE SMOKE. CAN YOU IDENTIFY? OVER.	
THIS IS HAMMER 11, ROGER, I SEE THE TARGET, OVER.		
	THIS IS K12, YOU ARE CLEARED IN HOT, OVER. HAMMER 11, THIS IS K12, END OF MISSION, T-62s DESTROYED, YOU ARE RELEASED FROM CONTROL, OVER. K28, THIS IS K12, END OF MISSION, OVER.	
		THIS IS K28, END OF MISSION, OUT.

Section III. NAVAL GUNFIRE

7-7. Call for Fire

On most occasions when naval gunfire (NGF) is available, an NGF spot team will be with the company to call for and adjust NGF. The FIST chief, however, must be able to call for and adjust NGF if a spot team is not available. The call for fire for NGF follows the same general format as a call for fire for artillery support. Certain elements, however, are modified when calling for NGF support.

a. Observer identification. Same as for artillery fires. Call sign of ship will be provided to the FIST chief by the naval gunfire liaison officer (NGLO) with the FSE at battalion.

b. Warning order. Observer can only request SPOTTER ADJUST, FIRE FOR EFFECT, as for artillery. SHIP ADJUST is used when the ship observer clearly can see the target better than the ground observer, and adjustment by spotters on the ship is desired. The warning order must also include a target number. A group of target numbers, to be used sequentially, will be assigned to the FIST chief by the NGLO. The NGF spot team call for fire uses FIRE MISSION as the warning order (with the target number) and indicates SHIP ADJUST, ADJUST FIRE, or FIRE FOR EFFECT under method of control.

c. Location of target. Same as for artillery fires. The polar plot, shift from a known point, or grid method can be used. When using the grid method, include the altitude of the target and direction to the target.

d. Description of target. Same as for artillery fires.

e. Method of engagement.

(1) Danger close. Announce DANGER CLOSE if friendly troops are within 750 meters for 5-inch guns and 1000 meters for 6-inch guns and above. Send the direction and distance of friendly forces from the target.

(2) Trajectory. Request REDUCED CHARGE to raise the trajectory of the projectiles to increase accuracy and engage targets in defilade.

(3) Ammunition.

(a) Projectiles. High explosive (HE) is the standard projectile for naval guns. Other projectiles that may be requested are armor piercing (AP), smoke, white phosphorus (WP), and illuminating (ILLUM).

(b) Fuzes. Fuze quick is the standard fuze for naval guns. Other fuzes that may be requested are fuze delay (DELAY), mechanical time (TIME), and controlled variable time (CVT). A variable time (VT) fuze is available, but is used against aircraft. It is extremely sensitive and should normally not be fired at ground targets. It may not be fired over friendly troops without the maneuver commander's permission.

(4) Distribution of fire. Not requested by observer for NGF.

(5) Standard elements. Standard elements may be omitted from the call for fire.

f. Method of fire and control.

(1) Method of fire. Must indicate number of guns desired to fire in adjustment, and number desired to fire in effect if different from number firing in adjustment.

(2) Method of control. Two methods of control are used in NGF: CANNOT OBSERVE and AT MY COMMAND. Both are used in the same manner as for artillery fires. In addition, the terms "SPOTTER ADJUST," "FIRE FOR EFFECT," or "SHIP ADJUST" are used.

Example.

Ship's call sign is MUSTANG UNION, the observer's is K12.

MUSTANG UNION, THIS IS K12, FIRE MISSION, TARGET B0001, OVER.

GRID 579262, ALTITUDE 650, DIRECTION 3800, FIVE ENEMY BUNKERS, REDUCED CHARGE, FUZE DELAY, ONE GUN IN ADJUSTMENT, TWO GUNS IN EFFECT, SPOTTER ADJUST, OVER.

7-8. Adjustment Terms

Additional terms, not used in the adjustment of other fires, may be used in the adjustment of NGF.

a. Terms used by the observer.

(1) LARGE SPREAD. Indicates distances between bursts is excessive.

(2) TREND. Indicates fires are creeping off target. Followed by direction and distance. Example. "TREND SOUTHWEST, 50 METERS PER SALVO."

(3) SPREADING FIRE. Informs the ship that fire is about to be distributed over an area target. Followed by appropriate correction.

(4) FRESH TARGET. Informs the ship that a target of higher priority has appeared during the conduct of a mission and will be engaged. Followed by a shortened call for fire, locating the new target by shift-from-known-point procedures (shift from the previous target).

b. Terms used by the ship.

