Appendix C

Fire Planning

Fire planning is the continual process of selecting targets on which fires are prearranged to support a phase of the concept of operation. Fire planning is accomplished concurrently with maneuver planning at all levels. Leaders conduct fire planning to suppress, isolate, obscure, neutralize, destroy, deceive, or disrupt known, likely, or suspected targets, and to support the actions of the maneuver element. Fires are planned for all phases of an operation.

SECTION I — FIRE PLANNING

C-1. Fire planning starts as soon as the leader gets a mission. Once begun, fire planning continues through the operation's completion. The primary aim of fire planning is to develop how fire is to be massed, distributed and controlled to best support the leader's concept of operation.

C-2. Fires are either *targets of opportunity, or planned targets*. Targets of opportunity are not planned in advance, but are engaged as they present themselves in accordance with established engagement criteria and rules of engagement. Planned targets are ones on which fires are prearranged, although the degree of this prearrangement may vary. The degree of prearrangement influences the time it takes to receive fires. The greater the prearrangement—the faster the reaction time. The subject of this section is planned fires.

C-3. Planned targets are categorized as *scheduled,* or *on-call.* Scheduled fires are fired in accordance with a pre-established time schedule and sequence. On-call targets are fired in response to a request for fires. Priority targets are a special type of on-call target. Priority targets have quick reaction times because the firing unit has guns set on a specific target when not engaged in other fire missions.

C-4. To be effective fires must be integrated and synchronized in time, space, and purpose over the entire concept of operation. Integration means all available assets are planned and used throughout an operation. Synchronization means that these assets are sequenced in time, space, and purpose in an optimal manner, producing complementary and reinforcing effects for the maneuver element.

On 14 May 1945 during the Ryukyus Campaign in Okinawa after three days of heavy fighting, the companies of 1st Battalion, 305th IN, 77th ID were reduced to the size of platoons, led by corporals and sergeants. Despite loses, the commander decided to continue its advance. In order to achieve surprise, the morning attack began without preparatory fires. The rifle companies moved over the LD at 0800 hours and advanced 200 yards with out a shot being fired by the enemy. Surprise had been achieved, but the enemy quickly recovered and achieved fire superiority by pouring machine gun and mortar fire on the attacking units, stopping their advance. Two of the enemy positions along ridge were destroyed by mortar fire but the troops were still unable to move with out being met by enemy fire. Determined not to loose ground already gained, the battalion commander ordered the 81-mm mortar platoon to place suppressive fires in front of the lead company. Placing fire only 50 yards in front of the troops, he kept moving the barrage ahead as troops advanced.

The battalion's mortar PL went forward to the lead elements, and after a hasty visual recon decided to use two mortars on the mission. He adjusted one mortar about 50 yards in front of the company and the second about 100 yards in front of the company. One fired at a range of 700; the other at a range of 750 yards.

At these ranges two turns of the elevating crank would move the impact of the round about 25 yards.

The lead company slowly resumed its advance, moving behind this curtain of mortar fire. The enemy moved back into their cave positions to get out of the fire, becoming easy prey for flame throwers and satchel charges. Seven caves were taken care of in this fashion as the advance moved slowly – but continuously forward. Each mortar fired at a rate of about 10 rounds per minute. Some rounds fell as close as 25 yards to the troops, wounding three riflemen with fragments. Within 45 minutes ridge 59 was secured.

—Suppressive Fires

FIRE PLANNING PROCESS

C-5. Fire planning begins with the concept of fires. This essential component of the concept of operation complements the leader's scheme of maneuver detailing the leader's plan for direct and indirect preparatory and supporting fires. Fire planning requires a detailed knowledge of weapon characteristics and logistical capabilities of those providing the support. Although leaders may be augmented with personnel to assist in planning and controlling attached or supporting assets, the responsibility for planning and execution of fires lies with the leader. The leaders do not wait to receive the higher headquarters' plan to begin their own fire planning. Rather, he begins as soon as possible to integrate fires into his own concept of operation and the concept of operation of the higher headquarters.

C-6. Additional assets are allocated in either a command or support relationship (see Chapter 1). An example of a command relationship would be an attachment of a section from the weapons company. The leader relies on the senior representative from the organization to provide expertise when planning. An example of a support relationship would be direct support from the artillery battalion or from an attack aviation company. When planning fires or CAS from a supporting unit, the leader normally receives someone from that organization to assist them. For example, if the unit were to get close air support (CAS), a Soldier trained to control the CAS would probably be attached to assist the leader in his planning and execution.

C-7. Developing the concept of fire should be fairly straight forward during deliberate operations because of the ability to conduct reconnaissance, planning, and preparation. However, during hasty operations the unit may have to rely on its internal SOPs and more hands on control by the leader.

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C-8. Leaders refine, or establish if required, timings and control to ensure these targets are initiated, adjusted, and shifted properly. If possible, the observer should locate where he can see assigned target. Leaders refine, or develop a detailed execution matrix assigning responsibility for each target to the leader or observer who is in the best position to control them should be developed. These Soldiers must know when each target, series, or group is fired. They must also understand what effect is desired on which enemy positions, and when to lift or shift the fires. Leaders may consider the use of pyrotechnic or other signals to ensure communication. Units' assigned responsibilities for executing fires continually refine and rehearse their actions. Responsibilities are further refined with the information contained in the categories contained in the memory aid PLOT:

Purpose

C-9. The purpose outlines how the target assists the maneuver element or contributes to the higher headquarters' concept of operation.

Location

C-10. An identified target is the target's proposed location given as a grid preferably with a known point. The target location is not the location of the enemy – it is where the leader (or the higher headquarters) thinks the enemy will be.

Observer

C-11. The observation plan is how the leader plans to monitor the battlefield to execute the target. He assigns primary and alternate observers with proposed locations where they can observe the target and associated triggers. Positioning is perhaps the most important aspect of the plan. Observers' positions must allow them to see the trigger for initiating fires as well as the target area and the enemy forces on which the target is oriented. The leader also must consider other aspects of observer capabilities, including available equipment, communication, and their security. This information is critical to the leader. If an enemy asset is critical enough to be designated as a target, then it must be adequately resourced with execution assets.

Trigger

C-12. A trigger is event- or time-oriented criteria used to initiate planned actions directed toward achieving surprise and inflicting maximum destruction on the enemy or a designated point (FM 1-02). Triggers can be a physical point on the ground, a laser or lazed spot, or an action or event that causes and action among friendly forces. When using triggers to control fires, leaders ensure they have allocated them to start, shift, and cease fires. There are two types of triggers: tactical; and technical. Tactical triggers cue the observer/ executor of the target to communicate to the firing agency to prepare to fire. In the offense tactical triggers are tied to a friendly maneuver event. In the defense, tactical triggers are usually tied to enemy actions. Technical triggers involve the actual firing of the target, taking into account the enemy rate of march, and the friendly munition's time of flight.

C-13. When using triggers in the defense it is important for subordinates to have a method, usually addressed in the unit's SOP, for marking triggers. The marking method should work during day and limited visibility operations.

TACTICAL USES OF PLANNED FIRES

C-14. Fires are used for many different tactical reasons. They include:

- Fire delivered before an attack to weaken the enemy position (FM 1-02).
- Supporting fires (covering fires). Supporting fires enable the friendly maneuver element to move by destroying, neutralizing, or suppressing enemy fires, positions, and observers.
- Final protection fires (FPF) is an immediately available prearranged barrier of fire designed to impede enemy movement across defensive lines or areas.
- Suppression.
- Obscuration.
- Counterbattery (indirect fires only). Counterbattery is fire to destroy or neutralize enemy artillery / mortars. These missions are normally controlled at higher level headquarters. Direct support artillery moves with supported units and aviation is used to destroy enemy fire support means and key enemy units and facilities. Counter battery radars are positioned to maintain radar coverage to ensure continuous coverage during rapid movement forward.
- Harassing fire is observed or predicted (unobserved) fire intended to disrupt enemy troop and vehicle movement, disturb their rest, and lower their morale.
- Illumination.

ECHELONMENT OF FIRE – PLANNED FIRES TECHNIQUE

C-15. Echelonment of fires is the schedule of fire ranging from the highest caliber munitions to the lowest caliber munitions. The purpose of echeloning fires is to maintain constant fires on the enemy while using the optimum delivery system. Leaders use REDs, SDZs, and MSDs to manage associated risks. In the defense, triggers are tied to the progress of the enemy as it moves through the AO, enabling the leader to engage the enemy throughout the depth of the sector. In the offense triggers are tied to the progress of the maneuver element as it moves toward the objective protecting the force and facilitating momentum up to the objective.

Defensive Echelonment

C-16. In the defense, echeloning fires are scheduled based on their optimum ranges to maintain continuous fires on the enemy, disrupting his formation and maneuver. Echelonment of fires in the defense places the enemy under increasing volumes of fire as he approaches a defensive position. Aircraft and long-range indirect fire rockets and artillery deliver deep supporting fires. Close supporting fires such as final protective fires (FPF) are closely integrated with direct fire weapons such as Infantry weapons, tank support, and antiarmor weapons systems. Figure C-1 illustrates an example of defensive echelonment.

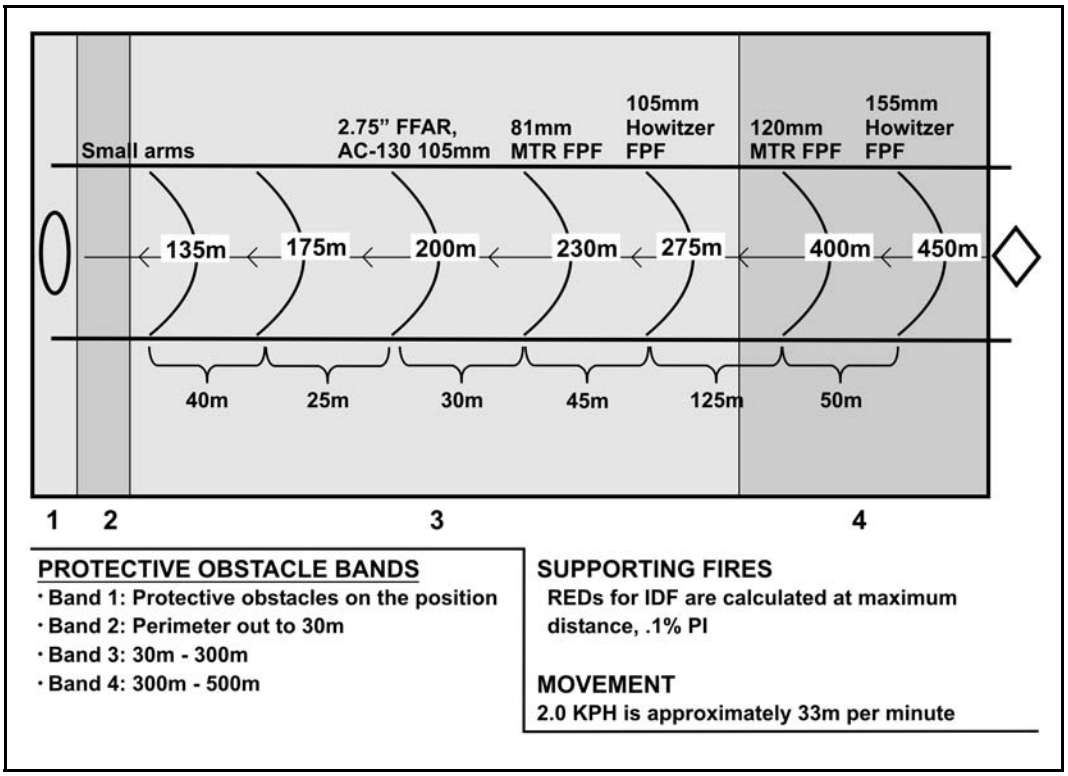

Figure C-1. Defensive echelonment of fires example.

Offensive Echelonment

C-17. In the offense, weapons are scheduled based on the point of a predetermined safe distance away from any maneuvering friendly troops. When scheduled effectively, fires provide protection for friendly forces as they move to and assault an objective. They also allow friendly forces to get in close with minimal casualties and prevent the defending enemy from observing and engaging the assault by forcing him to take cover. The overall objective of offensive scheduled fires is to allow the friendly force to continue the advance unimpeded (Figure C-2).

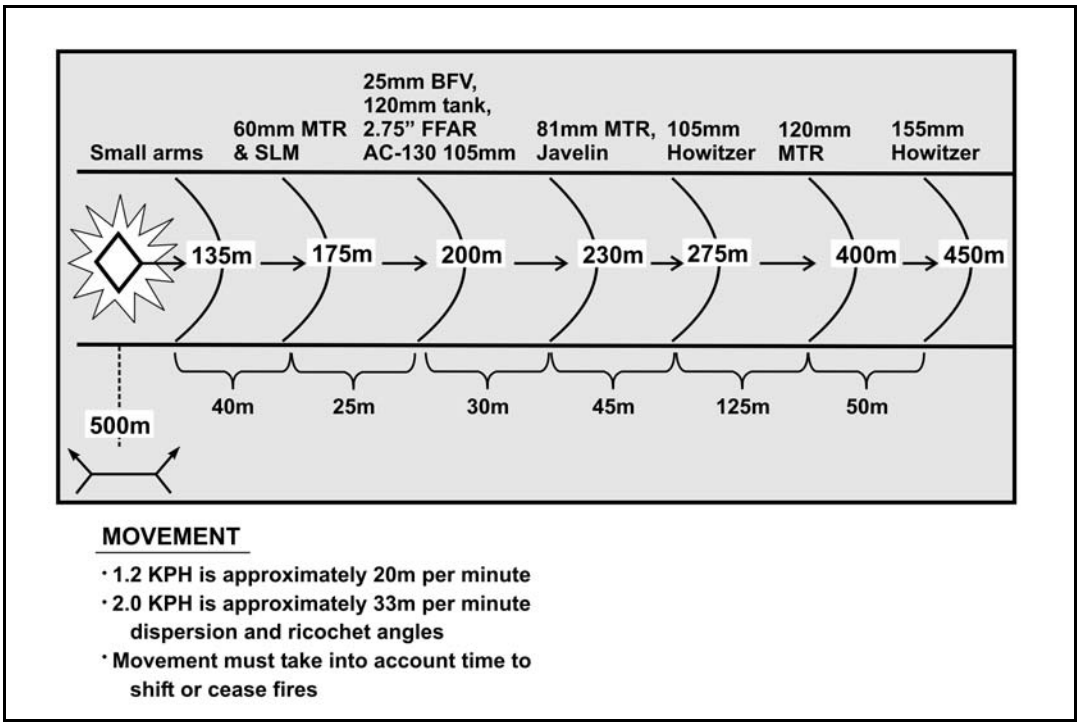

Figure C-2. Offensive echelonment of fires example.

C-18. As an example of echelonment of fires use during the conduct of a mission, consider an operation in which a platoon assaults an enemy position (Figures C-3 through C-6). As the lead elements of the unit approach the designated phase line en route to the objective, the leader orders the fire support officer (FSO) to begin the preparation. Observers track friendly movement rates and confirm them. Other fire support officers in the chain of command may need to adjust the plan during execution based on unforeseen changes to anticipated friendly movement rates.

C-19. As the unit continues its movement toward the objective, the first weapon system engages its targets. It maintains fires on the targets until the unit crosses the next phase line that corresponds to the RED of the weapon system being fired.

C-20. To maintain constant fires on the targets, the next weapon system begins firing before the previous weapon system ceases or shifts. This ensures no break in fires, enabling the friendly forces' approach to continue unimpeded. However, if the unit rate of march changes, the fire support system must remain flexible to the changes.

C-21. The FSO shifts and engages with each delivery system at the prescribed triggers, initiating the fires from the system with the largest RED to the smallest. Once the maneuver element reaches the final phase line, the FSO ceases the final indirect fire system or shifts to targets beyond the objective to cease all fires on the objective. Direct fire assets in the form of supporting fires are also maintained until the final assault, then ceased or shifted to targets beyond the objective.

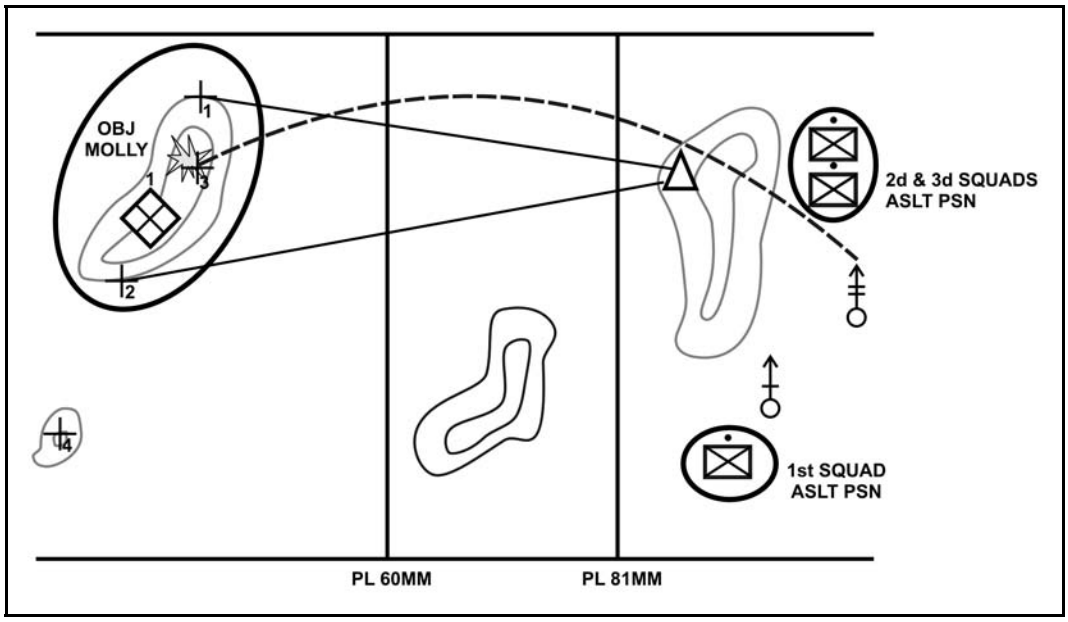

Figure C-3. 81-mm mortars begin firing.

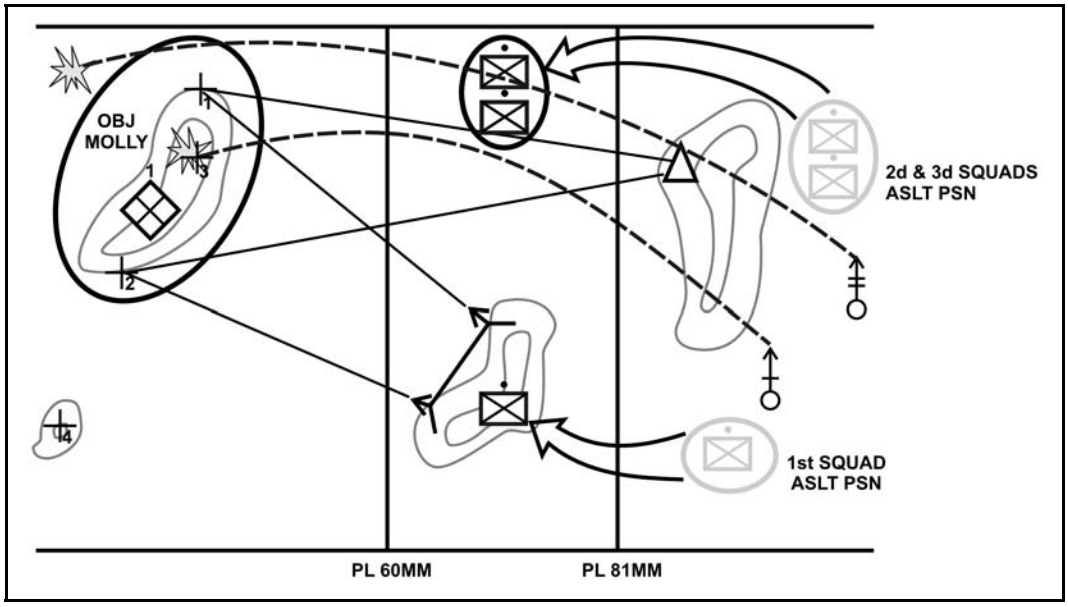

Figure C-4. 81-mm mortars shift, 60-mm mortars and supporting fires begin.

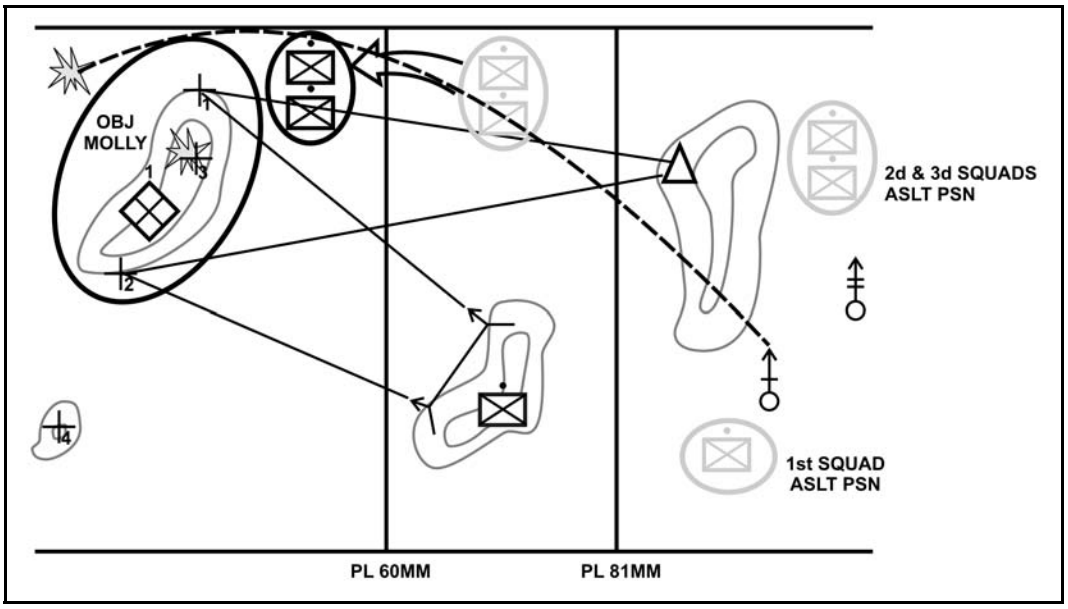

Figure C-5. 60-mm mortars shift.

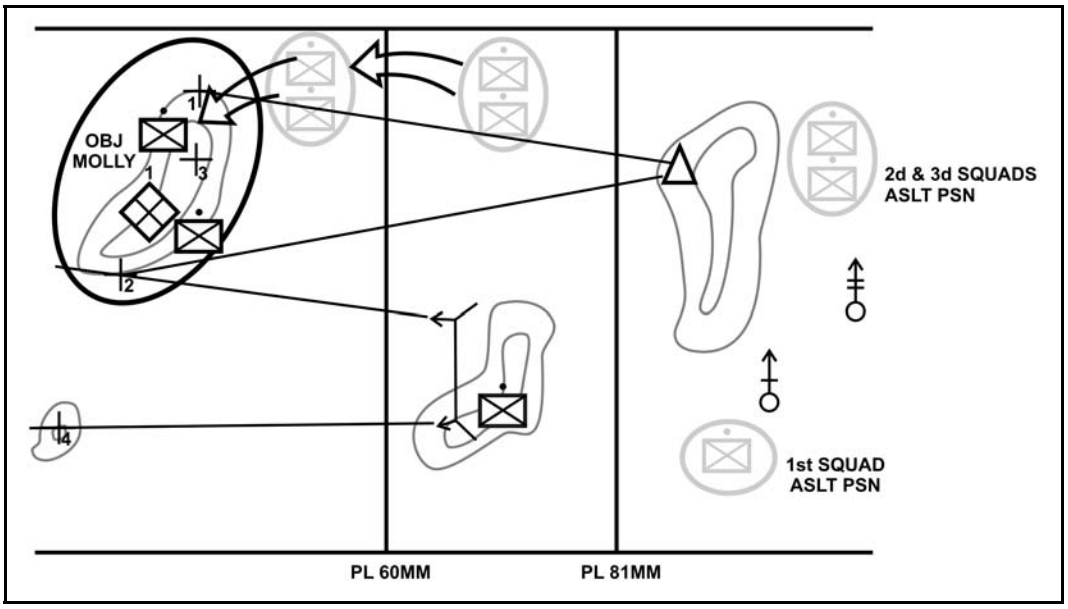

Figure C-6. Supporting fires shift for final assault.