(1) DELAY. Indicates that the ship is not ready to fire. Will be followed by estimated time when the ship will be ready.

(2) NEGLECT. Informs the observer that the last rounds were fired with incorrect settings.

(3) WILL NOT FIRE. Informs the observer that the ship is unable to fire for safety or other reasons.

APPENDIX B

INTERNATIONAL STANDARDIZATION AGREEMENTS

Standardization agreements (STANAGs and QSTAGs) are international agreements designed to facilitate allied operations. Upon ratification by the United States, these standardization agreements are binding upon the United States Forces (entirely or with exceptions as noted).

B-1. STANAGs

A STANAG is an international agreement wherein the nations of a specific treaty organization, such as NATO, SEATO, or CENTO, agree to certain operational actions to enhance the allied operation. The status of STANAGs associated with field artillery cannon gunnery, which the United States agrees to implement and promulgate, are categorized as in table B-1.

B-2. QSTAGs

A QSTAG is an international agreement wherein the ABCA nations (United States, United Kingdom, Canada, Australia) form a quadripartite alliance and agree to certain operational and procedural techniques to enhance the allied operation. Status of QSTAGs associated with field artillery cannon gunnery, which the United States agrees to implement and promulgate, are categorized in table B-2.

B-3. Implementation

The doctrine, procedures, and techniques promulgated in the listed STANAGs and QSTAGs are implemented in FM 6-40 only as indicated in the STATUS shown for each STANAG/QSTAG. As ratification details occur, specifically those agreements that have been changed by USAFAS, subsequent implementation and promulgation action will be made accordingly. Paragraphs B-4 through B-7 are examples of basic cannon gunnery procedures as promulgated in the various QSTAGs and STANAGs and are included here to allow member nation units to operate with United States Army units when this manual is the only reference available.

Table B-1. FA Cannon Gunnery STANAGs

STANAG	SUBJECT	STATUS
2144	Call for Fire Procedures	USAFAS changes to US-ratified STANAG 2144 are included in FM 6-40.
2867	Radio-Telephone Procedures for the Conduct of Artillery Fire	USAFAS changes to US-ratified STANAG 2867 are included in FM 6-40.
2875	Calls for Destruction, Smoke, Illumination, and Danger Close Missions	USAFAS changes to nonratified (DRAFT) STANAG 2875 are included in FM 6-40.

Table B-2. FA Cannon Gunnery QSTAGs

QSTAG	SUBJECT	STATUS
220	Cannon Artillery Equipment and Procedures for the Manual Determination of Firing Data for Nonstandard Conditions for Post-1970	ABCA-ratified, Amendment action is on-going.
224	Manual Fire Direction Equipment, Target Classification and Methods of Engagement for Post-1970	ABCA-ratified.
225	Call for Fire Procedures	USAFAS changes to US-ratified QSTAG 225 are included in FM 6-40.
246	Radio-Telephone Procedures for the Conduct of Artillery Fire	USAFAS changes to US-ratified QSTAG 246 are included in FM 6-40.

B-4. Call for Fire Other Than US (Example)

Serial	General Heading	Specific Example
1	OBSERVERS IDENTIFICATION	20 THIS IS 21
2	WARNING ORDER	FIRE MISSION BATTERY
3	LOCATION OF TARGET INCLUDING DIRECTION	GRID 123456 ALTITUDE 100 DIRECTION 1640
4	TARGET DESCRIPTION	PLATOON DUG IN ON RIDGE 200×50 ATTITUDE 4850
5	METHOD OF ENGAGEMENT	
	a. TYPE OF ENGAGEMENT	DANGER CLOSE
	b. TRAJECTORY	HIGH ANGLE
	c. AMMUNITION	VT IN EFFECT 10 ROUNDS
	d. DISTRIBUTION OF FIRE	OPEN
6	METHOD OF FIRE AND CONTROL	AT MY COMMAND TWO GUNS PLATOON RIGHT ADJUST FIRE

B-5. US Call for Fire (Example)

Serial	General Heading	Specific Example
1	OBSERVERS IDENTIFICATION	A57, THIS IS A71
2	WARNING ORDER	ADJUST FIRE, SHIFT 176
3	LOCATION OF TARGET	DIRECTION 5210, LEFT 380, ADD 400, DOWN 25
4	TARGET DESCRIPTION	PLATOON DUG IN ON RIDGE 200×50 ATTITUDE 4850

APPENDIX C
REFERENCES

C-1. Publication Indexes

Department of the Army Pamphlets of the 310-series should be consulted frequently for latest changes or revisions of references given in this appendix and for new publications relating to material covered in this manual.