FIRE PLANNING FOR THE DEFENSE

C-22. To develop a defensive fire plan, the leader—

- Assigns primary and secondary sectors from primary and alternate position to each subordinate.
- Designates unit point or area targets and other control measures, such as target reference points (TRPs), to coordinate the fire when more than one subordinate is firing into the same engagement area or sector.
- Receives target information from subordinates (normally provided on sector sketches and/or individual weapon range cards). The leader reviews this target information to insure that fire is equally distributed across the entire unit's sector and that sufficient control measures are established.
- Completes the unit's fire plan and gives a sketch to his higher headquarters.

C-23. In the defense, fires are planned in three locations – in front of the unit's position, on the position (FPF), and behind the position. Figure C-7 shows fires masses in front of a company-sized position. Fire plans are best developed using the seven steps of engagement area development technique:

(1) Identify likely enemy avenues of approach.

(2) Identify the enemy scheme of maneuver.

(3) Determine where to kill the enemy.

(4) Emplace weapon systems.

(5) Plan and integrate obstacles.

(6) Plan and integrate indirect fires.

(7) Conduct an engagement area rehearsal.

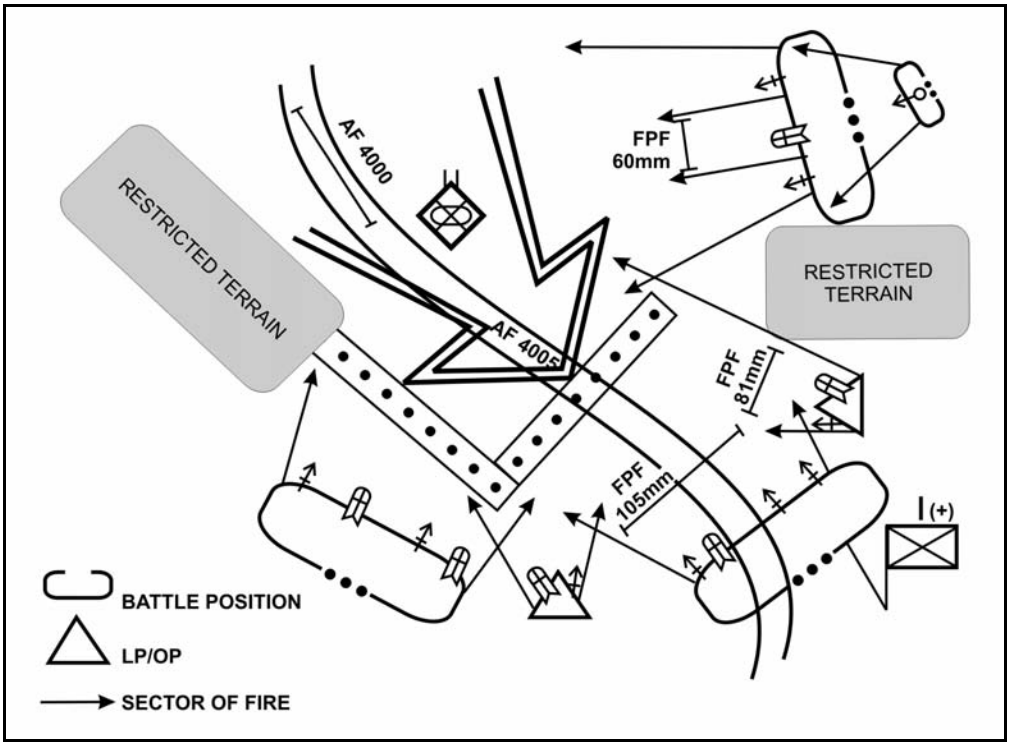

Figure C-7. Company defensive fire plan sketch.

C-24. The engagement area (EA) is the place where the leader intends to destroy an enemy force using the massed fires of all available weapons. The success of any engagement depends on how effectively the leader can integrate the obstacle and indirect fire plans with his direct fire plan in the EA to achieve the unit's purpose. Completing the steps of EA development is not a lengthy process. Particularly at the Infantry platoon level, EA development can occur rapidly without an elaborate decision making process.

SQUAD FIRE PLANNING

C-25. The squad leaders make two copies of their sector sketches. One copy goes to the platoon leader; the other remains at the position. The squad leaders draw sector sketches as close to scale as possible, showing the elements contained in Figure C-8.

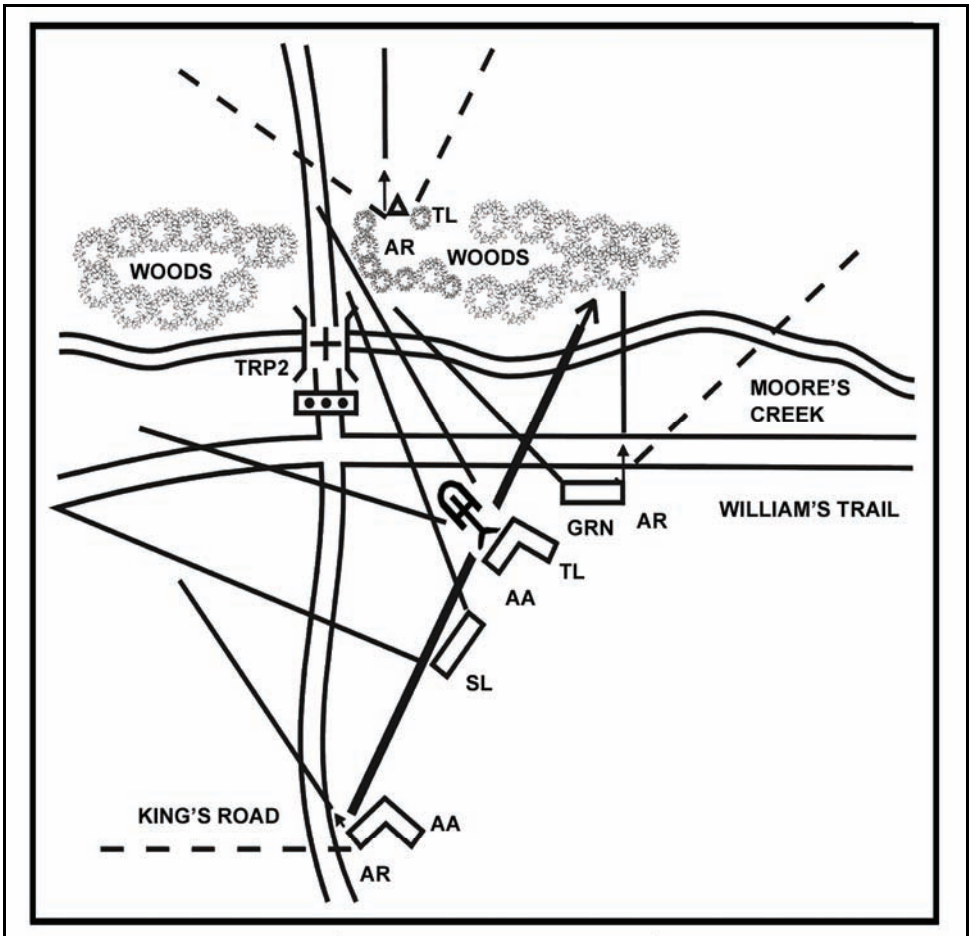

Figure C-8. Squad sector sketch.

PLATOON FIRE PLANNING

C-26. Squad leaders prepare their sketches and submit them to the platoon leader. The platoon leader combines all sector sketches (and possibly separate range cards) to prepare a platoon sector sketch. A platoon sector sketch is drawn as close to scale as possible that includes a target list for direct and indirect fires. One copy is submitted to the company commander, one copy is given to the PSG, and one copy is maintained by the platoon leader. As a minimum, the platoon sector sketch should show the elements contained in Figure C-9.

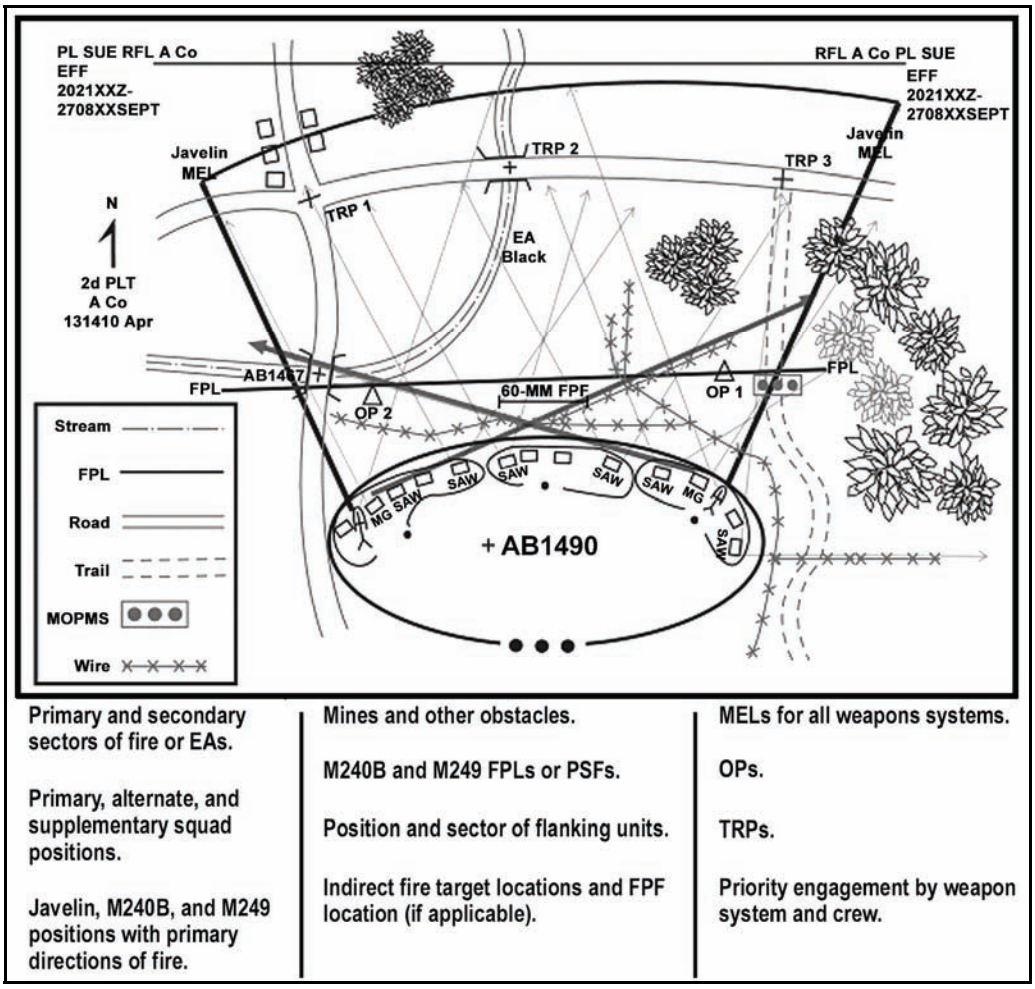

Figure C-9. Platoon sector sketch.

FINAL PROTECTIVE LINE

C-27. The final protective line (FPL) is a line of fire selected where an enemy assault is to be checked by interlocking fire from all available weapons and obstacles (FM 1-02). The FPL consists of all available measures, to include protective obstacles, direct fires, and indirect fires. The FPF targets the highest type of priority targets and takes precedence over all other fire targets. The FPF differs from a standard priority target in that fire is conducted at the maximum rate until the mortars are ordered to stop, or until ammunition is depleted. If possible, the FPF should be registered.

C-28. If Soldiers are in well-prepared defensive positions with overhead cover, an FPF can be adjusted very close to the friendly positions, just beyond bursting range. If required, the leader can even call for artillery

fires right on the unit's position using proximity or time fuzes for airbursts. Table C-1 shows indirect fire mortar weapon system characteristics that should be used when planning the FPF.

Table C-1. Normal FPF dimensions for each number of mortars.

Weapon	Number of Tubes	Width (meters)	Depth (meters)	Risk Estimated Distance, .1% PI	Risk Estimated Distance, 10% PI
MORTARS					
120 mm	4	300	75	400m	100m
120 mm	2	150	75		
81 mm	4	150	50	230m	80m
81 mm	2	75	50		
60 mm	2	60	30	175m	65m

FIRE PLANNING FOR THE OFFENSE

C-29. Offensive fire planning follows the same methodology as defensive fire planning within constraints of the situation. The main difference is that offensive fire planning always includes the synchronization between the base of fire and the maneuver element. Inevitably, the leader's plan will not be as detailed as the defensive plan, but the presence of a maneuver element requires a baseline of planning and control to ensure fire support is effective and efficient.

C-30. The leader must plan how he will engage known or suspected enemy targets, where friendly suppressive fire may be needed, and how he will control the unit's fires against both planned targets and targets of opportunity. Fire planning should include a thorough analysis of the type of threat expected. This will aid the supporting friendly element in tailoring the weapon and ammunition requirements to suit the situation.

C-31. Offensive fire planning supports four phases: planning and preparation, approach to the objective, actions on the objective, and follow-through. The degree of completeness and centralization of offensive fire planning depends on the time available to prepare for the offensive. Fires are planned in four locations on the battlefield – short of the LD / LC, LD / LC to the objective, on the objective, and behind the objective. Table C-2 lists planning considerations for each of the four locations.

Table C-2. Planning considerations.

Phase	Plan Fires to:
1) Planning and Preparation (Short of the LD / LC)	• Support unit in assembly areas. • Support unit's movement to the LD / LC. • Disrupt enemy reconnaissance forces. • Disrupt enemy defensive preparations. • Disrupt enemy spoiling attacks.
2) Approach to the Objective (LD / LC to the Objective)	• Begin echeloning fires for maneuver units. • Suppress and obscure for friendly breaching operations. • Suppress and obscure enemy security forces throughout movement. • Provide priority of fires to lead element. • Screen / guard exposed flanks.
3) Actions on the Objective (On the Objective)	• Fires to block enemy reinforcements. • Fires to suppress enemy direct fire weapons. • Suppress and obscure point of penetration. • Suppress and obscure enemy observation of friendly forces.
4) Follow Through (Beyond The Objective)	• Disrupt movement of enemy reinforcements during the assault. • Block avenues of enemy approach. • Disrupt enemy withdraw. • Screen friendly forces from enemy counterattacks during the assault. • Consolidate objective after the assault.

C-32. For simplicities, offensive fire planning is divided into two categories – preparatory and supporting fires. The concept of fires will have artillery and mortars in support of an attack to gain and maintain fire superiority on the objective until the last possible moment. When this indirect fire lifts, the enemy should be stunned and ineffective for a few moments. Take full advantage of this period by doing any or all of the following:

- Combat Vehicles. Vehicles used in the attack, or as fire support, continue to give close support.
- Maintaining Fire Superiority. Small-arms fire from local and internal SBF is continued as long as possible.
- Maneuver Elements. Assaulting troops must try to fire as they advance. Troops must observe fire discipline, as in many cases fire control orders will not be possible. They must not arrive at the objective without ammunition.
- Audacity. Where the ground and vegetation do not prohibit movement, leading sections should move very quickly over the last 30 or 40m to the enemy positions to minimize exposure.

C-33. When planning fires for the offense, leaders verify the fire element's task organization and ensure there exists plans and coordinating measures for the attack, exploitation, pursuit, and contingency plans. Leaders develop or confirm with the responsible level authority that supporting systems are positioned and repositioned to ensure continuous fires throughout the operation. Mutual support of fire systems promotes responsive support and provides the commanders of maneuver units freedom of action during each critical event of the engagement or battle

C-34. There exists a diverse variety of munitions and weapon systems, direct and indirect, to support close offensive operations. To effectively integrate fire support, the leader must understand the mission, the commander's intent, the concept of operations, and the critical tasks to be accomplished. The leader plans fires to focus on enemy capabilities and systems that must be neutralized. Critical tasks include:

- Continuous in-depth support (accomplished by proper positioning of systems).
- Isolating enemy forces.
- Softening enemy defenses by delivering effective preparatory fires.

- Suppressing and obscuring enemy weapon systems to reduce enemy standoff capabilities.
- Interdicting enemy counterattack forces, isolating the defending force, and preventing its reinforcement and resupply.

SECTION II — TARGET EFFECTS PLANNING

C-35. Not only must fire support planners determine what enemy targets to hit, and when, but must also decide how to attack each enemy target. Leaders should consider all the aspects of target effects when planning fires. Although this section is specific to mortars, the following concepts generally apply to most indirect fires.

HIGH-EXPLOSIVE AMMUNITION

C-36. When mortar rounds impact they throw fragments in a pattern that is never truly circular, and may even travel irregular, based on the round's angle of fall, the slope of the terrain, and the type soil. However, for planning purposes, each mortar high explosive (HE) round is considered to have a circular lethal bursting area. Figure C-10 shows a scale representation of the lethal bursting areas of mortar rounds.

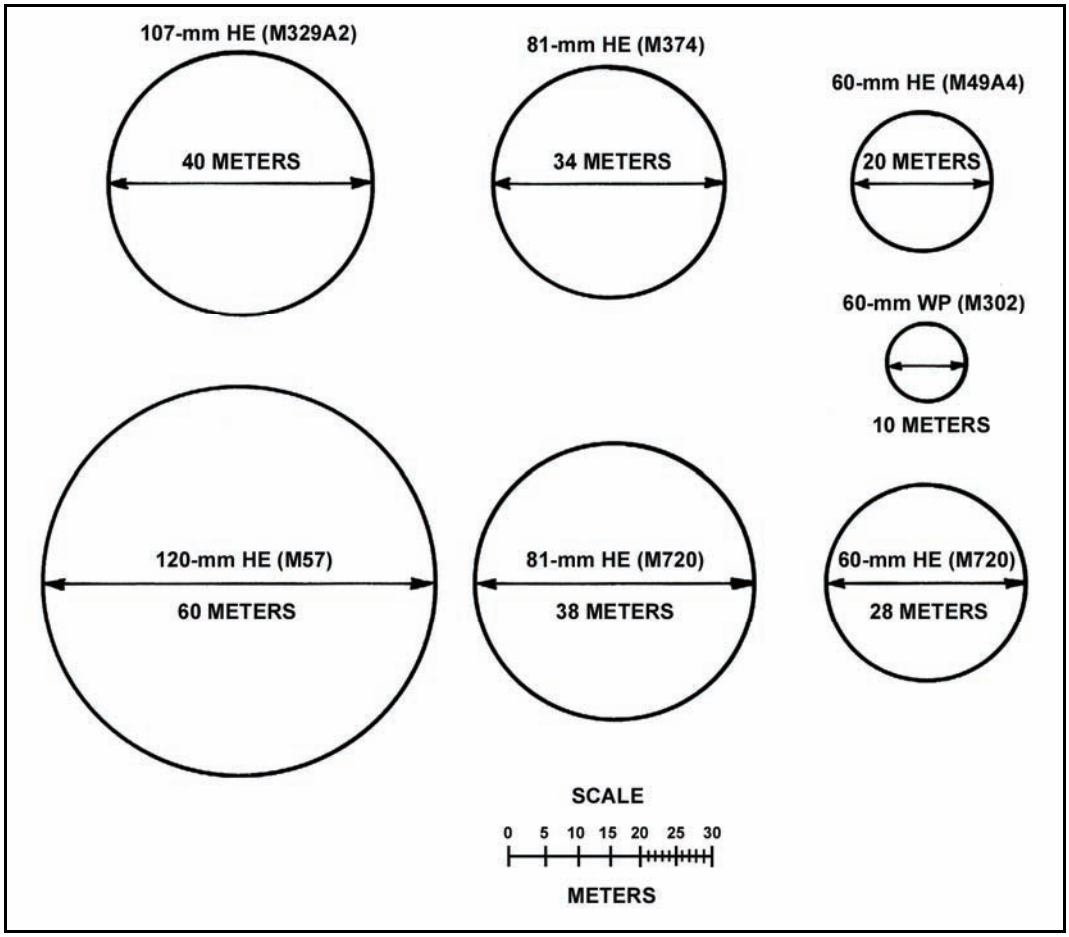

Figure C-10. Comparison of lethal bursting areas of U.S. mortar rounds.

FUZE SETTINGS

C-37. The decision concerning what fuze setting to use depends on the position of the enemy.

C-38. Exposed enemy troops that are standing up are best engaged with impact (IMP) or near surface burst (NSB) fuze settings. The round explodes on, or near, the ground. Shell fragments travel outward perpendicular to the long axis of the standing target (Figure C-11).

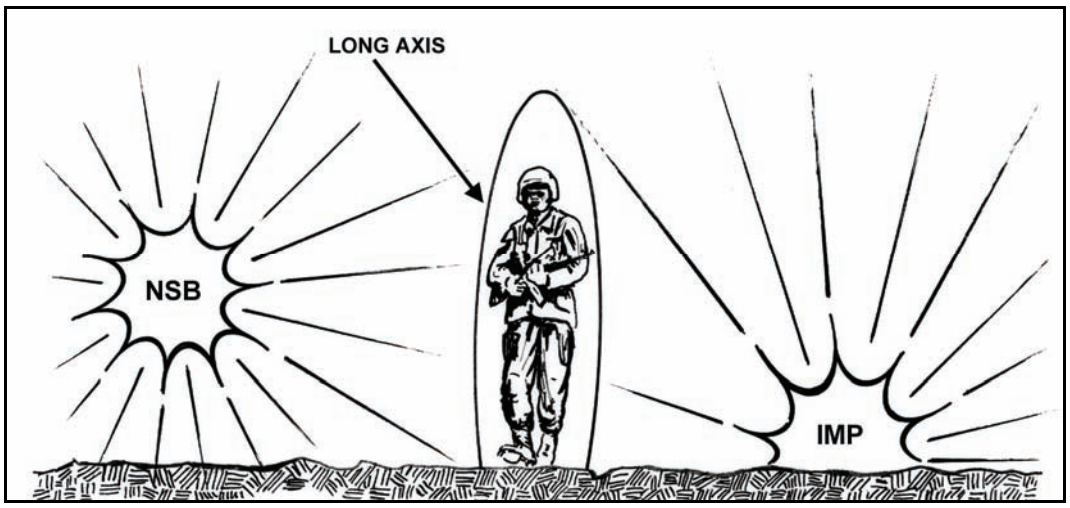

Figure C-11. Standing targets.

C-39. If exposed enemy troops are lying prone, the proximity (PRX) fuze setting is most effective. The rounds explode high above the ground, and the fragments coming downward are once again traveling perpendicular to the long axis of the targets (Figure C-12).

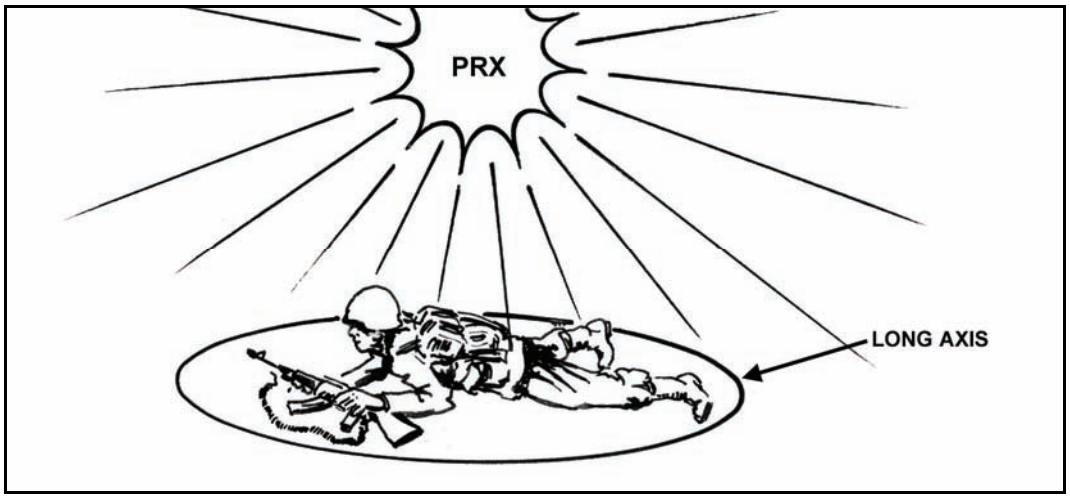

Figure C-12. Prone targets.

C-40. The PRX setting is also the most effective if the enemy is in open fighting positions, without overhead cover. Even PRX settings will not always produce effects if the positions are deep (Figure C-13).

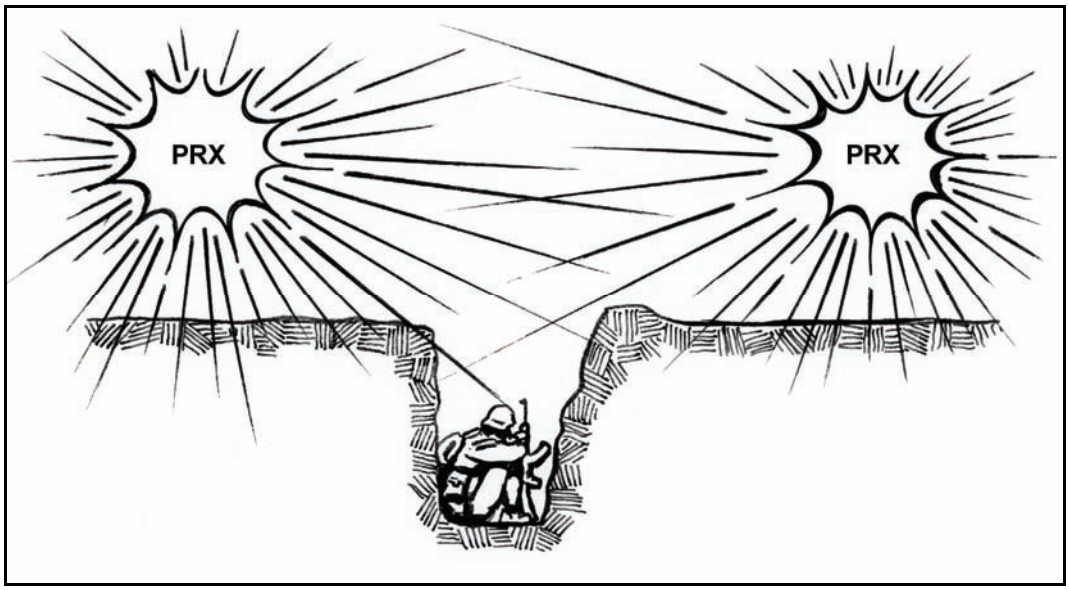

Figure C-13. Targets in open fighting positions.

C-41. The DLY fuze setting is most effective when the enemy is below triple canopy jungle or in fighting positions with overhead cover. Light mortars will have little effect against overhead cover. Even medium mortars have limited effect. Heavy mortars can destroy a bunker or enemy troops beneath jungle canopy with a hit or near-miss (Figure C-14).

Figure C-14. Targets beneath triple canopy jungle.

EFFECTS OF COVER ON HIGH-EXPLOSIVE ROUNDS

C-42. Enemy forces will normally be either standing or prone. They maybe in the open or protected by varying degrees of cover. Each of these changes the target effects of mortar fire.

C-43. Surprise mortar fire is always more effective than fire against an enemy that is warned and seeks cover. Recent studies have shown that a high casualty rate can be achieved with only two rounds against an enemy platoon standing in the open. The same studies required 10 to 15 rounds to duplicate the casualty rate when the platoon was warned by adjusting rounds and sought cover. If the enemy soldiers merely lay prone, they significantly reduce the effects of mortar fire. Mortar fire against standing enemy forces is almost twice as effective as fire against prone targets.

C-44. Proximity fire is usually more effective than surface-burst rounds against targets in the open. The effectiveness of mortar fire against a prone enemy is increased by about 40 percent by firing proximity-fuzed rounds rather than surface-burst rounds.

C-45. If the enemy is in open fighting positions without overhead cover, proximity-fuzed mortar rounds are about five times as effective as impact-fuzed rounds. When fired against troops in open fighting positions, proximity-fuzed rounds are only 10 percent as effective as they would be against an enemy in the open. For the greatest effectiveness against troops in open fighting positions, the charge with the lowest angle of fall should be chosen. It produces almost two times as much effect as the same round falling with the steepest angle.

C-46. If the enemy has prepared fighting positions with overhead cover, only impact-fuzed and delay-fuzed rounds will have much effect. Proximity-fuzed rounds can restrict the enemy's ability to move from position to position, but they will cause few, if any, casualties. Impact-fuzed rounds cause some blast and suppressive effect. Delay-fuzed rounds can penetrate and destroy a position but must achieve a direct hit. Only the 120-mm mortar with a delay-fuze setting can damage a Soviet-style strongpoint defense. Heavy bunkers cannot be destroyed by light or medium mortar rounds.

SUPPRESSIVE EFFECTS OF HE MORTAR ROUNDS

C-47. Suppression from mortar is not as easy to measure as the target effect. It is the psychological effect produced in the mind of the enemy that prevents him from returning fire or carrying on his duties. Inexperienced or surprised Soldiers are more easily suppressed than experienced, warned Soldiers. Soldiers in the open are much more easily suppressed than those with overhead cover. Suppression is most effective when mortar fires first fall; as they continue, their suppressive effects lessen. HE rounds are the most suppressive, but bursting WP mixed with HE has a great psychological effect on the enemy.

C-48. If a 60-mm mortar round lands within 20 meters of a target, the target will probably be suppressed, if not hit.

C-49. If a 60-mm mortar round lands within 35 meters of a target, there is a 50 percent chance it will be suppressed. Beyond 50 meters, little suppression takes place.

C-50. If an 81-mm mortar round lands within 30 meters of a target, the target will probably be suppressed, if not hit.

C-51. If an 81-mm mortar round lands within 75 meters of a target, there is a 50 percent chance that the target will be suppressed. Beyond 125 meters, little suppression takes place.

C-52. If a heavy mortar round (proximity-fuzed) lands within 65 meters of target, the target will probably be suppressed, if not hit.

C-53. If a heavy mortar round (proximity-fuzed) lands within 125 meters of a target, there is a 50 percent chance the target will be suppressed. Beyond 200 meters, little suppression takes place. The 120-mm mortar round is better for suppression than the 107-mm, but both are excellent suppressive rounds.

ILLUMINATION, SMOKE, AND WHITE PHOSPHORUS

C-54. Illumination and obscuration missions are important functions for mortar platoons or sections. Atmospheric stability, wind velocity, and wind direction are the most important factors when planning target effects for smoke and white phosphorus (WP) mortar rounds. The terrain in the target area also effects smoke and WP rounds.

C-55. The bursting WP round provides a screening, incendiary, marking, and casualty-producing effect. It produces a localized, instantaneous smoke cloud by scattering burning WP particles.

C-56. The WP round is used mainly to produce immediate, close point obscuration. It can be used to screen the enemy's field of fire for short periods, which allows troops to maneuver against him. The 60-mm WP round is not sufficient to produce a long-lasting, wide-area smoke screen, but the much larger WP round from the heavy mortar is.

C-57. The bursting WP round can be used to produce casualties among exposed enemy troops and to start fires. The casualty-producing radius of the WP round is much less than that of the HE round. Generally, more casualties can be produced by firing HE ammunition than by firing WP. However, the WP burst causes a significant psychological effect, especially when used against exposed troops. A few WP mixed into a fire mission of HE rounds may increase the suppressive effect of the fire.

C-58. The WP rounds can be used to mark targets, especially for attack by aircraft. Base-ejecting smoke rounds, such as the 81-mm M819 RP round, produce a dispersed smoke cloud, normally too indistinct for marking targets.

C-59. The effects of atmospheric stability can determine whether mortar smoke is effective at all or, if effective, how much ammunition will be needed.

- During unstable conditions, mortar smoke and WP rounds are almost ineffective--the smoke does not spread but often climbs straight up and quickly dissipates.
- Under moderately unstable atmospheric conditions, base-ejecting smoke rounds are more effective than bursting WP rounds. The M819 RP round for the M252 mortar screens for over 2½ minutes.
- Under stable conditions, both RP and WP rounds are effective.
- The higher the humidity, the better the screening effects of mortar rounds.

C-60. The M819 RP round loses up to 35 percent of its screening ability if the ground in the target area is covered with water or deep snow. During extremely cold and dry conditions over snow, up to four times the number of smoke rounds may be needed than expected to create an adequate screen. The higher the wind velocity, the more effective bursting WP rounds are, and the less effective burning smoke rounds become.

C-61. If the terrain in the target area is swampy, rain-soaked, or snow-covered, then burning smoke rounds may not be effective. These rounds produce smoke by ejecting felt wedges soaked in red phosphorus. These wedges then burn on the ground, producing a dense, long-lasting cloud. If the wedges fall into mud, water, or snow, they can be extinguished. Shallow water can reduce the smoke produced by these rounds by as much as 50 percent. Bursting WP rounds are affected little by the terrain in the target area, except that deep snow and cold temperatures can reduce the smoke cloud by about 25 percent.

C-62. Although bursting WP rounds are not designed to cause casualties, the fragments of the shell casing and bits of burning WP can cause injuries. Burning smoke rounds do not cause casualties and have little suppressive effect.

ILLUMINATION

C-63. Illumination rounds can be used to disclose enemy formations, to signal, or to mark targets. There are illumination rounds available for all mortars.

C-64. The 60-mm illumination round available now is the standard cartridge, illuminating, M83A3. This round has a fixed time of delay between firing and start of the illumination. The illumination lasts for about 25 seconds, providing moderate light over a square kilometer.

C-65. The 60-mm illumination round does not provide the same degree of illumination as do the rounds of he heavier mortars and field artillery. However, it is sufficient for local, point illumination. The small size of the round can be an advantage where illumination is desired in an area but adjacent friendly forces to not want to be seen. The 60-mm illumination round can be used without degrading the night vision devices of adjacent units.

C-66. The medium and heavy mortars can provide excellent illumination over wide areas. The 120-mm mortar illumination round provides one million candlepower for 60 seconds.

C-67. The M203 40-mm grenade, as well as all mortars have the capability to deliver IR illumination rounds in addition to the more common white light.

SPECIAL ILLUMINATION TECHNIQUES

C-68. Following are three special illumination techniques that mortars have effectively used.

C-69. An illumination round fired extremely high over a general area will not always alert an enemy force that it is being observed. However, it will provide enough illumination to optimize the use of image intensification (starlight) scopes such as the AN/TVS-5 and the AN/TVS-4.

C-70. An illumination round fired to burn on the ground will prevent observation beyond the flare into the shadow. This is one method of countering enemy use of image intensification devices. A friendly force could move behind the flare with greater security.

C-71. An illumination round fired to burn on the ground can be used to mark targets during day or night. Illumination rounds have an advantage over WP as target markers during high winds. The smoke cloud from a WP round will quickly be blown downwind. The smoke from the burning illumination round will continue to originate from the same point, regardless of the wind.

CONSIDERATIONS WHEN USING THERMAL SIGHTS

C-72. Although illumination rounds may aid target acquisition when friendly forces are using image intensification devices (such as night vision devices), this is not so when thermal sights are used. As the illumination flares burn out and land on the ground, they remain as a distinct hot spot seen through thermal sights for several minutes. This may cause confusion, especially if the flare canisters are between the enemy and the friendly forces. WP rounds can also cause these hot spots that can make target identification difficult for gunners using thermal sights (tanks, BFV, TOW, or Javelin).

Appendix D

Vehicle Employment Considerations

Employing combat vehicles with Infantry platoons and squads increases their combat power. Combining combat vehicles and Infantry to achieve complementary and reinforcing effects has proven to be a significant advantage. Operations that integrate combat vehicles and Infantry forces combine the advantages of the vehicle's mobility, protection, firepower, and ability to use their information platform. They also increase the Infantryman's ability to operate in restricted and severely restricted terrain.

Infantry units conduct operations with a variety of combat vehicles. The principles for integrating combat vehicles with Infantry are similar regardless of the specific vehicle type. Combat vehicles that most often work with Infantry forces include the M1 Abrams tank, the M2 Bradley fighting vehicle (BFV), the Stryker Infantry carrier vehicle (ICV), and multiple versions of the assault high-mobility multipurpose wheeled vehicle (HMMWV). This appendix is written from the perspective of an Infantry platoon leader controlling a combat vehicle section or platoon. However, the technical and tactical information addressed in the following pages is also generally valid for Infantry platoons attached to mechanized/heavy units.

SECTION I — CAPABILITIES

D-1. The primary roles of the combat vehicles discussed in this appendix are to provide Infantry platoons with mobility to allow them to maneuver. Combat vehicles also provide bases of fire; protection, breaching capabilities, enhanced communication platforms, and a variety of sustainment assets that include re-supply and MEDEVAC capabilities. Effective integration of these forces provides complementary and reinforcing effects to Infantry and mounted forces.

PRINCIPLES OF EMPLOYMENT

D-2. There are three general principles for employing combat vehicles with Infantrymen:

(1) So the combat power capabilities of the vehicle can support the maneuver of the Infantry.

(2) So the combat power of the Infantry platoon can support the maneuver of combat vehicle sections or platoons.

(3) The wingman concept. To achieve mutual support, combat vehicles almost always work in this concept. The wingman concept is similar to the buddy team concept Infantrymen employ (operating in two-vehicle sections). Just like Infantrymen never fight alone, combat vehicles never operate without the mutual support and evacuation capability the combat vehicle wingman provides.

GENERAL EMPLOYMENT CONSIDERATIONS

D-3. Employment of combat vehicles requires thorough understanding and integration of the vehicle and the Infantry unit. The following paragraphs focus on general employment considerations.

Combat Vehicles Supporting the Infantry

D-4. Combat vehicles support Infantry units by leading Infantrymen in open terrain and providing them a protected, fast-moving assault weapons system. They suppress and destroy enemy weapons, bunkers, and tanks by fire and movement. They may provide transport when the enemy situation permits.

Mobility

D-5. The following is a list of the primary mobility functions that combat vehicles provide an Infantry platoon during combat operations:

- Assist opposed entry of Infantry into buildings or bunkers.
- Breach or reduce obstacles by fire.
- Provide mobility to the dismounted force.
- Provide enhanced communication platforms and multiple communications systems.
- Sustainment (MEDEVAC and re-supply).

Firepower

D-6. The following is a list of the primary firepower functions that combat vehicles provide an Infantry platoon during combat operations:

- Speed and shock effect to assist the Infantry in rapidly executing an assault.
- Lethal and accurate direct fire support (support by fire).
- Suppression of identified sniper positions.
- Heavy volume of suppressive fires and a mobile base of fire for the Infantry.
- Employment of technical assets (thermal viewers and range finders) to assist in target acquisition and ranging.
- Neutralization or suppression of enemy positions with direct fire as Infantry closes with and destroys the enemy.
- Attack by fire any other targets designated by the Infantry.
- Accurate direct fires even while the vehicle is moving at high speeds with stabilized gun systems.
- Destruction of enemy tanks and armored personnel carriers (APCs).

Protection

D-7. The following are ways that combat vehicles protect an Infantry platoon during combat operations:

- Dominate the objective during consolidation and reorganization to defeat a counterattack and protect Infantry forces.
- Protect the movement of advancing Infantry through open terrain with limited cover and concealment.
- Secure cleared portions of the objective by covering avenues of approach.
- Establish roadblocks or checkpoints.
- Provide limited obscuration with smoke grenades and smoke generators.
- Isolate objectives with direct fire to prevent enemy withdrawal, reinforcement, or counterattack.

Infantrymen Supporting Combat Vehicles

D-8. Infantrymen support vehicular forces by finding and breaching or marking antitank obstacles. They detect and destroy or suppress enemy antitank weapons. Infantrymen may designate targets for armored vehicles and protect them in close terrain.

Mobility

D-9. Mobility functions that Infantry provide to units with vehicles during combat operations include:

- Seize and retain terrain.
- Clear defiles and restrictive urban terrain ahead of vehicular forces.

Firepower

D-10. Firepower functions that Infantry provide to units with vehicles during combat operations include:

- Actions on the objective (clear trenches, knock out bunkers, enter and clear buildings).
- Employ AT systems (Javelin) to destroy armored threats.

Protection

D-11. Ways Infantry protect units with vehicles during combat operations include:

- Provide local security over dead space / blind spots that weapon systems on combat vehicles cannot cover.
- Consolidate and reorganize (perform EPW procedures and direct MEDEVAC).

TECHNICAL CAPABILITIES

D-12. Infantry leaders must have a basic understanding of the technical capabilities of combat vehicles. These include vehicle characteristics, firepower and protection.

VEHICLE CHARACTERISTICS

D-13. To win in battle, leaders must have a clear understanding of the capabilities and limitations of their equipment. The tank, Bradley, Stryker ICV, and assault HMMWV each have their own capabilities, limitations, characteristics, and logistical requirements. Even though their role to the Infantry is virtually the same, these vehicles provide support in different ways. To effectively employ combat vehicles, leaders must understand the specific capabilities and limitations of vehicles that may be attached/OPCONed to their unit. The following information is a brief overview of the combat vehicles' characteristics as they apply to combat power. Table D-1 displays vehicle characteristics. (*Specifics vary by vehicle and modifications.)

Table D-1. Mobility characteristics of combat vehicles.

	ASSLT HMMWV*	ICV*	BFV*	Tank*
Tracks/Wheels	Wheels	Wheels	Tracks	Tracks
Length	196.5"	275"	254"	312"
Width	86"	107"	126"	144"
Height	74" (without wpn)	104"	117"	96"
Weight	5,600 lbs	38,000 lbs	50,000 lbs	68.7 tons
Speed	78 mph	60 mph	42 mph	42 mph

Firepower

D-14. The weapons and ammunition of vehicular units are designed to defeat specific enemy targets, though many are multi-purpose. An Infantry leader with a basic understanding of these weapons and ammunition types will be able to better employ vehicular units to defeat the enemy. Table D-2 lists the basic weapons and ammunition types offered by vehicular units that generally support Infantry platoons.

Table D-2. Weapons, ammunition, and targets.

		ASSLT HMMWV		ICV		BFV		Tank	
		Weapon Ammo	**Target**	**Weapon Ammo**	**Target**	**Weapon Ammo**	**Target**	**Weapon Ammo**	**Target**
Blast Munition		**40mm MK 19** Max area: 2,212m Max point: 1,500m	Trucks, troops, bunkers, buildings	**40mm MK 19** Max area: 2,212m Max point: 1,500m	Trucks, troops, bunkers, buildings	**25mm (HE)** Max effective: 3,000m	Trucks, troops, bunkers, buildings	**120mm (HEAT)** Max effective: 3,000m	Trucks, troops, bunkers, buildings, APCs
KINETIC (AT)	**Cannon**	None	None	None	None	**25mm (sabot)** Max effective: 2,500m	APCs	**120mm (sabot)** Max effective: 3,000m	APCs, tanks
	Machine Gun	**M249 5.56mm** Max area: 800m Max point: 600m **M240B 7.62mm** (mounted) Max area: 1,100m Max point: 800m **M2 .50 caliber** Max area: 1,830m Max point: 1,200m	Troops, trucks, eqpmnt	**M2 .50 caliber** Max area: 1,830m Max point: 1,200m	Troops, trucks, equipment	**M240C 7.62mm*** Max effective: 900m	Troops, trucks	**M240C 7.62mm** Max effective: 900m **M2 .50 caliber** Max area: 1,830m Max point: 1,200m	Troops, trucks, eqmnt
TOW Missile		Max effective: 3,750m	Tanks	Max effective: 3,750m	Tanks, helicopters, bunkers	Max effective: 3,750m	Tanks, helicopters, bunkers	None	None
*The BFV does not have a heavy machine gun.									

Protection

D-15. All combat vehicles offer varying degrees of protection from direct and indirect fire. Figure D-1 illustrates the generally-progressive degrees of protection offered by combat vehicles.

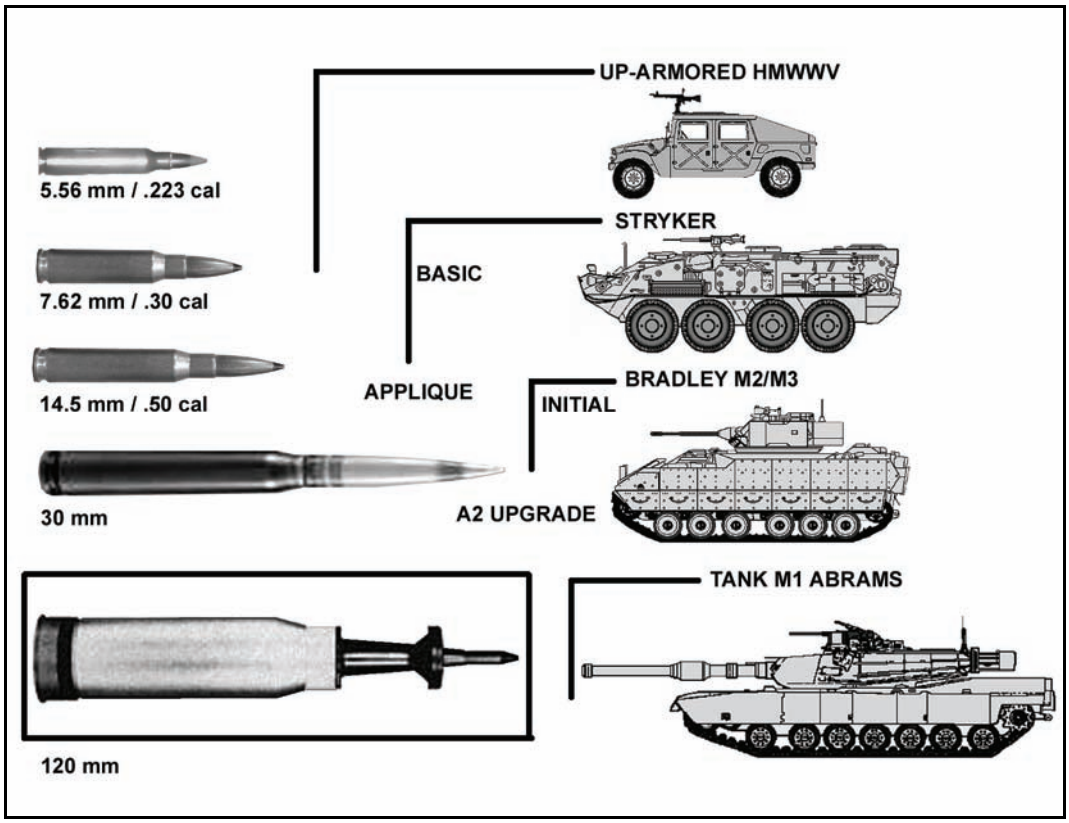

Figure D-1. Comparative levels of ballistic protection.