C-2. Army Regulations (AR)

310-25	Dictionary of United States Army Terms
310-50	Authorized Abbreviations and Brevity Codes

C-3. Department of Army Field Manuals (FM)

3-10	Employment of Chemical and Biological Agents
6-2	Field Artillery Survey
6-10	Field Artillery Communications
6-20	Fire Support in Combined Arms Operations
6-40-3	Operation of the Gun Direction Computer M18, Cannon Gunnery Application
6-50	The Field Artillery Cannon Battery
6-115	The Field Artillery Searchlight Battery
21-6	How to Prepare and Conduct Military Training
21-26	Map Reading
23-90	81-mm Mortar, M291A1
23-91	Mortar Gunnery
23-92	4.2-inch Mortar, M30

C-4. Firing Tables (FT)

14.5-A-1	Cannon, 14.5-mm, M31 Artillery Trainer, Firing Fuzed Cartridges M181, M182, M183.
8-R-1	Cannon, 8-inch Howitzer M201, on Howitzer, Heavy, Self-Propelled, 8-inch, M110A1, Firing Projectile, HES M424 and M424A1, and Projectile, Atomic, M422A1.
155-ADD-I-1	Firing Table Addendum to FT 155-AM-1 for Projectile, HE, M449A1 (M449E2), Projectile, HE, M449 (T379), Projectile, HE, M449E1.
155-AJ-2	Firing Tables for Cannon, 155-mm Howitzer, M126E1 and M126 on Howitzer, Medium, Self-Propelled, 155-mm, M109 Cannon, 155-mm Howitzer, M185 on Howitzer, Medium, Self-Propelled, 155-mm M109A1, and Cannon, 155-mm Howitzer, M1A2 Howitzer, Medium, Towed, 155-mm M114A2, Firing Projectile, Atomic, M454.

L44-AM-1	Firing Tables for Cannon, 155-mm Howitzer, M185 on Howitzer, Medium, Self-Propelled, 155-mm, M109A1 Howitzer, Medium, Self-Propelled, 155-mm, M109A1B.

C-5. Training Circulars (TC)

21-5-3	TEC Management Instruction
21-5-4	Catalog of Training Extension Course Lessons

C-6. DA Forms (available through normal AG publications supply channels)

2408-4	Weapon Record Data
3675	Ballistic Met Message
3677	Computer Met Message
4176	Target Grid, Scale 1:25,000 Meters
4200	Met Data Correction Sheet
4201	High-Burst (Mean Point of Impact) Registration Computation of HB (MPI) Location
4504	Record of Fire
4505	155-mm Nuclear Computation—MET Correction Technique

C-7. Technical Manuals (TM)

TM 9-1220-221-10/CL	FADAC User's Manual
TM 9-6920-361-13 & P	Operator, Organizational, and Direct Support Maintenance Manual, Trainer, Field Artillery: 14.5-mm, M31 and Kits

C-8. Miscellaneous Publications

ARTEP 6-105	Field Artillery 105-mm Howitzer, Towed, Infantry, Airmobile, and Airborne Divisions and Separate Brigades
ARTEP 6-165	General Support Cannon Units
ARTEP 6-365	Field Artillery, 155 SP, Direct Support Units
ARTEP 7-15	The Infantry Battalion
ARTEP 71-2	ARTEP for Mech Infantry/Tank Task Force
QSTAG 224	Manual Fire Direction Equipment, Target Classification and Methods of Engagement for Post—1970
QSTAG 225	Call for Fire Formats
QSTAG 246	Radio-Telephone Procedures for the Conduct of Artillery Fire
QSTAG 220	Cannon Artillery Equipment and Procedures for the Manual Determination of Firing Data for Nonstandard Conditions for Post—1970

C-9. USAFAS Training Support Publications

Field Artillery Catalog of Instructional Material (available by writing: COMDT, USAFAS, ATTN: ATSF-CR-TS, Fort Sill, OK 73503).

USAFAS Correspondence Course Catalog (available by writing: COMDT, USAFAS, ATTN: ATSF-CR-TS, Fort Sill, OK 73503).

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