TANKS (M1)

D-16. The M1-series tank provides rapid mobility combined with excellent protection and highly lethal, accurate fires. They are most effective in generally open terrain with extended fields of fire.

Mobility Advantages

D-17. The tank's mobility comes from its capability to move at high speed both on and off road. The tank's ability to cross ditches; ford streams and shallow rivers; and push through small trees, vegetation, and limited obstructions allows effective movement in various types of terrain.

Mobility Disadvantages

D-18. Tanks consume large quantities of fuel. They are very noisy and must be started periodically in cold weather or when using thermal night sights and radios to ensure the batteries stay charged. The noise, smoke, and dust generated by tanks make it difficult for the Infantry in their vicinity to capitalize on stealth to achieve surprise. Tanks cannot cross bodies of water deeper than four feet without deep water fording kits or bridging equipment. Due to the length of the tank main gun, the turret will not rotate if a solid object such as a wall, post, or tree is blocking it. Tracked vehicles can also "throw track." This occurs when the track loses tension on the sprockets and/or support arms and the track becomes disconnected from the tank. Repairing the track can be a lengthy process.

Firepower Advantages

D-19. The tank's main gun is extremely accurate and lethal at ranges out to 4,000 meters. Tanks with stabilized main guns can fire effectively even when moving at high speeds cross-country. The tank remains the best antitank weapon on the battlefield. The various machine guns (M1 tank commander's caliber .50 and 7.62-mm coax and the loader's 7.62-mm MG) provide a high volume of supporting fires for the

Infantry. The target acquisition capabilities of the tank exceed the capability of all systems in the Infantry battalion. The thermal sight provides a significant capability for observation and reconnaissance. It can also be used during daylight hours to identify heat sources (personnel and vehicles), even through vegetation. The laser range finder provides an increased capability for the Infantry force to establish fire control measures (such as trigger lines and TRPs), and to determine exact locations.

Firepower Disadvantages

D-20. The normal, basic load for the tank's main gun is primarily armor piercing discarding sabots (APDS) antitank rounds. These rounds are not as effective against light armored or wheeled vehicles, bunkers, trench lines, buildings, or enemy personnel. They also present a safety problem when fired over the heads of exposed Infantrymen due to the discarded sabot pieces that fall to the ground. HE ammunition provides better destructive effects on the above-mentioned targets except enemy personnel, which the tank's machine guns are most effective against. The resupply of all tank ammunition is difficult and requires logistic support from the heavy battalion. The main gun of an M1A2 can only elevate +20 degrees and depress -9 degrees. Figure D-2 illustrates M1A2 fields of fire on the urban terrain.

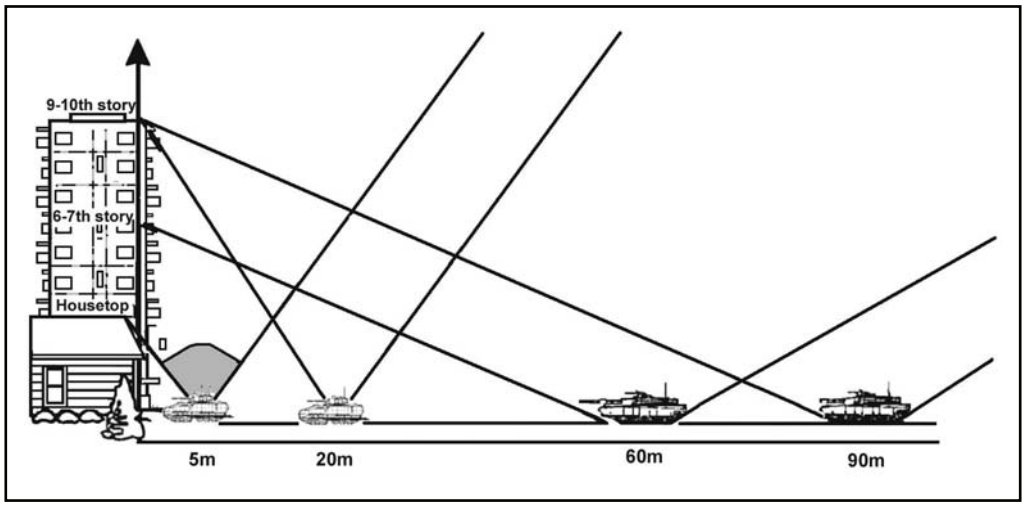

Figure D-2. M1A2 fields of fire on urban terrain.

Protection Advantages

D-21. Generally, tank armor provides excellent protection to the crew. Across the frontal 60-degree arc, the tank is impenetrable to all weapons except heavy AT missiles or guns and the main gun on enemy tanks. When fighting with the hatches closed, the crew is impenetrable to all small arms fire, artillery rounds (except a direct hit), and AP mines. The tank's smoke grenade launcher and on-board smoke generator provide rapid concealment from all but thermal observation.

Protection Disadvantages

D-22. The tank is most vulnerable to lighter AT weapons from the flanks, top, and especially the rear. The top is especially vulnerable to precision-guided munitions (artillery or air delivered). AT mines can also destroy or disable the vehicle. When fighting with hatches closed, the tank crew's ability to see, acquire, and engage targets (especially close-in Infantry) is greatly reduced.

Information Advantages

D-23. FBCB2, global positioning systems (GPSs), and inertial position navigation (POSNAV) systems allow today's tanks the mobility to virtually any designated location with greater speed and accuracy than ever before. Use of visual signals and the single channel ground/airborne radio system (SINCGARS) facilitates rapid and secure communication of orders and instructions. This capability allows tank crews to quickly mass the effects of their weapon systems while remaining dispersed to limit the effects of the

enemy's weapons. On-board optics and sighting systems enable tank crews to acquire and destroy enemy tanks, armored vehicles, and fortifications using the main gun, and to suppress enemy positions, personnel, and lightly armored targets with the tank's machine guns

Information Disadvantages

D-24. Not all tanks are equipped with digitally enhanced systems (FBCB2). Additionally, at present, the situational awareness and enemy situation acquired by the FBCB2 cannot be easily shared with Infantry units on the ground.

M2 BRADLEY FIGHTING VEHICLE (BFV)

D-25. The M2 BFV provides good protection and mobility combined with excellent firepower to support Infantry units with direct fire.

Advantages

D-26. The mobility of the M2 is comparable to the tank. In addition to the three-man crew, the vehicle is designed to carry seven additional Infantrymen with a combat load.

Disadvantages

D-27. The M2 consumes significant quantities of fuel, but less than a M1. The BFV is louder than the M1, and like the M1, its engine must be started periodically in cold weather or when using the thermal night sight and radios to ensure the batteries stay charged. Like all heavy vehicles, the noise, smoke, and dust generated by the M2 makes it difficult for the Infantry to capitalize on its ability to move with stealth and to avoid detection when moving on the same approach. Improvised barricades, narrow streets and alleyways, or large amounts of rubble can block BFVs in an urban area. Heavy woods will restrict their movement in a rural area. The 25-mm cannon does not project out over the front of the Bradley like a tank, but it does protrude over the sides of the Bradley when the gunner is aiming at 3 o'clock or 9 o'clock. This will cause some problems for the Bradley when trying to negotiate narrow avenues of approach. Attaching and removing rucksacks to the exterior of the vehicle can be a lengthy process, and the rucksacks are exposed to enemy fire.

Firepower Advantages

D-28. The primary weapon on the M2 is the 25-mm chain gun that fires APDS, high explosive incendiary with tracer (HEI-T), and TPT. This weapon is extremely accurate and lethal against lightly armored vehicles, bunkers, trench-lines, and personnel at ranges out to 2,000 meters. The stabilized gun allows effective fires even when moving cross-country. The TOW provides an effective weapon for destroying enemy tanks or other point targets at extended ranges to 3,750 meters. The 7.62-mm coax provides a high volume of suppressive fires for self defense and supporting fires for the Infantry up to 800 meters. The combination of the stabilized turret, thermal sight, high volume of fire, and the reinforcing effects of weapons and ammunition makes the M2 an excellent suppression asset supporting Infantry assaults. The thermal sight provides a significant capability for observation and reconnaissance. It can also be used during the day to identify heat sources (personnel and vehicles) even through light vegetation. Figure D-3 shows the 25-mm supporting Infantry in an urban setting.

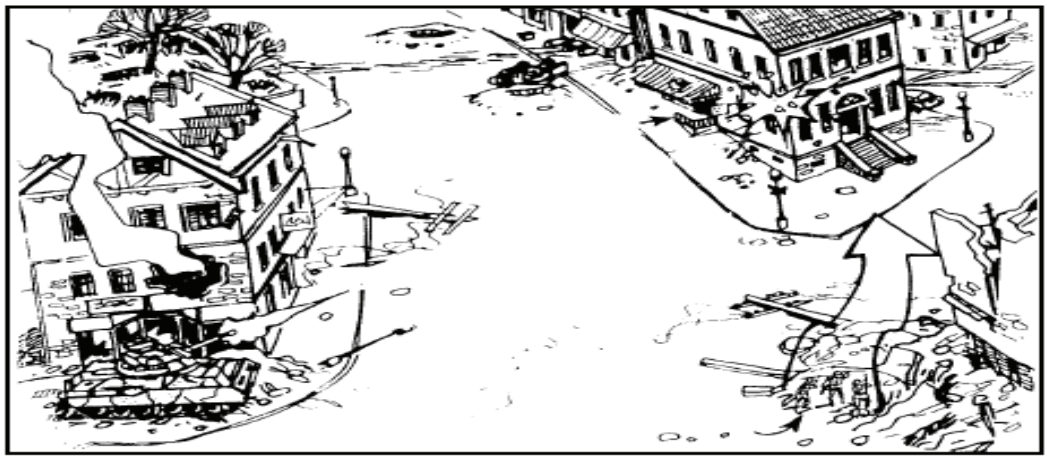

Figure D-3. BVF 25-mm infantry support.

Firepower Disadvantages

D-29. When operating the thermal sight with the M2engine off, a "clicking" sound can be heard at a considerable distance from the vehicle. The resupply of ammunition is difficult and requires external logistic support.

Protection Advantages

D-30. Overall, the M2 provides good protection. When fighting with the hatches closed, the crew is well protected from small-arms fire, fragmentation munitions, and AP mines. The M2 smoke-grenade launcher and on-board smoke generator provide rapid concealment from all but thermal observation.

Protection Disadvantages

D-31. The vehicle is vulnerable from all directions to any AT weapons and especially enemy tanks. AT mines can destroy or disable the vehicle. When the crew is operating the vehicle with the hatches open, they are vulnerable to small-arms fire.

Information Advantages

D-32. The target acquisition capabilities of the M2 exceed the capability of the other systems in the Infantry battalion. The thermal sight provides a significant capability for observation and reconnaissance. It can also be used during the day to identify heat sources (personnel and vehicles) even through light vegetation. Many models of the BFV are now equipped with the FBCB2.

Information Disadvantages

D-33. Bradley vehicle crewmen have poor all-round vision through their vision blocks. They are also easily blinded by smoke or dust. Therefore, the Bradley vehicle should not be approached while it is in contact because the crew may have difficulty seeing Infantryman outside of the vehicle. The Bradley commander (BC) must be informed where the dismounted Infantry are located to prevent any accidents on the battlefield.

STRYKER INFANTRY CARRIER VEHICLE (ICV)

D-34. There are two variants of the Stryker: the Infantry carrier vehicle (ICV); and the mobile gun system (MGS). The primary design of the Stryker is found in the basic ICV. This troop transport vehicle is quite capable of carrying nine Infantry Soldiers and their equipment, a crew of two, a driver, and a vehicle commander. There are eight configurations of the ICV that provide comprehensive sustainment. The eight ICV configurations include: command vehicle; reconnaissance vehicle; fire support vehicle; mortar carrier

vehicle; antitank guided missile vehicle; engineer squad vehicle; medical evacuation vehicle; and nuclear, biological, and chemical reconnaissance vehicle. The MGS incorporates a 105-mm turreted gun and autoloader system. The Stryker can greatly reduce the amount of inventory and logistical support for combat brigades, while at the same time increasing the Infantry's ability to deploy.

Mobility

D-35. The Stryker vehicle enables the team to maneuver in close and urban terrain, provide protection in open terrain, and transport infantry quickly to critical battlefield positions.

Advantages

D-36. With 4x8- and 8x8-wheel drive, the Stryker is designed for all-weather use over all types of terrain and can ford hard-bottomed bodies of water to a depth of 67 inches. Stryker vehicles have a maximum speed of 60 miles per hour and a range of 300 miles on a tank of fuel. The vehicles are swift, easily maintainable, and include features designed for the safety of Soldiers. The Stryker's has run-flat tires that can be inflated or deflated from inside the vehicle to adapt to surfaces ranging from deep mud to hardtop. It also has a built-in fire suppression system, and a self-recovery winch. The vehicles run quieter than current armored personnel carriers, increasing their stealth. Steel-belted tires with run-flat liners enable vehicle mobility for 5 miles (8 km) with all tires flat.

Disadvantages

D-37. For vehicles weighing 10-20 tons, wheels are inferior to tracks in crossing sand, mud, and snow. Driving more than five miles on a flattened tire can cause a fire. Improvised barricades, narrow streets and alleyways, or large amounts of rubble can block Stryker vehicles in urban areas. Dense forests can block it in rural areas.

Firepower Advantages

D-38. The ICV has a remote weapon station with a universal soft mount cradle that can mount either a .50-caliber M2 machine gun, MK 19 40-mm grenade launcher, or M240B 7.62-mm machine gun. It is also armed with four M6 smoke grenade launchers. Stowed ammunition includes:

- 32 66-mm smoke grenades.
- 3,200 7.62-mm rounds.
- 2,000 .50 cal rounds *or* four hundred thirty MK 19 rounds.

D-39. Troops carry—

- 2,240 5.56-mm ball ammunition.
- 1,120 5.56-mm linked ammunition.

Firepower Disadvantages

D-40. The ICV loses some of the ammunition effects that tanks and Bradley fighting vehicles can provide to the Infantryman. For this reason the ICV can suppress light skinned vehicles, bunkers, buildings, and enemy Infantry, but is not as effective as a BFV or tank against enemy light-armored or armored vehicles.

Protection Advantages

D-41. The basic ICV provides armored protection for the two-man crew and a squad of nine Infantry Soldiers. The ICV's armor protection will stop .50-caliber bullets and protects against 152-mm airburst shells. The basic armor package on every Stryker vehicle is a steel hull that protects against 7.62-mm bullets; and a ceramic, added-on appliqué that gives protection against 14.5-mm machine guns. Hull floor plate and fuel tank armor protect from blast and fragment effects of antipersonnel mine detonations. Low silhouette and low noise output make the vehicle a difficult target to detect and engage.

Protection Disadvantages

D-42. The ICV is vulnerable to all AT fires and tanks. The effectiveness of RPG fire can be mitigated with a slat-armor application (cage) that causes a premature detonation of the RPG warhead away from the hull of the ICV.

Information

D-43. Just as with the tank and Bradley, the Stryker ICV vehicle crewmen have poor all-round vision through their vision blocks. They are also easily blinded by smoke or dust.

ASSAULT HIGH-MOBILITY MULTIPURPOSE WHEELED VEHICLE (HMMWV)

D-44. The HMMWV is a light, highly mobile, diesel-powered, four-wheel-drive vehicle equipped with an automatic transmission. Using components and kits common to the M998 chassis, the HMMWV can be configured as a troop carrier, armament carrier, TOW missile carrier, or a Scout vehicle.

MOBILITY ADVANTAGES

D-45. The HMMWV rests on a four-wheel chassis. Its four-wheel drive enables it to operate in a variety of terrain and climate conditions. It is capable of fording water up to 30 inches in depth, and can ford depths of up to 60 inches with the deep water fording kit. The HMMWV's size allows it to travel in the narrow streets of urban terrain with minimal damage to the infrastructure. Some models of the HMMWV (M1026, M1036, M1046, and M1114) employ a winch that aids in self recovery and recovery of similar vehicles.

Mobility Disadvantages

D-46. Although generally equipped with run-flat tires, the HMMWV's tires are very susceptible to enemy fire. HMMWVs have much less ability to breach obstacles than tracked vehicles. The HMMWV can be blocked by hasty and complex obstacles. I can also be easily rolled, especially with the armored M114.

Firepower Advantages

D-47. The HMMWV can employ a variety of weapon systems that offer excellent direct fire support to Infantry forces. The TOW, .M2, MK 19, M240B, and M249 can all be mounted in HMMWV models with turrets. The capabilities of these weapon systems are discussed in greater detail in Table D-2.

Firepower Disadvantages

D-48. In almost all instances, the HMMWV can only mount one weapon system. This makes it less effective than tanks or BFVs that can employ antitank and antipersonnel weapons simultaneously.

Protection Advantages

D-49. The M1114 is an up-armored HMMWV that provides ballistic, artillery, and mine blast protection to vehicle occupants. The M1114 can protect occupants from 7.62-mm assault rifle armor-piercing rounds and 155-mm artillery airburst, and provides 12 pounds front and 4 pounds rear antitank mine protection. Other protection features include complete perimeter ballistic protection, mine blast protection, and a turret shield for the gunner. Supplemental armor packages are now available for many models of the HMMWV. This armor has been shown to be effective against improvised explosive devices.

Protection Disadvantages

D-50. All models other than the M1114 offer extremely limited protection from direct or indirect fire. Leaders should not plan or direct the use of these vehicles for cover from enemy small arms, indirect fire, or rocket-propelled grenades. Gunners are exposed while manning their weapon system to direct and indirect fire. The lack of internal space causes difficulties if transporting a casualty.

Information Advantages

D-51. The HMMWV has a variety of features that make it excellent for gathering and managing information. The crew and passengers of the HMMWV generally have excellent situational awareness due to a large front windshield and large windows located on the door at each seat. HMMWVs can carry two SINCGARS-class FM radio systems. They can also employ a power amplifier to extend the communications range to 35 kilometers in open terrain. The HMMWV can be configured to carry many digital devices to include the FBCB2 and PLGRs. The weapon systems of the HMMWV can employ sites with night vision, thermal, and range-finding capabilities with high resolution and magnification in some systems.

Information Disadvantages

D-52. Many of the digital and electronic devices of the HMMWV require constant power sources. The need to start the HMMWV to keep the batteries charged can present a tactical problem if stealth is desired during an operation.

SIZE AND WEIGHT CONSIDERATIONS

D-53. Infantry leaders must consider the size and weight of combat vehicles operating in units before conducting an operation (Table D-3). Terrain that supports the movement of Infantrymen may or may not support the movement of combat vehicles. Structures of particular concern are bridges, overpasses, and culverts as structural failure could be deadly to the Soldiers in the vicinity. Many bridges in North America and Europe are marked with signs that state the load bearing capabilities of that structure. In other areas, Infantrymen should rely on route reconnaissance overlays that show the carrying capabilities of the routes being used. In the absence of such information, Infantry leaders should always use the cautious approach and avoid suspect infrastructure.

Table D-3. Vehicle size and weight classification.

Vehicle	Weight	Height (feet)	Width (inches)
M1 Tank	68.7 tons	10.14	143.75
BFV with reactive armor	33 tons	11.3	142.2
BFV without reactive armor	28 tons	11.3	130
Stryker ICV	38,000 lbs.	104	107
ASLT HMMWV	6,780 lbs.	74	85

SURFACE DANGER AREAS

D-54. Infantry leaders must consider the surface danger zones (SDZ) of combat vehicle weapon systems that are operating with their units. This information is crucial for the leaders to develop safe and effective direct fire control plans. Effective application of SDZs prevents fratricide and maximizes direct fire upon the enemy.

D-55. Each weapon system has a unique SDZ. SDZs are the minimum safe distances and angles that must be considered when operating in close proximity to weapon systems. SDZs take into consideration a round's maximum distance, lateral dispersion, and backblast (if applicable). This information allows leaders to plan for safe and effective maneuver of their forces. Reference Section III of this appendix for a detailed analysis of SDZs for weapon systems associated with combat vehicles in this appendix.

TACTICAL CAPABILITIES

D-56. Light Infantry units may have combat vehicle sections attached for combat operations. Table D-4 shows a list of tasks that these combat vehicle sections may perform while attached or under the operational control of Infantry units.

Table D-4. Tasks of combat vehicles in Infantry operations.

Infantry Operations	Combat Vehicle Tasks
Movement to contact	Support by fire; attack by fire; assault; breach; follow and support; reserve; route clearance; convoy escort; checkpoint/roadblock operations.
Attack	Support by fire; attack by fire; assault; breach.
Exploitation	Serve as security force (screen); lead the exploitation (assault or attack by fire).
Pursuit	Serve as enveloping force, reserve (attack by fire or assault), or security force (screen); lead direct pressure force (support by fire, attack by fire, or assault).
Security (screen, guard, cover)	Screen; guard; defend; delay; attack by fire; assault.
Defend	Screen; guard; defend; delay; attack by fire (counterattack); assault (counterattack).
Retrograde (delay, withdraw, retire)	Defend; delay; screen; guard; attack by fire (counterattack); withdraw.
Break out from encirclement	Serve as rupture force (assault or attack by fire) or rear guard (delay).

D-57. Infantry units may be attached to mechanized/armored units during combat operations. Table D-5 shows a list of tasks that Infantry units may perform while attached or under the operational control of combat vehicular units.

Table D-5. Tasks of the Infantry in combat vehicle operations.

Combat Vehicle Operations	Infantry Tasks
Attack by fire	Secure an ABF position (reconnoiter an area or attack); provide local security or act as the blocking force (defend).
Support by fire	Secure an SBF position (reconnoiter an area or attack); provide local security; conduct overwatch/support by fire.
Bypass	Serve as the fixing force (defend); perform linkup with follow-on forces.
Assault	Attack; assault; breach; overwatch/support by fire; knock out a bunker; clear a trench line; clear a building.
Clearance in restricted terrain	Attack; assault; overwatch/support by fire; knock out a bunker; clear a trench line; clear a building; breach, clear AT teams.
Defend	Defend; defend in urban operations/building; construct an obstacle.
Screen/guard	Perform surveillance or screen.
Breach	Breach; overwatch/support by fire; assault.
Hasty water/gap crossing	Cross water obstacles; assault; overwatch/support by fire.
Delay	Delay; break contact.
Withdrawal	Break contact; serve as advance party (assembly area procedures).

TACTICAL MOVEMENT RATES

D-58. Leaders of combat vehicle units often fail to recognize the speed with which the Infantry can move when operating dismounted. Numerous factors can affect the rate of march for the Infantry forces including, tactical considerations, weather, terrain, march discipline, acclimatization, availability of water and rations, morale, and individual loads. Table D-6 summarizes dismounted rates of march for normal terrain. The normal distance covered by an Infantry force in a 24-hour period is from 20 to 32 kilometers, marching from five to eight hours at a rate of 4 kph. A march in excess of 32 kilometers in 24 hours is considered a forced march. Forced marches increase the number of hours marched; not the rate of march.

Absolute maximum distances for dismounted marches are 56 kilometers in 24 hours, 96 kilometers in 48 hours, or 128 kilometers in 72 hours.

Table D-6. Dismounted rates of march (normal terrain).

	ROADS	CROSS-COUNTRY
Day	4.0 kph	2.4 kph
Night	3.2 kph	1.6 kph

Carrying Capacities of Combat Vehicles

D-59. There may be times when combat vehicles and Infantrymen must move quickly from one place to another to accomplish their mission. In such cases, and depending on the enemy threat and the level of training, Infantrymen should ride in or on combat vehicles.

D-60. Riding on the outside of the vehicles is hazardous. Therefore, Infantry should only ride on vehicles when the need for speed is great. By riding on, not in, vehicles, the Infantry gives up its best protection—the ability to move with stealth and avoid detection. Soldiers riding on the outside armored vehicles are vulnerable to all types of fire. Also, Soldiers must watch out for obstacles that may cause tanks to turn suddenly; tree limbs that may knock them off; and for the traversing of the turret gun, which may also knock them off.

D-61. The only advantages the Infantry gains from riding in or on combat vehicles is speed of movement and increased haul capability. In this case, the following apply:

- Avoid riding on the lead vehicle of a section or platoon. These vehicles are most likely to make contact and can react quicker without Soldiers on top.
- Position the Infantry leaders with the combat vehicle leaders. Discuss and prepare contingency plans for chance contact or danger areas. Infantry should dismount and clear choke points or other danger areas.
- Assign air guards and sectors of responsibility for observation. Ensure all personnel remain alert and stay prepared to dismount immediately. In the event of contact, the armored vehicle will immediately react as required for its own protection. The Infantry on top are responsible for their own safety. Rehearse a rapid dismount of the vehicle.
- Consider putting rucksacks, ammunition, and other equipment on vehicles, and have the Infantry move on a separate avenue of approach. This can increase Infantry mobility by allowing them to move through more suitable terrain.

Tanks

D-62. Riding on tanks reduces tank maneuverability and may restrict firepower. Infantrymen may be injured if the tank must slew its turret to return fire on a target. Consequently, Soldiers must dismount to clear danger areas or as soon as enemy contact is made.

D-63. Soldiers ride on tanks by exception and depending on the likelihood of contact. There are several tactical and safety considerations that must be considered before Infantrymen ride on a tank. The M1 series tank is not designed to carry riders easily. Riders must *not* move to the rear deck. Engine operating temperatures make this area unsafe for riders (Figure D-4).

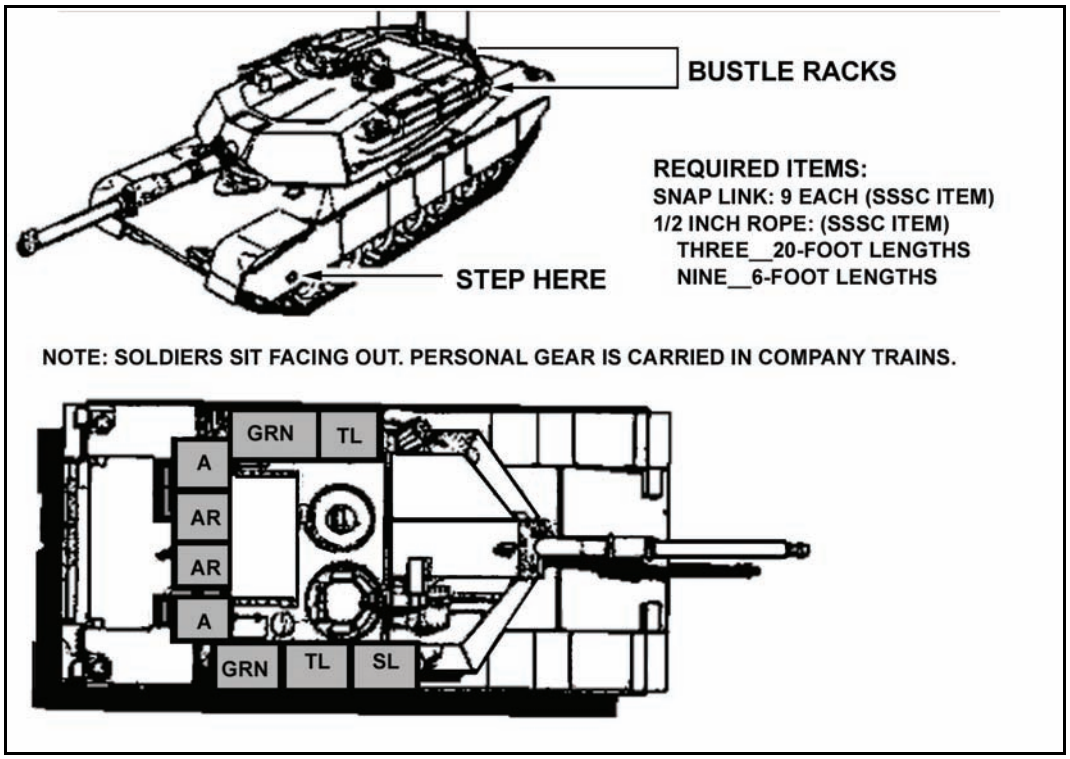

Figure D-4. Mounting and riding arrangements on an M1-series tank.

D-64. One Infantry squad can ride on the turret. Soldiers must mount in such a way that their legs cannot become entangled between the turret and the hull by an unexpected turret movement. Rope may be used as a field-expedient Infantry rail to provide secure handholds.

D-65. Everyone must ride to the rear of the smoke grenade launchers. This automatically keeps everyone clear of the coaxial machine gun and laser range finder.

D-66. The Infantry must always be prepared for sudden turret movement. Leaders should caution Soldiers about sitting on the turret blowout panels. This safety knowledge is critical because 250 pounds of pressure will prevent the panels from working properly. If there is an explosion in the ammunition rack, the panels blow outward to lessen the blast effect in the crew compartment.

D-67. If enemy contact is made, the tank should stop in a covered and concealed position and allow Infantry time to dismount and move away from the tank. This action needs to be practiced before movement.

D-68. The Infantry should not ride with anything more than their battle gear. Personal gear should be transported elsewhere.

Bradley Fighting Vehicle

D-69. The BFV is designed to carry six Infantrymen and a crew of three: a Bradley commander (BC), gunner (GNR), and driver (DVR). The troop compartment of the BFV carries six Infantrymen in combat gear. Rucksacks are generally carried on the outside of the vehicle. Prior to riding in the vehicle, Infantrymen who are not familiar with the BFV should be thoroughly trained on its exit points, fire drills, and rollover drills. The major difference in carrying capacity between the M2A1 and the M2A2/ODS/M2A3 is the seating configuration. The M2A1 has six individual seats, while the M2A2/ODS/M2A3 has two benches that are on the left and right sides of the troop compartment. Figures D-5 and D-6 illustrate the carrying capacity of the BFV-series combat vehicles.

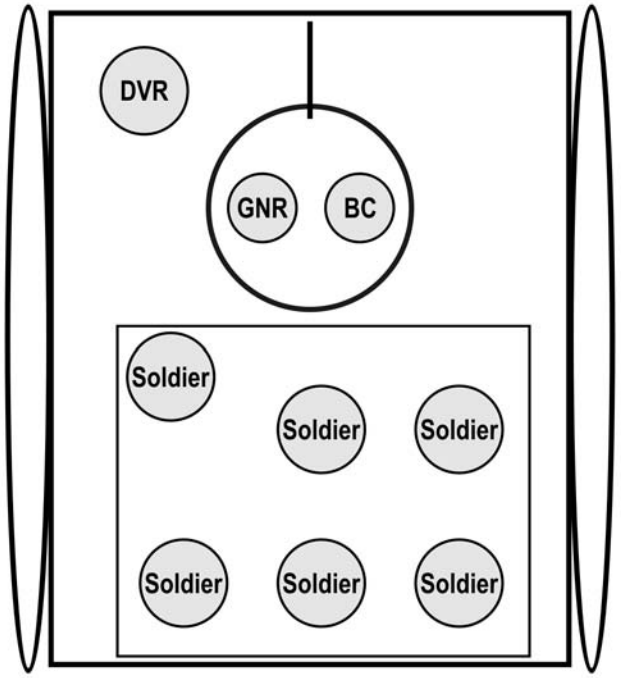

Figure D-5. M2A1 seating diagram.

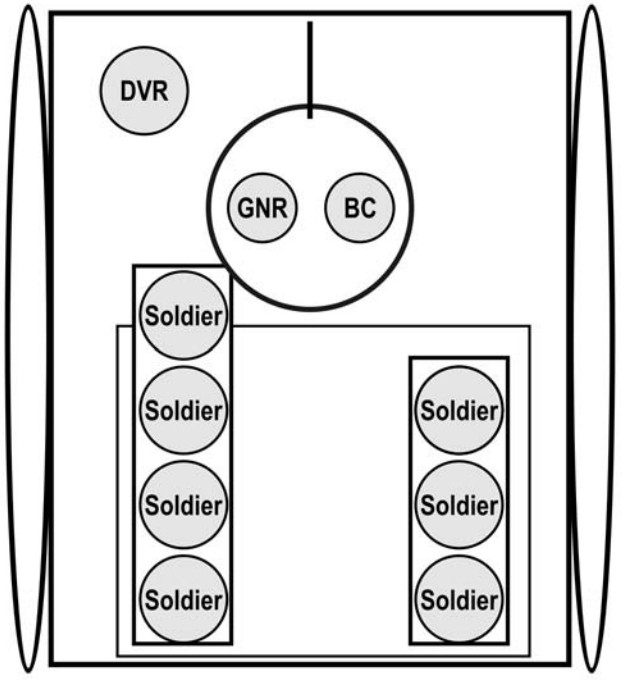

Figure D-6. M2A2, ODS, and M2A3 seating diagram.

Infantry Carrier Vehicle

D-70. The Stryker Infantry carrier vehicle is designed to carry a nine-man Infantry squad in combat gear, a driver, and a vehicle commander (VC). Rucksacks are generally carried on the outside of the ICV.

Infantrymen who are not familiar with the ICV should be thoroughly trained on its exit points, fire drills, and rollover drills prior to riding in the vehicle. Figure D-7 illustrates the carrying capacity of the ICV.

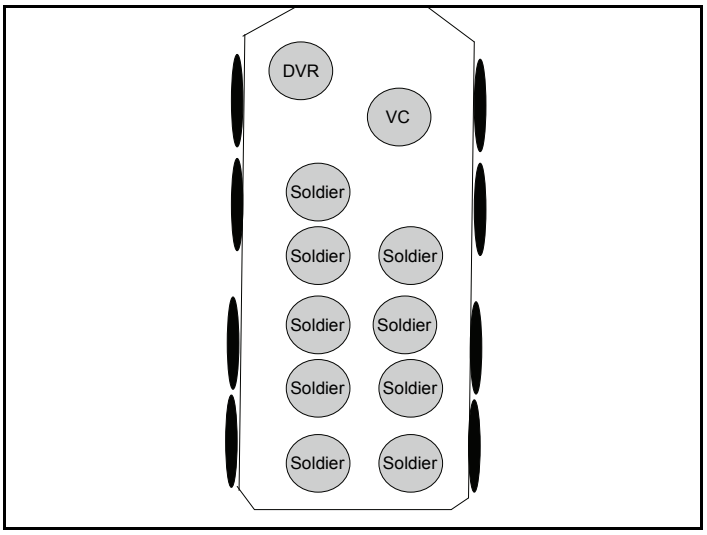

Figure D-7. Seating diagram for the ICV.

Assault HMMWV

D-71. The ASSLT HMMWV class of vehicles is designed to carry five Soldiers in combat gear, a truck commander (TC), a gunner, a driver, and two Soldiers in the rear passenger seats. Rucksacks are generally carried on the outside or in the rear cargo storage area of the ASSLT HMMWV. Infantrymen who are not familiar with the ASSLT HMMWV should be thoroughly trained on its exit points, fire drills, and rollover drills prior to riding in the vehicle. Figure D-8 illustrates the carrying capacity of the ASSLT HMMWV.

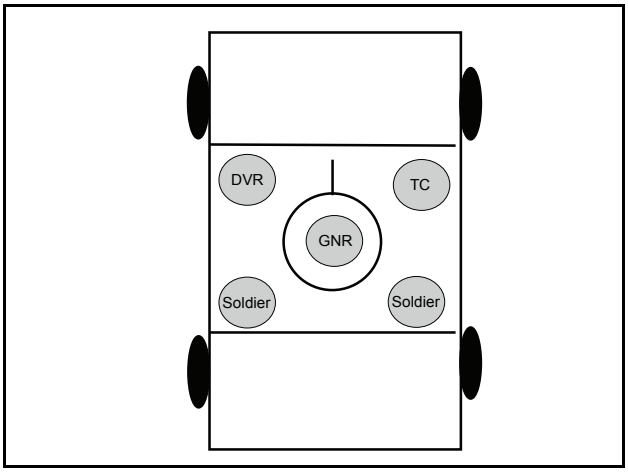

Figure D-8. Seating diagram for the ASSLT HMMWV.

SECTION II — OPERATIONS

D-72. The intent of this section is to familiarize leaders with conducting operations with combat vehicles. The section is divided under three subsections: plan, prepare, and execute.

PLAN

D-73. Employment of combat vehicles requires thorough understanding and integration of the vehicle with the Infantry unit. The following paragraphs focus on planning considerations for combat vehicles and dismounted Infantry integration.

TASK ORGANIZATION OPTIONS

D-74. A combat vehicle platoon or section would normally be OPCONed to an Infantry company during combined arms operations at the company team level. However, in the COE, Infantry platoons may receive combat vehicle platoons or sections to conduct operations. There are four basic techniques of task-organizing the combat vehicle section into the Infantry company for combat operations: combat vehicle platoon as a maneuver element; combat vehicle sections under Infantry control; combat vehicle sections under company and platoon control; and Infantry squads under combat vehicle control. This concept holds true for all combat vehicle units.

Combat Vehicle Platoon as a Maneuver Element

D-75. The combat vehicle platoon leader is responsible for maneuvering the vehicles IAW the company team commander's intent. Likely missions for the combat vehicles with this task organization are support by fire (SBF), or overwatch of the Infantry's movement. The combat vehicle platoon leader can choose to maneuver the platoon by sections to execute the mission. This maneuver provides greater flexibility in supporting the Infantry during the close fight.

Combat Vehicle Sections Under Infantry Platoon Control

D-76. Combat vehicles are broken down into two sections. Each section is placed under the OPCON of an Infantry platoon and maneuvered IAW the company team commander's intent. The commander relinquishes direct control of the combat vehicle maneuver to his subordinates. This technique is very effective in maintaining the same rate of progress between the combat vehicles and the Infantry. Leaders have the additional responsibility of maneuvering combat vehicles. The general lack of experience with combat vehicles and the overall battlefield focus of the leaders can affect this technique. This technique is best suited for when contact with the enemy is expected and close continuous support is required for movement or clearing buildings.

Combat Vehicle Sections Under Company and Platoon Control

D-77. Combat vehicle platoons can be broken down into two sections: one under company control; the other under platoon control. The selected maneuver Infantry platoon would have a combat vehicle section available to support the close fight. With this technique, the company team commander has a combat vehicle section to deploy. This task organization still allows support to the Infantry close fight while keeping additional support options in reserve for the commander to employ. The disadvantages to this technique are Infantry platoon leaders instead of the combat vehicle platoon leaders are maneuvering vehicles, and vehicles directly available to the company team commander are cut in half. This technique requires detailed planning, coordination, and rehearsals between the Infantry and combat vehicle sections.

Infantry Squads Under Combat Vehicle Platoon Control

D-78. The company team commander has the option of placing one or more Infantry squads under the OPCON of the combat vehicle platoon leader. He may also retain all combat vehicles under the control of the combat vehicle platoon leader, or place a combat vehicle section under the OPCON of an Infantry platoon leader. This provides the company team commander with a fourth maneuver platoon. It also involves the combat vehicle platoon leader in the fight. It can work well when a mobile reserve that needs Infantry protection is required.

Guidelines

D-79. None of the techniques described are inherently better than another one. The task organization must be tailored to accomplish the mission. Regardless of the technique selected, the following guidelines should be followed.

D-80. It is preferable for combat vehicles to operate as sections. This is an integral component of how combat vehicle units train and fight. If the company commander is controlling the combat vehicles, he needs to move forward to a position where he can effectively maneuver the combat vehicles in support of the Infantry.

D-81. Combat vehicles should be used to shield squads and teams (minus the unarmored versions of the ASSLT HMMWV) from building to building. As part of the maneuver plan, the leader of the forward element controls the combat vehicles.

D-82. The task organization should support the span of control. If the company commander is going to control the combat vehicles, there is no reason to task-organize the tanks by section under Infantry platoons.

D-83. Combat vehicles need Infantry support when the two elements are working together. Do not leave combat vehicles alone because they are not well suited to provide local security during the operation. Combat vehicles are extremely vulnerable to dismounted attack when operating in urban terrain. They are most vulnerable and need local security when Infantry are in the process of clearing buildings.

RISK MANAGEMENT

D-84. Infantry leaders must identify and implement controls to mitigate risks associated with conducting operations with combat vehicles. These risks are divided into two categories: tactical and accidental risk. Table D-7 contains a basic list of risks and control measures leaders should consider when conducting operations with combat vehicles. Table D-8 contains a list of possible accidental hazards and control measures.

Table D-7. Risk management matrix for tactical hazards.

Tactical Hazards	Control Measure
Enemy Direct Fire	Wear individual body armor (IBA), reinforce vehicle (sand bags), use proper scanning techniques, and engage in marksmanship training.
Enemy Indirect Fire	Practice mounted react to indirect fire drills, vary speed and distance to avoid a trigger from an enemy indirect fire system.
Mines	Maintain situational awareness (SA), maintain current obstacle overlay for AO, remain on cleared areas, be proficient in mine removal.
IEDs	Scan, use WARLOCK (anti-remote-detonation IED system), use up-armor, and avoid predictability.
Sniper Attacks	Scan, maintain SA, avoid predictability, use DVR techniques, engage in tactical movement (MVT) training.
Media Exploitation	Train leaders; refer to PAO; adhere to the ROE, Soldier's Creed, Law of War, and the Geneva Conventions.
VBIED	Gunner and Infantrymen riding on vehicles use proper scanning techniques, maintain SA, avoid predictability, use DVR techniques, and engage in tactical MVT training.
Ambush	Scan, maintain SA, avoid predictability, use DVR techniques, engage in tactical MVT training.

Table D-8. Risk management matrix for accidental hazards.

Accidental Hazards	Control Measure
Vehicle Collision	Ensure DVR is qualified and TC is alert.
Vehicle Fire	Conduct fire drills, keep fire extinguishers present and serviceable, perform proper PMCS.
Vehicle Rollover	Ensure DVR/TC/dismount situational awareness, train and rehearse with vehicles, know SOPs for communication between vehicle and dismounts. Secure loads.
Vehicle Striking Dismount	Train on high decibel danger zones and wear hearing protection.
Vehicle Malfunction	Perform proper PMCS, ensure BDR kit is available.
Hearing Damage	Train on high decibel danger zones and wear hearing protection.
Eye Damage	Verify eye protection during PCI, leaders enforce it during execution.
Burns	Be aware of TOW backblast and high heat exhaust zones, wear gloves when riding or operating equipment and weapons (changing barrels).
Falling From Moving Vehicle	Have proper load plan, use tie downs with snap links (M1 turret), wear seat belts (HMMWV, LMTV, 5-Ton), and ensure DVR is qualified.
Drowning After Water Entry	Train on vehicle exits and ensure Soldiers have passed the Combat Water Survival Test (CWST).
Fratricide by WPN System of Vehicle	Use day/night friendly recognition systems and proper fire control measures.
Disorientation	Ensure map is present, TC is briefed, and graphics are current.

D-85. Many Infantrymen are not familiar with the hazards that may arise during operations with combat vehicles. The most obvious of these include the dangers associated with main-gun fire, and the inability of combat vehicle crews to see people and objects near their vehicles. Leaders of heavy and Infantry units alike must ensure that their troops understand the following points of operational safety.

Discarding Sabot

D-86. Tank 120-mm sabot rounds and 25-mm BFV rounds discard stabilizing petals when fired, posing a downrange hazard for Infantry. The aluminum petals of the tank rounds are discarded in an area extending 70 meters to the left and right of the gun-target line out to a range of 1 kilometer (Figure D-9). The danger zone for plastic debris from BFV rounds extends 60 degrees to the left and right of the gun-target line, and out to 100 meters from the vehicle (Figure D-10). Infantrymen should not be in or near the direct line of fire for the tank main gun or BFV cannon unless they are under adequate overhead cover.

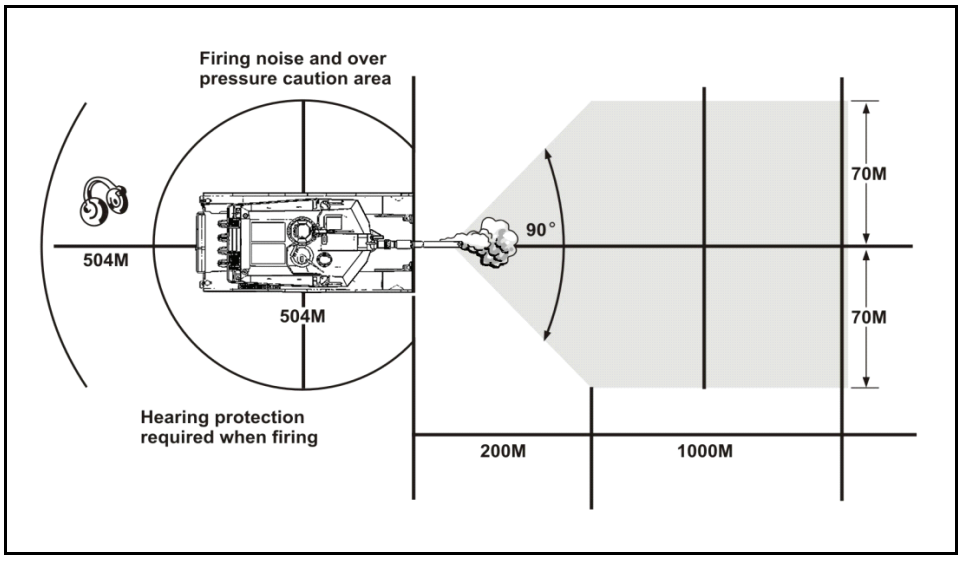

Figure D-9. M1 tank danger zone.

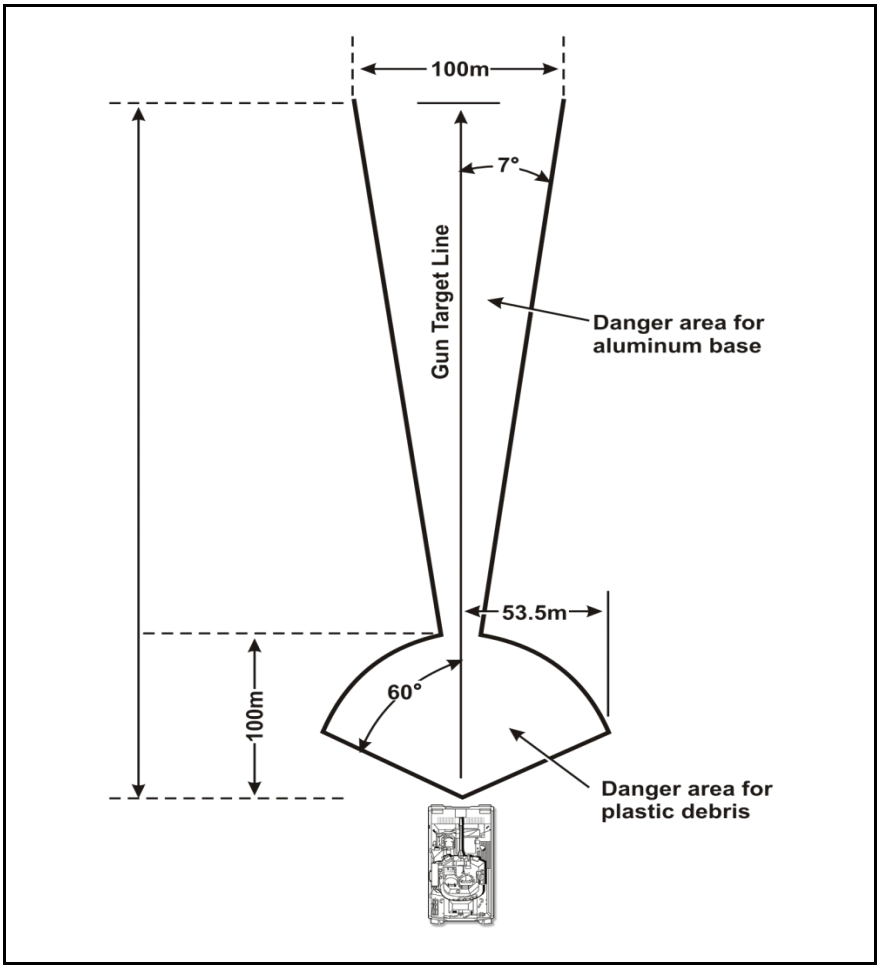

Figure D-10. BFV danger zone.

Ground Movement Hazards

D-87. Crewmen on combat vehicles have very limited abilities to see anyone on the ground to the side or rear of the vehicle. As a result, vehicle crews and dismounted Infantrymen share responsibility for avoiding the hazards this may create. Infantrymen must maintain a safe distance from heavy vehicles at all times. In addition, when they work close to heavy vehicles, Infantry Soldiers must ensure that the vehicle commander knows their location at all times, by establishing communication.

NOTE: Mounted and M1-series tanks are deceptively quiet and may be difficult for Infantrymen to hear as they approach. As noted, vehicle crews and Infantrymen share the responsibility of eliminating potential dangers in this situation.

M1 Exhaust Plume Hazard

D-88. M1-series tanks have an extremely hot exhaust plume that exits from the rear of the tank and angles downward. This exhaust is hot enough to burn skin and clothing. Infantrymen should therefore avoid the rear exhaust of the M1.

TOW Missile System

D-89. The TOW missile system can be employed on the BFV, the ASSLT HMMWV, and the ICV. The system has a dangerous area extending 75 meters to the rear of the vehicle in a 90-degree "cone." The area is divided into a 50-meter danger zone and a 25-meter caution zone (Figure D-11). In the 50-meter zone, serious casualties or fatalities are likely to occur from the blast and flying debris. Soldiers are safe in the 25-meter zone, provided they do not face the aft end of the launcher.

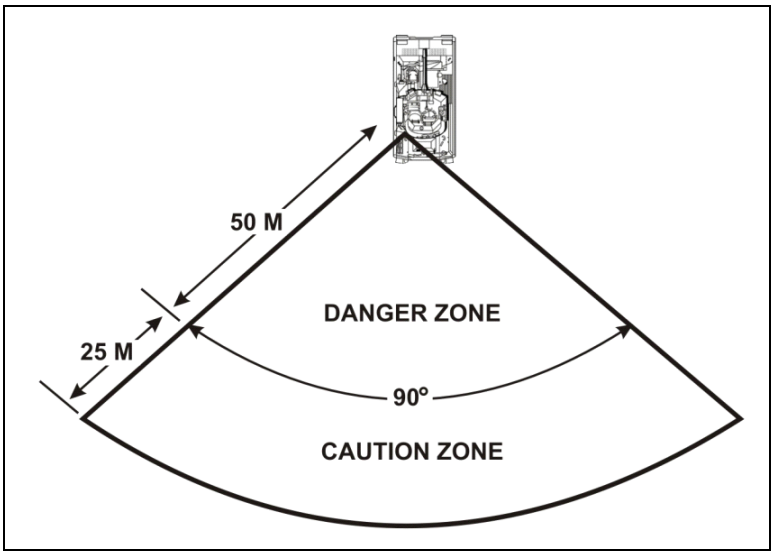

Figure D-11. BFV TOW backblast danger zone.

PREPARE

D-90. Key to planning operations with combat vehicles are rehearsals that gain the trust and confidence of vehicle crews and Infantryman.

REHEARSAL TECHNIQUES

D-91. A rehearsal is a session in which a staff or unit practices expected actions to improve performance during execution (FM 6-0). They are the cornerstone to any successful operation. Leaders are responsible to ensure that all combat vehicles attached to their units are incorporated into rehearsals. Rehearsals should include the tactical movement plan, and actions on the objective. Integration of combat vehicles is crucial because the relationship between vehicle crew men and Infantrymen may not be routine. Thorough rehearsals ensure that—

- Communications are established between the crewmen in the vehicles and Infantrymen prior to execution.
- Infantrymen are familiar with the technical capabilities and tactical movement of the vehicle.
- Vehicle crewmen understand the spatial relationship between the Infantrymen on the ground and their sectors of fire.
- Infantrymen understand the spatial relationship between the combat vehicles on the ground and their sectors of fire.

D-92. Following are five types of rehearsal techniques that can be used with combat vehicles: full-dress, reduced-force, terrain-model, sketch-map, and map.

Full-Dress Rehearsal

D-93. A full-dress rehearsal produces the most detailed understanding of the operation. It involves every participating Soldier, system, and combat vehicle. If possible, organizations execute full-dress rehearsals under the same conditions the force expects to encounter during an actual operation (weather, time of day, terrain—with use of live ammunition). The full-dress rehearsal is the most difficult to accomplish at higher echelons. At those levels, commanders develop a second rehearsal plan that mirrors the actual plan but fits the terrain available for the rehearsal. Mounted rehearsals involve actual movement of the combat vehicles along with the Infantrymen. Advantages of full-dress rehearsals include:

- Maintenance, communications, and weapon systems of the vehicles are checked during the rehearsal.
- Vehicle crewmen and Infantrymen gain a greater understanding of the battle space and spatial relationship of their operations.
- Leaders can ensure their graphic control measures are safe and effective.

D-94. The disadvantage of the full-dress rehearsal is it requires a larger area to conduct properly. Nevertheless, when METT-TC allows, leaders should always conduct a full-dress rehearsal.

Reduced-Force Rehearsal

D-95. A reduced-force rehearsal involves only key leaders of the organization and its subordinate units (squad leaders and vehicle commanders). It normally takes fewer resources than a full-dress rehearsal. Terrain requirements can be the same as for a full-dress rehearsal even though there are fewer participants. The platoon leader first decides the level of leader involvement. The selected leaders then rehearse the plan while traversing the actual or similar terrain. Leaders often use the reduced-force rehearsal technique to rehearse fire control measures for an engagement area during defensive operations. It may be used to prepare key leaders for a full-dress rehearsal, and may require developing a rehearsal plan that mirrors the actual plan, but fits the terrain of the rehearsal.

Terrain-Model Rehearsal

D-96. The terrain-model rehearsal takes less time and fewer resources than a full-dress or reduced-force rehearsal. (A terrain-model rehearsal takes proficient Soldiers to execute to standard.) It is the most popular rehearsal technique. An accurately-constructed terrain model helps subordinate leaders visualize the commander's intent and concept of operations. When possible, leaders place the terrain model where it overlooks the actual terrain of the area of operations (AO). However, if the situation requires more security, they place the terrain model on a reverse slope within walking distance of a point overlooking the AO. The

model's orientation coincides with that of the terrain. The size of the terrain model can vary from small (using markers to represent units) to large (on which the participants can walk). A large model helps reinforce the participants' perception of unit positions on the terrain.

Sketch-Map Rehearsal

D-97. Leaders can use the sketch-map technique almost anywhere, day or night. Procedures are the same as for a terrain-model rehearsal, except the leader uses a sketch map in place of a terrain model. Effective sketches are large enough for all participants to see as each participant walks through execution of the operation. Participants move markers on the sketch to represent unit locations and maneuvers.

Map Rehearsal

D-98. A map rehearsal is similar to a sketch-map rehearsal, except the leader uses a map and operation overlay of the same scale used to plan the operation.

EXCHANGE INFORMATION

D-99. Task organizations of units are likely to change during combat operations. When this occurs, some basic exchange information must occur to ensure success. First, an area must be chosen that provides security for the exchange to take place. The METT-TC may dictate the exchange must occur over FM or digital communications. However, when possible, leaders should meet and speak face to face. General exchange information includes:

- Number of personnel in the unit.
- Number of vehicles in the unit.
- Sensitive items list.
- Weapons capabilities.
- Logistical capability (particularly Class I, III, and V).
- Status/problems with logistics.
- Radio frequencies, call signs, and time hack.
- Graphics and overlays.
- Soldier uniform types.
- Day/night marking systems.
- Enemy situation updates.
- Terrain/route information.

PRECOMBAT CHECKS/PRECOMBAT INSPECTIONS

D-100. Infantry leaders may not always be proficient with the combat vehicles that are attached to their units for combat operations. Nevertheless, leaders are still responsible for ensuring that the combat vehicles and Soldiers in their unit are prepared to begin combat operations. Table D-9 contains a generic pre-execution checklist leaders can use to ensure that combat vehicles in their unit are prepared for combat operations.

Table D-9. Sample vehicle pre-execution checklist.

Vehicle Preparations	• Configured according to the secure load plan (personnel and equipment). • Vehicle refueled. • Water cans full, Class I stowed. • Equipment cleaned and stowed. • First-aid kit/combat-lifesaver bag complete and stowed. • Eye protection (sun, wind, dust goggles) stowed for exposed Soldiers. • Fire extinguisher secured and serviceable. • Slave cable secured and operational (at least one for each vehicle type). • One tow bar or recovery strap stowed for every two like-vehicle types. • Vehicle dispatched, technical manual (TM) present, vehicle tool kit stowed. • Basic load of ammunition stowed. • Rollover drill (water & land) complete. • CASEVAC drill complete. • Fire escape drill complete. • A basic Class IV load stowed (concertina wire, sandbags, pickets). • Battle damage repair kit (BDR) stowed. • Map of AO with current graphic control measures stowed.
Communications Equipment	• Radios operational, mounted, and secured; connections and receptacles cleaned and frequencies set. • Internal communication operational. • Extra hand microphones stowed. • Dismount kit for radios stowed. • Force XXI Battle Command, brigade and below (FBCB2); Blue Force Tracker (BFT); precision lightweight global positioning system receiver (PLGR); and inertial navigational system are operational, loaded with current graphics (if applicable), and communicating with other digital systems. • FM, integrated communications (ICOM), and communications checks are complete with higher, adjacent units, and subordinate units. • Vehicles' internal communication is operational. • Antennas present and operational, connections clean. • COMSEC (ANCD) equipment operational. • Telephones operational and stowed. • OE-254 complete, operational, and stowed. • All required nets entered and monitored.
CBRN	• M11 decontamination apparatus mounted and operational. • Hasty decontamination kit with DS-2 and nitrogen bottles stowed. • Automatic chemical alarm operational and mounted. • M256 kits stowed.
Optics	• Night-vision devices and binoculars cleaned, operational, and stowed for DVR/TC/GNR (night vision goggles [NVGs]) and driver's night vision block (VVS2 for BFV). • Weapons' optics operational, zeroed, clean, with extra batteries (if needed).
Maintenance	• Preventive maintenance checks (-10) and services conducted on all equipment. • DA Form 2404, *Equipment Inspection and Maintenance Worksheet*, completed on all equipment.
Firepower	• Weapons' mounts and turrets are operational and move freely. • Boresight complete (if needed). • All weapons cleaned and test-fired.

Security

D-101. Security must be maintained at all times during combat operations. Combat vehicles and Infantrymen provide complementary effects to one another with respect to security.

Combat Vehicles Securing Infantry

D-102. Combat vehicles can provide security to Infantrymen in many ways. In patrol bases and assembly areas, combat vehicles can use their weapon systems and night vision/thermal sights to provide early detection and a high volume of fire. During movement, combat vehicles can move to the front, rear, or flanks of the Infantry to provide protection from direct fire (tank, BFV, ICV, M1114 ASSLT HMMWV) and antipersonnel mines. They can also use their sights and weapon systems to detect and engage the enemy. On the objective, combat vehicles can dominate the terrain, provide security, and defeat a counterattack while the Infantrymen conduct actions on the objective.

Infantry Securing Combat Vehicles

D-103. Infantrymen can provide security to combat vehicles throughout an operation. In patrol bases and assembly areas, Infantrymen can secure the perimeter while combat vehicles conduct maintenance. During movement, Infantrymen can move to the front, rear, and flanks of combat vehicles to eliminate antiarmor threats and detect antitank mines. Infantrymen also clear defiles and other terrain that restrict the movement of combat vehicles. On the objective, Infantrymen can clear buildings, trenches, and bunkers while conducting EPW searches.

Sustainment

D-104. Infantry leaders should be aware of the robust logistical requirements of combat vehicles during combat operations. Normally, the leaders of attached vehicular units are responsible for bringing the majority of their logistical needs with them due to the austere and very different logistical support system of light Infantry units. Table D-10 provides leaders an overview of some logistical planning factors for combat operations.

Table D-10. Classes of supply considerations for combat vehicles.

Class I	Class I food requirements are determined based on the vehicular unit's personnel strength reports. This process may be complicated by unique mission requirements imposed on the team. This could include rapid changes in task organization or dispersion of subordinate team elements over a wide area.
Class II	Many Class II items required by tank and BFV crews such as specialized tools and flame retardant clothing may be difficult to obtain in a light organization. These items will usually come with the combat vehicles and should be checked by Infantry leaders.
Class III	The fuel and other POL products required by vehicular units are extremely bulky, so they present the greatest sustainment challenges in planning and preparing for light/heavy operations. Transportation support must be planned carefully. Planners must consider the placement of fuel heavy expanded mobility tactical trucks (HEMTTs) during all phases of the operation. Also, leaders must know their locations and the resupply plan. They must focus on general-use POL products such as lubricants that are not ordinarily used by light organizations. Vehicular units should stock their basic load of these items and make necessary resupply arrangements before attachment to the light Infantry unit.

Table D-10. Classes of supply considerations for combat vehicles (continued).

Class IV	Vehicular units do not have any unique requirements for barrier or fortification materials. The main consideration is any Class IV materials the vehicle commanders want may need loading and transport prior to attachment. Infantry leaders should be aware of the increased load capacity of combat vehicles and plan to utilize this asset to carry larger volumes of Class IV items such as sandbags, concertina wire, and pickets.
Class V	Along with POL products, ammunition for vehicular units presents the greatest transportation challenge in light/heavy operations. Class V requirements may include TOW missiles, 120-mm main gun rounds, 25-mm rounds, 40-mm MK19 rounds, .50 cal rounds, 7.62-mm link, 5.56-mm loose, and smoke grenades for smoke grenade launchers. Planning for Class V resupply should parallel that for Class III. Key considerations include anticipated mission requirements, and the availability of HEMTTs. Ammunition may be pre-stocked based on expected consumption rates.
Class VI	Vehicular unit operations create no unique requirements for personal demand items and sundries.
Class VII	Class VII consists of major end items. This includes entire vehicles such as a "float" tanks or BFVs units require as replacements for organic vehicles. The handling of these items requires thorough planning to determine transportation requirements and positioning in the scheme of the operation. Class VII items include smaller, but mission-essential items such as the boresight telescope for the BFV.
Class VIII	Vehicular units involved in light/heavy operations have no unique requirements for medical supplies. However, vehicular units may be capable of carrying more Class VIII supplies and provide standard/non-standard CASEVAC for combat operations.
Class IX	Class IX products (repair parts) are crucial to the sustainment of combat vehicles attached to Infantry units. Repair parts are essential during combat operations. Requirements for items on the team's parts load list (PLL) and ASL must be carefully considered before light/heavy operations begin. The vehicular unit may find it advantageous to prestock selected items in anticipation of its operational needs.

D-105. Combat vehicle sections attached to Infantry units may also receive resupply through a LOGPAC (logistical resupply) from their parent unit. These LOGPACs generally occur in the tailgate or service station method.

D-106. As directed by the commander or XO, the first sergeant establishes the company resupply point. He uses either the service station or tailgate method, and briefs each LOGPAC driver on which method to use. When he has the resupply point ready, the first sergeant informs the commander. The company commander then directs each unit or element to conduct resupply based on the tactical situation.

Service Station Method

D-107. The service station method allows vehicles with their squads to move individually or in small groups to a centrally-located resupply point (Figure D-12). Depending on the tactical situation, a vehicle, section, or platoon moves out of its position, conducts resupply operations, and then moves back into position. This process continues until the entire platoon has received its supplies. When using this method, vehicles enter the resupply point following a one-way traffic flow. Only vehicles that require immediate maintenance stop at the maintenance holding area. Vehicles move through each supply location. The crews rotate individually to eat, pick up mail and sundries, and refill or exchange water cans. When all platoon vehicles and crews have completed resupply, they move to a holding area. There, time permitting, leaders conduct a precombat inspection (PCI).

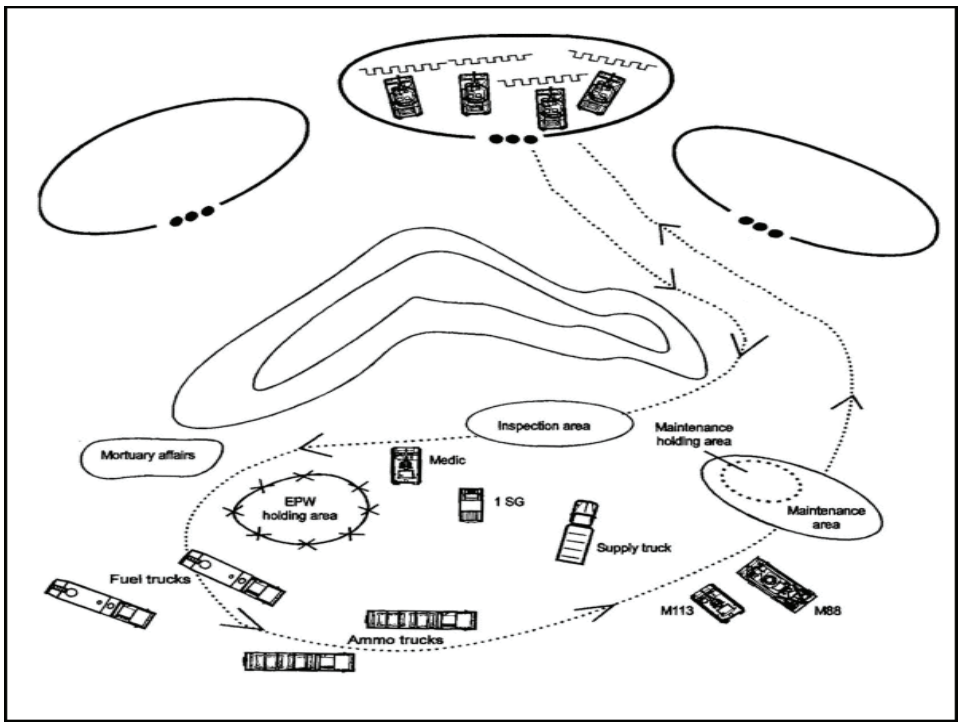

Figure D-12. Service station method.

Tailgate Method

D-108. In assembly areas, the first sergeant normally uses the tailgate method (Figure D-13). Combat vehicles remain in their vehicle positions or back out a short distance to allow trucks carrying Class III and V supplies to reach them. Individual Soldiers rotate through the feeding area. While there, they pick up mail and sundries and refill or exchange water cans. They also centralize and guard any EPW, and take Soldiers killed in action (KIA) and their personal effects to the holding area. Once there, the first sergeant assumes responsibility for them.

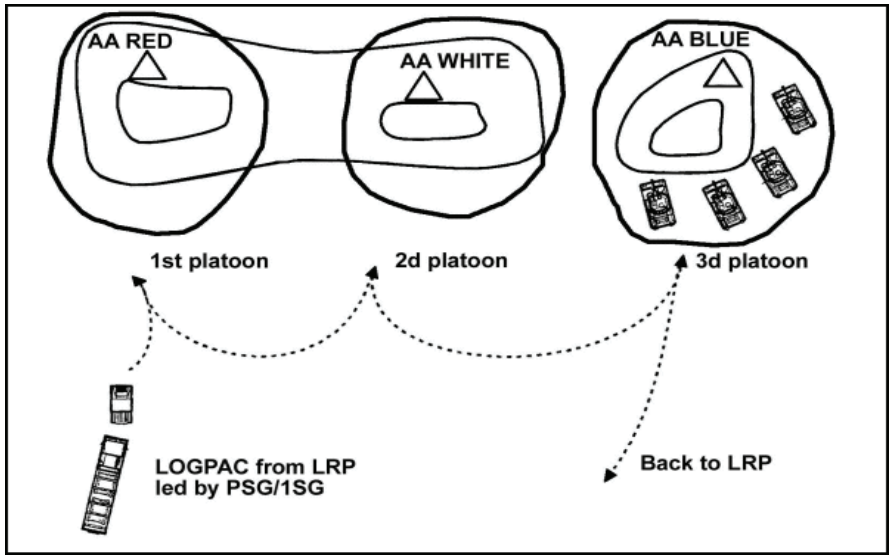

Figure D-13. Tailgate method.

Emergency Resupply

D-109. Occasionally (normally during combat operations), the unit might have such an urgent need for resupply that it cannot wait for a routine LOGPAC. Emergency resupply could involve CBRN equipment as well as Classes III, V, VIII, and water.

Prestock Resupply

D-110. In defensive operations, and at some other times, the unit will most likely need restocked supplies, also known as pre-positioned or "cached" resupply. Normally, the unit only pre-positions Class IV and V items, but they can also pre-position Class III supplies. However, they must refuel platoon vehicles before they move into fighting positions, while first occupying the battle position, or while moving out of their fighting position to refuel.

D-111. All levels must carefully plan and execute prestock operations. Every leader, down to vehicle commanders and squad leaders, must know the exact locations of prestock sites. During reconnaissance or rehearsals, they verify these locations. Leaders take steps to ensure the survivability of prestocked supplies. These measures include selecting covered and concealed positions and digging in the prestock positions. The leader must have a removal and destruction plan to prevent the enemy from capturing pre-positioned supplies.

D-112. During offensive operations, the unit can pre-position supplies on similar combat vehicles well forward on the battlefield. This works well if the unit expects to use a large volume of fire, with corresponding ammunition requirements, during a fast-moving operation.

MAINTENANCE AND RECOVERY

D-113. Recovery operations and maintenance are crucial components of the leader's plan when working with combat vehicles.

Maintenance

D-114. Leaders must plan for regular maintenance halts throughout extended operations. Combat vehicles require regular maintenance to perform consistently throughout combat operations. Combat vehicles can become non-mission capable (NMC) due to a number of variables including, direct and indirect enemy fire, mines and IEDs, vehicle accidents, and parts failure. Infantry leaders should enforce regular preventive maintenance checks and services (PMCS) of all combat vehicles attached to their unit. PMCS is operator-level maintenance conducted before, during, and after equipment operations. Comprehensive PMCS identifies actual and potential problems and ensures repairs are made in a timely manner to minimize vehicle downtime. Early detection and correction of these faults can decrease the possibility of the combat vehicle breaking down during combat operations and prevent minor faults from deteriorating into major faults. It is the vehicle crew's responsibility to conduct PMCS. It is the leader's job to ensure the PMCS is conducted regularly and to standard.

D-115. Leaders should plan vehicle security for the vehicle crews as they conduct PMCS, based on the enemy situation. Additionally, leaders should establish a maintenance rotation to ensure that all of their combat vehicles are not conducting maintenance at the same time. This will maximize the combat power of the unit. Leaders should also—

- Verify that all current and updated technical manuals and references are available or requisitioned for unit assigned equipment.
- Verify that all tools, POL, personnel, and other resources are available for PMCS.
- Observe operators performing PMCS at prescribed intervals.
- Review maintenance forms and reporting procedures for accuracy and completeness.
- Verify that the operator has correctly identified and corrected, or recorded, faults on DA Form 2404, *Equipment Inspection and Maintenance Worksheet*.
- Confirm that NMC faults are corrected before dispatch.

D-116. Leaders should also plan for the possibility of combat vehicles requiring maintenance at a level greater than the crew is equipped or trained to conduct. This often requires specially trained mechanics and equipment that is organic to the parent unit of the combat vehicle attachment. Leaders should plan for two possibilities. One, the maintenance team moves to the combat vehicles. This may require additional security and or escorts from the Infantry. Two, the combat vehicles must move to the maintenance team. Maintenance teams are often located at the parent unit's UMCP (unit maintenance collection point). Infantry leaders may have the responsibility of providing security or escort duties. Additionally, leaders should plan on the NMC vehicles to be absent from their task organization if a major maintenance fault is discovered.

Recovery Operations

D-117. Leaders are responsible for recovery operations that occur within their units. However, leaders should consult the senior officer or non-commissioned officer of the attached vehicular unit for the technical aspects of the recovery operation. Infantry leaders must have a thorough recovery plan that ensures their combat vehicles can be recovered throughout the operation. Recovery operations extricate damaged or disabled equipment and move it to locations where repairs can be made. Recovery is the primary responsibility of the using unit. The primary role of the Infantry during recovery operations is to provide security and assist with the recovery under supervision of the vehicle crew.

D-118. Recovery operations can be very dangerous. Recovery should be conducted under the supervision of the Infantry leader, using the experience and technical competence of the combat vehicle crew. The general rule in recovering a vehicle that is simply NMC in simple terrain is like vehicles can recover each other. For example, tanks recover tanks, and BFVs recover BFVs. However, there are vehicles specifically designed for recovery operations. These vehicles should be used if vehicles become stuck, flipped over, or severely damaged. The M-936 medium wrecker can be used to recover some wheeled vehicles, to include the assault HMMWV. The M88A1 medium recovery vehicle (MRV) is a full-tracked armored vehicle used to perform battlefield rescue and recovery missions. The M88A1 MRV performs hoisting, winching, and towing operations in support of recovery operations and evacuation of heavy tanks and other tracked combat vehicles. It has a fuel/defuel capability and is fully equipped to provide maintenance and recovery support for the main battle tank family and similar vehicles. These functions can be performed in all types of terrain during all weather conditions.

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Appendix E

Helicopter Movement

Infantry platoons may conduct air movement operations to pick up patrols by helicopter, re-supply with helicopters, or evacuate casualties. This appendix discusses general helicopter information including, the five stages of an airmobile operation, how to organize the unit for a helicopter move, and how to select and secure a pickup zone.

SECTION I — CHARACTERISTICS OF HELICOPTERS

E-2. Helicopters most commonly used by Infantry platoons are the UH-60, Blackhawk and the CH-47, Chinook (Table E-1). See FM 90-4, *Air Assault Operations*, for information on air movement and air assault operations, and FM 3-21.38, *Pathfinder Operations*, for information on pathfinder operations.

Table E-1. Helicopter characteristics.

	UH-60A	UH-60L	CH-47D
Passenger capacity (seats in)	11	11	33
Passenger capacity (seats out)	18	18	60
Max cargo weight	8,500 lbs.	8,500 lbs.	26,000 lbs.
Cargo hook capacity	8,000 lbs.	9,000 lbs.	26,000 lbs. (center hook) 17,000 lbs (fore & aft hook) 25,000 lbs (fore & aft hook combined)
NOTE: Actual allowable cargo load (ACL) may be determined by ground and aviation unit commanders.			

CAPABILITIES

E-3. Under normal conditions, helicopters can climb and drop at steep angles. This allows them to fly from and into confines and unimproved areas. Other helicopter capabilities include—

- Transporting cargo as an internal load or external (sling) load and delivering to unit areas not supplied by any other means.
- Overflying or bypassing obstacles or enemy in order to reach objectives otherwise inaccessible.
- Flying at low altitudes to achieve surprise and deceive the enemy using hills and trees for cover and concealment.
- Operating under limited visibility conditions.

E-4. It is ALWAYS preferred to use a helicopter for loading or unloading of troops and equipment. If terrain prevents the helicopters from landing, troops and their combat equipment can be unloaded while hovering a short distance above the ground with troop ladders, rappelling ropes, or fast ropes. If the aircraft can hover low enough, Soldiers may jump out. The troop ladder (or in limited applications- a SPIES rope) can also be used to extract troops when the helicopter cannot land.

LIMITATIONS

E-5. The large amount of fuel used by helicopters may limit their range and allowable cargo load (ACL). Other helicopter limitations include:

- Extreme weather conditions such as fog, hail, sleet, ice, or winds (40 knots or more) and gusty winds (gusts up to 15 knots above a lull) will prevent the use of helicopters.
- Engine and rotor noise may compromise the secrecy of the mission.
- Limited size or number of suitable landing zones (LZs).
- The load-carrying capability of helicopters decreases with increases of pickup zone (PZ)/landing zone (LZ) altitude, humidity, and temperature.
- Vulnerability to enemy air defense systems and small arms fire.

SECTION II —AIRMOBILE OPERATIONS STAGES

E-6. There are five stages to an air movement operation (Figure E-1). The ground tactical plan is the key planning phase. All other planning is conducted in a backward manner from it. The five stages of this reverse planning sequence are—

(1) Ground tactical plan (GTP).
(2) Landing plan.
(3) Air movement plan.
(4) Loading plan.
(5) Staging plan.

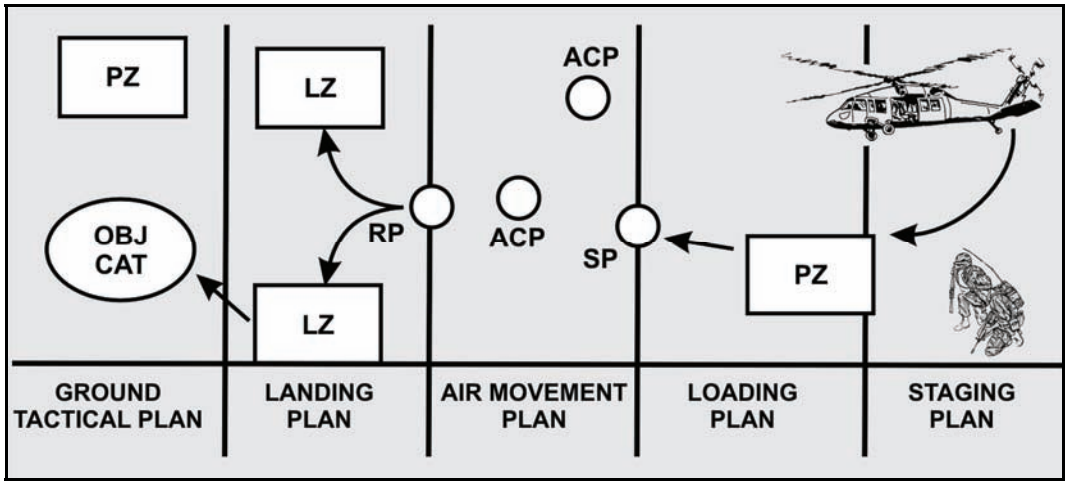


Figure E-1. Air movement through the five stages.

E-7. The ground tactical plan drives the entire mission. Convenience of landing considerations is subordinate to putting units on the ground where they can fight. The five plans tie together in this way:

- The ground tactical plan drives the sequence of arrival and amount of combat power onto the LZs.
- Combat power arriving at available LZs to accomplish the mission becomes the landing plan.
- Moving troops and equipment to LZs on the designated flight routes becomes the air movement plan.
- Getting troops and equipment from current friendly locations to the designated LZs dictate the loading plan and PZ locations.
- The PZ loading plan designates the requirements that become the staging plan to move friendly troops onto the PZ when and where needed.

GROUND TACTICAL PLAN

E-8. The ground tactical plan for an air movement operation contains the same essential elements as other Infantry missions, but differs in one area: it is prepared to capitalize on the speed and mobility of the aircraft to achieve surprise. Units are placed on or near the objective to immediately seize the objective.

The ground tactical commander, in accordance with doctrine and METT-TC, determines his ground tactical plan. The five stages of the reverse planning sequence cannot be developed independently. In addition to standard planning considerations for actions on the objective, the commander's plan should include—

- H-hour times.
- Primary and alternate LZ(s).
- Means of identifying LZ(s).
- Task organization.
- Chalk configurations.
- Special equipment required (such as kick-off bundles, ropes).
- Attack aviation assets available and missions.
- Suppression of enemy air defenses (SEAD).
- Landing formations.
- Offloading procedures.

LANDING PLAN

E-9. Unlike approaching an objective in armored vehicles, Soldiers in helicopters are most vulnerable when landing, and are potentially more vulnerable to enemy fire than if they were on the ground. Suppressive fires are employed to deny the enemy unhindered access to the landing forces, so the timing of fires is critical to the success of the landing.

E-10. The ground tactical commander's plan typically results in two types of landing plans: on the objective (within enemy small arms range), or away from the objective (outside of enemy small arms range). Landing away from the objective is the more common of the two landing plans. The mobility and speed of the helicopters further enables the unit to land to the rear of the objective and aid in the element of surprise and confusion during any subsequent assault. Table E-2 lists factors considered when constructing the landing plan. Regardless of the landing plan used, the Infantry platoon must land ready to fight.

Table E-2. Landing plan considerations.

Factors	Land away from the objective (outside of enemy small arms range) when…	Land on the objective (within enemy small arms range) when…
Mission	The mission is enemy force-oriented.	The mission is terrain-oriented.
Enemy	There is incomplete intelligence on enemy disposition.	There is precise intelligence on enemy dispositions.
Terrain	There is incomplete intelligence on terrain (especially LZs) and weather, or there are no suitable LZs on or near the objective.	There is precise intelligence on terrain (especially LZs) and weather, and there are suitable LZs on the objective.
Troops available	Conditions are not set.	Conditions are set and verified.
Time	There is time available to develop the situation.	Time is critical to secure the objective.
Intent	The unit plan is to arrive at the LZ prepared to move out quickly and ensure rapid advance on objective.	The unit has a plan to establish continuous suppression of any enemy fire immediately upon landing while aggressively assaulting to secure the objective.

E-11. Good PZs and LZs allow for helicopter insertion or extraction without exposing the unit or aircraft to unnecessary risks. Three-hundred-and-sixty-degree security must be maintained at all times. Preparatory and supporting fires are planned to suppress the enemy as the aircraft land on the LZ or the PZ. The control and distribution of all available means to suppress the enemy at a most vulnerable time is imperative. Fires should be focused along the base of the exit tree line (right door exit shoots at the right tree line). Regardless of threat data, suppressive fires are planned, although not necessarily executed, for every primary and alternate PZ or LZ. Whether a PZ or LZ, units establish a defensive posture and employ local security measures as required, shifting as necessary when chalks land or depart.

E-12. The ground tactical commander, in coordination with the supporting aviation unit, selects the location of helicopter PZs and LZs. There are many factors that leaders must consider when choosing appropriate LZs and PZs. These requirements are covered by aviation unit SOPs or are prearranged by the aviation unit commander in coordination with the pathfinder leader. The final decision concerning minimum landing zone requirements rests with the aviation unit commander. Among those factors considered is the number, type and landing formation of the helicopters, surface conditions, obstacles, ground slope, approach and departure route, atmospheric conditions, and type of loads.

NUMBER, TYPE, AND LANDING FORMATION OF THE HELICOPTERS

E-13. The number, type, and landing formation of helicopters determine the minimum landing space requirement and total size of the LZ and PZ. It may be necessary to have two PZs or LZs, or to land the necessary aircraft one at a time. Differing aircraft may have different landing point size requirements. A single UH-60 requires a touch down point (cleared area) of 50 meters in diameter without sling load, and 80 meters with sling load. A CH-47 requires a touchdown point of 80 meters in diameter without sling load, and 100 meters with sling load.

SURFACE CONDITIONS

E-14. The surface at the landing point must be firm enough to keep helicopters from bogging down, raising too much dust, debris, or blowing snow. Troops remove loose debris that may damage the rotor blades or engines.

OBSTACLES

E-15. Helicopters should not land on a landing point that includes obstacles. An obstacle in this case is defined as any object or terrain feature (anything 18 inches high or deep) that could cause damage to the airframe or rotor system of the aircraft, or prevent safe landing. Objects or equipment placed on the PZ/LZ in conjunction with the operation (such as landing lights and slingloads) are not included. Obstructions (for example, rocks, stumps, and holes) that cannot be removed must be clearly marked. Methods of marking obstacles that cannot be cleared for both day and night must also be considered.

GROUND SLOPE

E-16. When the slope is less than 7 percent (4 degrees), helicopters may land in any direction. Where ground slope is from 7 to 15 percent (4 to 8 degrees), aircraft must land and park sideslope or upslope. Helicopters with skids as landing gear may not land, but must terminate at a hover. If ground slope is greater than 15 percent (8 degrees), helicopters cannot land safely, and may sometimes hover to drop off Soldiers or supplies.

APPROACH AND DEPARTURE ROUTES

E-17. The direction of departure and landing should be generally into the wind, over the lowest obstacle, and along the long axis of the LZ. If there is only one satisfactory approach direction because of obstacles or the tactical situation, most helicopters can land with a slight crosswind or tailwind. PZs or LZs should be free of tall trees, telephone and power lines, and similar obstructions on the approach and departure ends. Use an obstacle ratio of 10:1 when determining how much additional space is required for landing and take-off. A helicopter needs 100 meters of horizontal clearance from a 10-meter tree for takeoff or landing.

ATMOSPHERIC CONDITIONS

E-18. As the humidity, altitude and temperature increase, the performance capability of aircraft decrease. This result in greater fuel consumption, lower ACLs, and larger LZ requirements. These limitations/considerations should be highlighted by aviation LNOs during planning.

TYPE OF LOAD

E-19. Most helicopters cannot take off or land vertically when fully loaded, so a larger LZ/PZ and better approach and departure routes may be required for fully loaded aircraft. LZs must be larger for aircraft delivering sling loads compared to aircraft delivering internal loads and Soldiers.

OTHER CONSIDERATIONS

E-20. Other considerations when selecting PZs and LZs include:

- Location in relation to objective.
- Ability of the unit to secure.
- Enemy location, capabilities, and strength.
- Cover and concealment.
- Identification from air.
- Weather and its effect.
- Visibility (darkness, fog, snow, dust, etc)

AIR MOVEMENT PLAN

E-21. Air movement involves flight operations from PZ, to LZ, and back. The Infantry leader and all chalk leaders should maintain the following items:

- A marked air route map.
- Compass/GPS.
- Watch synchronized with the flight crew and ground element.
- Air movement table, PZ sketch, and LZ sketch.
- Call signs and frequencies for all aviation and ground units involved in or around the operation.
- Backpack FM radio.

E-22. The air movement plan includes en-route security for the lift aircraft by attack aviation. It also includes, false insertions to deceive the enemy, suppression of enemy air defense positions along the flight route, and emergency procedures in the event an aircraft is lost en route due to maintenance or enemy fire.

E-23. To maximize operational control, aviation assets are designated as lifts, serials, and loads. A *lift* is all utility and cargo aircraft assigned to a mission. Each time all assigned aircraft pick up troops and/or equipment and set them down on the LZ, one lift is completed. The second lift is completed when all aircraft place their second load on the LZ. There may be times when a lift is too large to fly in one formation. In such cases, the lift is organized into a number of serials. A *serial* is a tactical group of two or more aircraft and separated from other tactical groupings within the lift by time or space. The use of serials may be necessary to maintain effective control of aviation assets when the capacity of available PZs or LZs is limited or to take advantage of available flight routes. The personnel and equipment designated to be moved a single aircraft is called a load or *chalk*. Each chalk must have a chalk leader who ensures that every man in his chalk gets on and off the helicopter, that everything is ready to load, and that everything gets loaded and unloaded correctly. The chalk leader should sit in the aircraft where he can best stay oriented during flight and where he can get off quickly at landing sites to control his men. Figure E-2 shows the relationship between a chalk, serial, and lift.

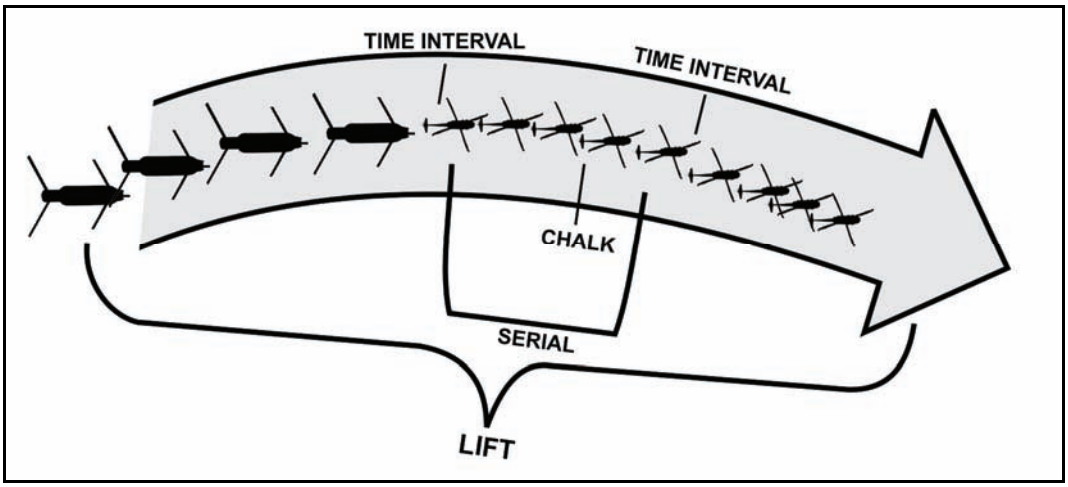
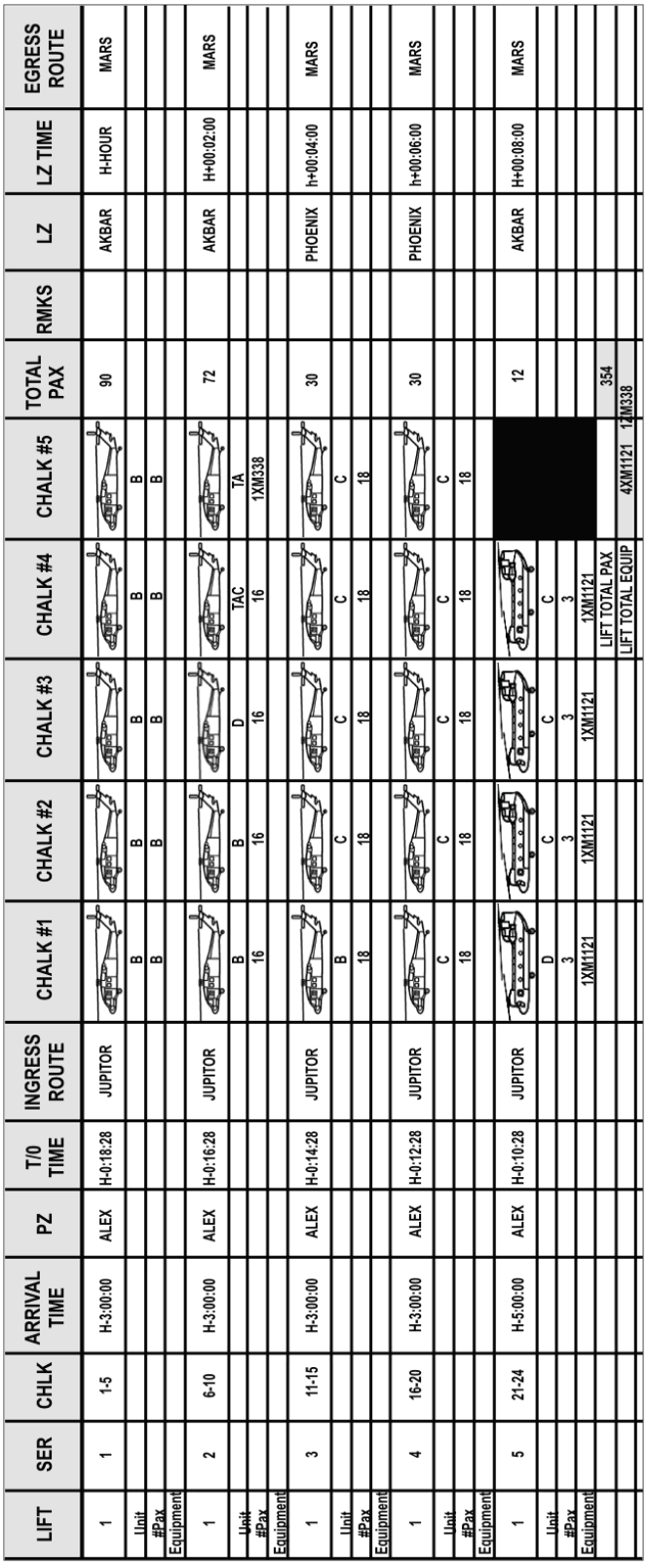


Figure E-2. Lifts, serials, and chalks.

LOADING PLAN

E-24. Air movement operations do not succeed on the PZ, but the failure of the mission can occur there. Therefore, PZs must be established to run efficiently. Assault forces are organized on the PZ, not the LZ. Every serial must be a self-contained force that understands what it must do on landing at either the primary or alternate LZ, and later in executing the ground tactical plan.

E-25. Before an Infantry platoon is lifted by helicopter, it must be organized for the move. The load (amount of men, weapons, equipment, and ammunition) that can be carried by a helicopter varies. It is based on the type of helicopter used, configuration of the helicopter, temperature, altitude of the PZ or LZ, humidity, and fuel load. What can be carried is the allowable cargo load (ACL). This is one of the main factors considered when planning aircraft loads. When the Infantry platoon is alerted for a movement by helicopter, the allowable cargo load will be given to the leader. The unit can then be organized into chalks/loads based on the given allowable cargo load of each type of aircraft. Page E-5 displays an example of a "Tadpole Diagram" (Figure E-3) that is used to plan and organize the chalks and loads.



LIFT	SER	CHLK	ARRIVAL TIME	PZ	T/O TIME	INGRESS ROUTE	CHALK #1	CHALK #2	CHALK #3	CHALK #4	CHALK #5	TOTAL PAX	RMKS	LZ	LZ TIME	EGRESS ROUTE
1	1	1-5	H-3:00:00	ALEX	H-0:18:28	JUPITOR	B	B	B	B	B	90		AKBAR	H-HOUR	MARS
Unit							B	B	B	B	B					
#Pax							16	16	16	16	1XM338					
Equipment																
1	2	6-10	H-3:00:00	ALEX	H-0:16:28	JUPITOR	B	B	D	TAC	TA	72		AKBAR	H+00:02:00	MARS
Unit							B	B	D	TAC	TA					
#Pax							16	16	16	16	1XM338					
Equipment																
1	3	11-15	H-3:00:00	ALEX	H-0:14:28	JUPITOR	B	C	C	C	C	30		PHOENIX	h+00:04:00	MARS
Unit							B	C	C	C	C					
#Pax							18	18	18	18	18					
Equipment																
1	4	16-20	H-3:00:00	ALEX	H-0:12:28	JUPITOR	C	C	C	C	C	30		PHOENIX	h+00:06:00	MARS
Unit							C	C	C	C	C					
#Pax							18	18	18	18	18					
Equipment																
1	5	21-24	H-5:00:00	ALEX	H-0:10:28	JUPITOR	D	C	C	C		12		AKBAR	H+00:08:00	MARS
Unit							3	3	3	3						
#Pax							3	3	3	3						
Equipment							1XM1121	1XM1121	1XM1121	1XM1121						
										LIFT TOTAL PAX		354				
										LIFT TOTAL EQUIP	4XM1121	1XM338				

Figure E-3. Tadpole diagram.

E-26. The leader maintains the tactical integrity and self-sufficiency of each aircraft load as much as possible. He maintains tactical integrity by keeping squads and fire teams intact on chalks and the platoon intact within a serial. He maintains self-sufficiency by loading a machine gun and its ammunition and crew, or an entire antiarmor team on the same aircraft. Key men, weapons, and equipment should be cross-loaded among different aircraft. Platoon leaders and platoon sergeants should fly on separate helicopters. So should machine gun teams. This kind of cross-loading can prevent the loss of control or unit effectiveness in the event a helicopter is lost.

E-27. The leader prepares a load plan for the platoon that tells each man which aircraft he is to get in and who the chalk leader is.

E-28. The chalk leader tells each man in his chalk where to sit, what to do in case of emergency, and what to do when the aircraft lands.

STAGING PLAN

E-29. As part of the staging plan, Soldiers must mark obstacles on the PZ in both day and night operations. In daylight, troops use red panels or other easily seen objects and materials to mark obstacles. In night operations, units use signal lights to avoid security problems. Visible or infrared lights can be used, but the choice must be coordinated with the lift unit. In any case, pilots should be advised of obstacles whether marked or unmarked.

E-30. For a night operation, Soldiers can use flashlights, chemical lights, or expedient devices to show the direction of landing and to mark aircraft landing points. However, pilots cannot see blue or green chemical lights under aviator night vision goggles. Therefore, blue and green chemical lights should be used for Infantry staging purposes only. Always use red, orange, yellow, or infrared for aircraft positions.

E-31. There are many ways to mark a PZ or LZ at night. The inverted "Y" is one way. An inverted "Y" indicates the landing point of the lead aircraft and its direction of approach. The formation used by the aircraft will determine how to place the lights for other aircraft. Table E-3 lists examples of PZ markings during day and night operations.

E-32. Security on the PZ is of the utmost importance. It may be conducted by a separate unit that is not conducting the air movement. At a minimum, the Infantry platoon secures itself and maintains a high state of readiness while awaiting arrival of the aircraft.

E-33. Whenever possible, Infantry platoons should conduct "cold-load" rehearsals prior to conducting an air movement. This can be done on the actual aircraft (best method), or using field expedient methods. Chalk leaders arrange their chalk considering the last one to load the aircraft is the first one off. Soldiers are designated to open/close doors, secure and unload equipment, and understand the direction they will move or secure once getting off the aircraft. If the lift aircraft arrives at the LZ before execution of the mission, the chalk leader should conduct face-to-face coordination with the air crew. This is done to ensure everyone knows the PZ on-load and LZ off-load procedures. It also avoids confusion and speeds actions on the LZ, allowing the aircraft to spend minimal time on the ground. Information that should be coordinated include: which door(s) will be used to load and unload; actions if the aircraft takes enemy fire en route and on the ground; special safety considerations; crash procedures; location of the primary and alternate LZs; direction of landing; time warnings with hand and arm signals inside the aircraft; and any other special mission requirements.

Table E-3. Example PZ marking methods.

Position	Day	Night
PZ entry point for Infantry	NCOIC, signage	NCOIC, two blue chem lights
PZ control point	HMMWV and VS-17 panel	Green chem lights on antennae
Chalk stage points	Guides, signage	Guide, blue chem light
Lead touchdown points	VS-17 panel	Inverted "Y," infrared lights
Aircraft touchdown points	VS-17 panel	Red chem light per aircraft
Obstacles	FM communication	Red chem light ring around obstacle
Loads to be picked up	Hook-up teams stationed on loads	Swinging infrared chem light per load

SECTION III — SAFETY

E-34. Infantry leaders must enforce strict safety measures when working with helicopters. Measures include:

- Avoid the tail rotor. Never approach or depart to the rear of a helicopter except when entering or exiting a CH-47. Approach from 3 or 9 o'clock is preferred when using UH-60s.
- Keep a low body silhouette when approaching and departing a helicopter, especially on slopes.
- Keep safety belts fastened when helicopter is airborne.
- Keep muzzle pointing down and on safe.
- Keep all radio antennas down and secure.
- Keep hand grenades secured.
- Do not jump from a hovering helicopter until told to by an air crew member.

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Appendix F

Obstacle Reduction and Employment

The Army defines mobility operations as "those activities that enable a force to move personnel and equipment on the battlefield without delays due to terrain or obstacles." Infantry units must be able to mass forces quickly at a chosen place and time to accomplish their assigned mission. Mobility is critical to achieving this situation. Mobility operations require the maintenance of force movement activities over great distances for extended periods of time. The Infantry platoon must be proficient in the reduction of obstacles to enable the movement of combat power through any obstacles while continuing to the objective.

Countermobility operations involve the augmentation of existing obstacles through the use of reinforcing obstacles that are integrated with direct- or indirect-fire systems. When employed effectively, this type of operation will disrupt, fix, turn, or block the enemy's ability to maneuver while giving the Infantry platoon opportunities to exploit enemy vulnerabilities. To be effective in countermobility operations, the Infantry platoon must be proficient in the employment of obstacles.

SECTION I — OBSTACLE TYPES AND CATEGORIES

F-1. An obstacle is any obstruction that is designed or employed by friendly or enemy forces to disrupt, fix, turn, or block the movement of the opposing force. Obstacles can impose additional losses in personnel, time, and equipment. It is therefore vital that Infantry leaders and Soldiers be knowledgeable in the various types of obstacles; not only to employ them effectively, but to reduce them when employed by enemy forces.

F-2. This appendix provides information on the types of obstacles (Section I), reduction of enemy obstacles (Section II), and employment of friendly obstacles (Section III). See FM 90-7, *Combined Arms Obstacle Integration*, for complete information on obstacles, and FM 20-32, *Mine/Countermine Operations*, for complete information on mine and countermine operations.

F-3. U.S. forces' employment of certain obstacles, booby traps, and antihandling devices are governed by the Law of Land Warfare and any applicable international laws. Rules governing their employment are also listed in the appropriate sections in this appendix.

F-4. There are four general types of obstacles. Each type is determined by its distinct battlefield purpose and the overall concept of the operation.

(1) P*rotective obstacles* are employed to protect Soldiers, equipment, supplies, and facilities from enemy attacks or other threats.

(2) *Tactical obstacles* directly affect the opponent's maneuver in a way that gives the defending force a positional advantage.

(3) *Nuisance obstacles* impose caution on opposing forces. They disrupt, delay, and sometimes waken or destroy follow-on echelons.

(4) *Phony obstacles* deceive the attacking force concerning the exact location of real obstacles. They cause the attacker to question his decision to breach and may cause him to expend his reduction assets wastefully. Phony minefields are used to degrade enemy mobility and preservefriendly mobility. Intended to simulate live minefields and deceive the enemy, they are used when lack of time, personnel, or material prevents use of actual mines. They may also be used as gaps in live minefields. To be effective, a phony minefield must look like a live

minefield, so Soldiers must bury metallic objects or make the ground look as though objects are buried.

F-5. Obstacles are employed by both friendly and enemy forces. The two main categories of obstacles are:

(1) Existing obstacles.

(2) Reinforcing obstacles.

EXISTING OBSTACLES

F-6. Existing obstacles are those natural or cultural restrictions to movement that are part of the terrain. Existing obstacles can be reinforced into more effective obstacles. They are normally in defilade from enemy observation (located where observation and fires can prevent the opposing force from breaching them), and are difficult to bypass. Existing obstacles include steep slopes, escarpments, ravines, rivers, swamps, deep snow, trees, and built-up areas.

REINFORCING OBSTACLES

F-7. Reinforcing obstacles are used by both friendly and enemy forces to tie together, anchor, strengthen, and extend existing obstacles. Careful evaluation of the terrain to determine its existing obstructing or canalizing effect is required to achieve maximum use of reinforcing obstacles. Installation time and manpower are usually the two most important factors. The four types of reinforcing obstacles are:

(1) Land mines.

(2) Constructed obstacles.

(3) Demolition obstacles.

(4) Improvised obstacles.

LAND MINES

F-8. Land mines are explosive devices that are emplaced to kill, destroy, or incapacitate personnel/ equipment, and to demoralize an opposing force. A mine (or other explosive device) is detonated by the action of its target, the passage of time, or other controlled means (Figure F-1). There are two types of land-based mines: antitank (AT); and antipersonnel (AP). They can be employed in quantity to reinforce an existing obstacle within a specified area to form a minefield, or they can be used individually to reinforce nonexplosive obstacles such as wire. FM 20-32 is the primary reference for mine and countermine operations. See Section II for more information on reducing mine obstacles and Section III for more information on employing them.

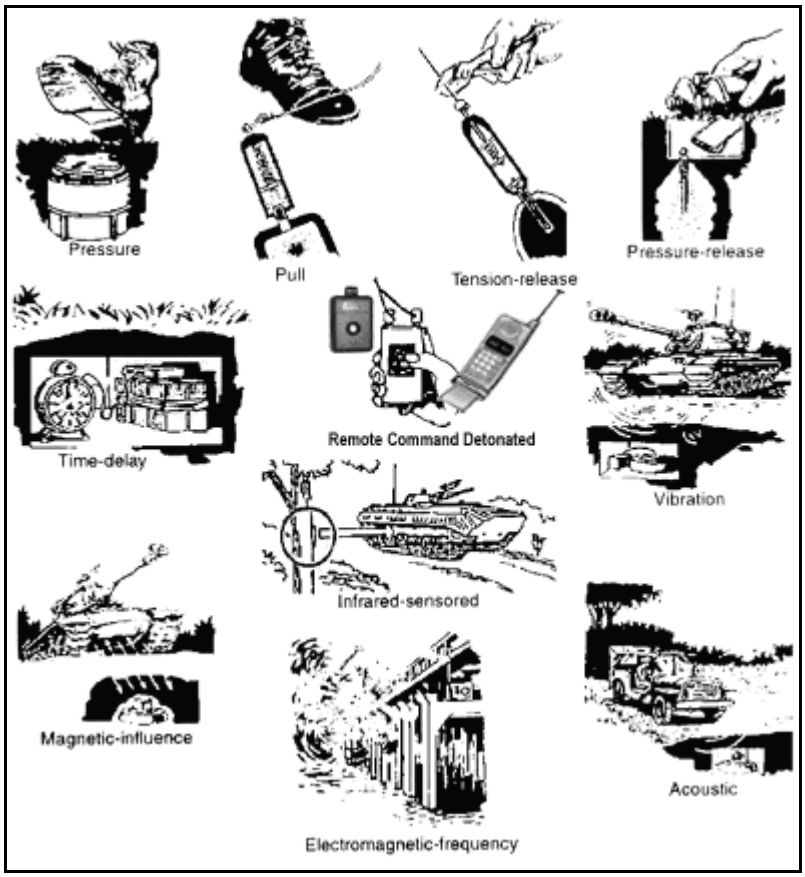

Figure F-1. Methods of actuating explosives.

CONSTRUCTED OBSTACLES

F-9. Units create constructed obstacles with manpower or equipment without the use of explosives. FM 5-34 covers constructed obstacles in detail. Examples of constructed obstacles include:

- **Ditches.** Ditches across roads and trails are effective obstacles. Large ditches in open areas require engineer equipment.
- **Log Hurdles.** Log hurdles act as "speed bumps" on roads.. They are easily installed and are most effective when used in conjunction with other obstacles.
- **Log Cribs.** A log crib is constructed of logs, dirt, and rocks. The logs are used to make rectangular or triangular cribs that are filled with dirt and rock. These are used to block narrow roads and defiles. Unless substantially built, log cribs will not stop tanks.
- **Log Posts.** Log posts embedded in the road and employed in depth can effectively stop tracked vehicles. If they are not high enough to be pushed out of the way, posts can cause a tracked vehicle to throw a track if it tries to climb over. If employed with wire and mines, they can also slow Infantry.
- **Wire Entanglements.** Wire entanglements impede the movement of dismounted Infantry, and in some cases, tracked and wheeled vehicles. Triple standard concertina is a common wire obstacle. However, there are other types, such as double apron, tanglefoot, and general-purpose barbed-tape obstacles. Figures F-2A and F-2B illustrate examples of wire and log obstacles. The materials used in constructing wire entanglements are relatively lightweight (compared to other obstacles) and inexpensive, considering the protection they afford.

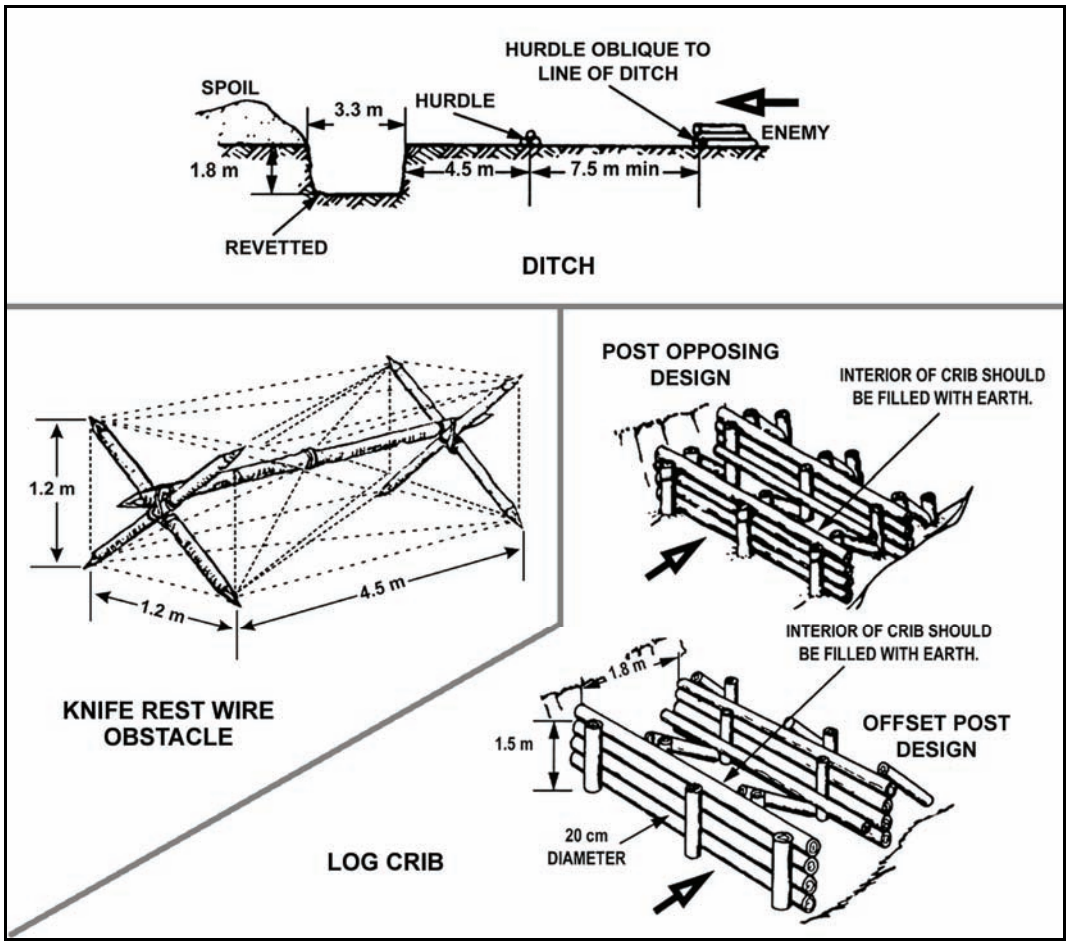

Figure F-2A. Constructed wire and log obstacles.

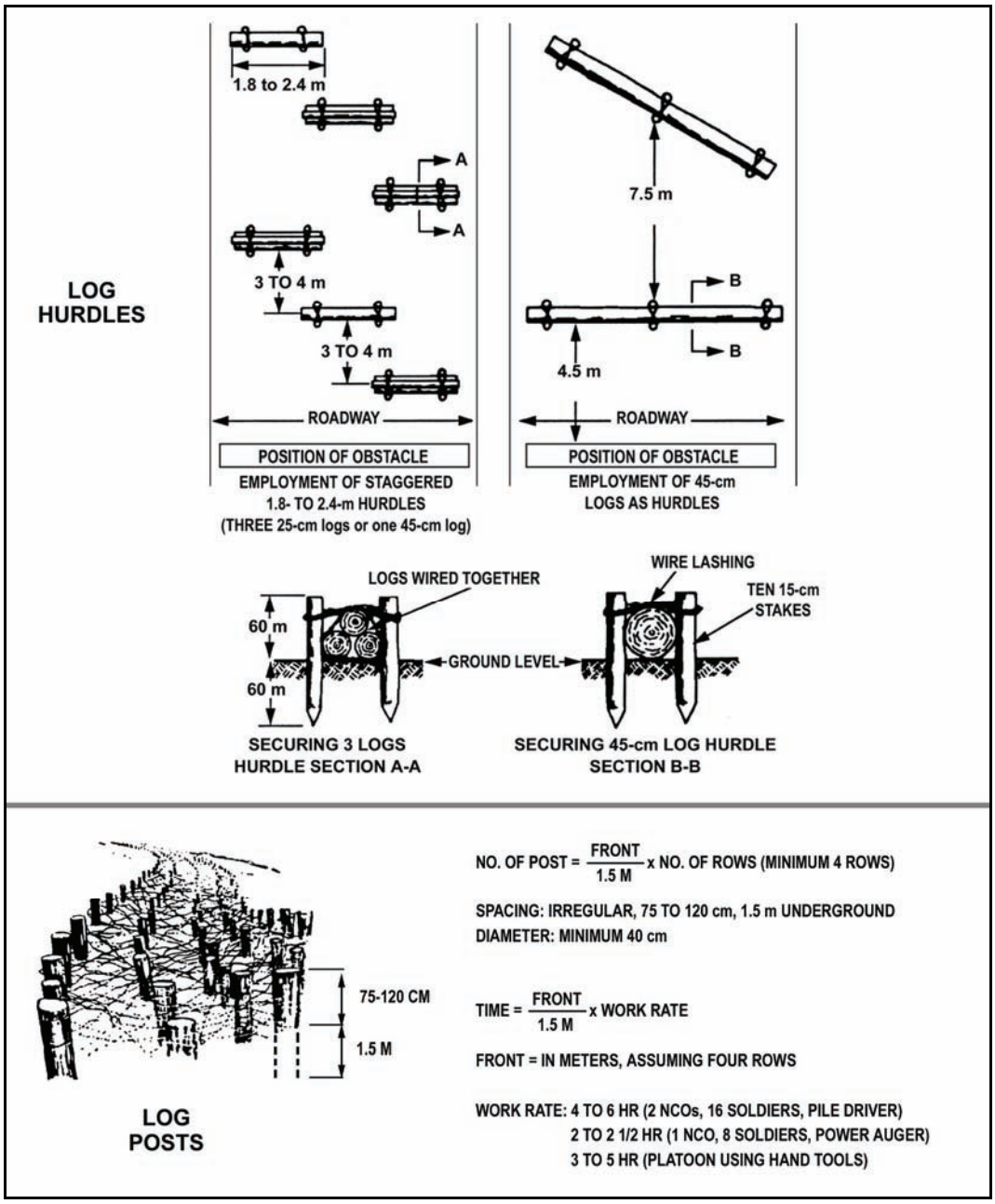

Figure F-2B. Constructed wire and log obstacles.

DEMOLITION OBSTACLES

F-10. Units create demolition obstacles by detonating explosives. FM 5-250, *Explosives and Demolitions*, covers demolitions in detail. There are many uses for demolitions, but some examples are road craters and abatis.

F-11. *Road craters* are effective obstacles on roads or trails if the areas on the flanks of the crater are tied into steep slopes or mined areas. Road craters can compel the opposing force to use earthmoving equipment, blade tanks, or mechanical bridging assets.

F-12. *Abatis* are only effective if large enough trees, telephone poles, or other similar objects are available to stop the opposing force. An abatis is an obstacle created by cutting down trees so their tops are

crisscrossed and pointing toward the expected enemy direction. It is most effective for stopping vehicles in a forest or narrow movement routes. This obstacle may be reinforced with mines.

IMPROVISED OBSTACLES

F-13. Improvised obstacles are designed by Soldiers and leaders with imagination and ingenuity when using available material and other resources. An example of obstacles in urban terrain is shown in Figure F-3. Improvised obstacles include the following:

- **Rubble.** Rubble from selected masonry structures and buildings in a built-up area will limit movement through an area and provide fortified fighting positions.
- **Battle Damage.** Damaged vehicle hulks or other debris are used as roadblocks.
- **Flooding.** Flooded areas are created by opening floodgates or breaching levees.

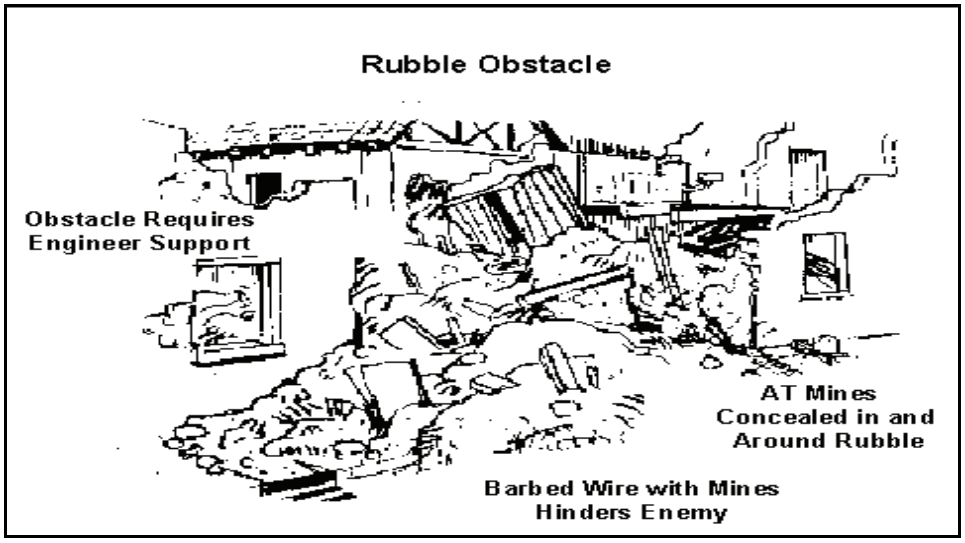

Figure F-3. Urban obstacles.

SECTION II — OBSTACLE REDUCTION

F-14. Suppress, obscure, secure, reduce, and assault (SOSRA) are the breaching fundamentals that must be applied to ensure success when breaching against a defending enemy. These obstacle reduction fundamentals will always apply, but they may vary based on the specific METT-TC situation.

BREACHING FUNDAMENTALS

SUPPRESS

F-15. Suppression is a tactical task used to employ direct or indirect fires or an electronic attack on enemy personnel, weapons, or equipment to prevent or degrade enemy fires and observation of friendly forces. The purpose of suppression during breaching operations is to protect forces reducing and maneuvering through an obstacle. Effective suppression is a mission-critical task performed during any breaching operation. Successful suppression generally triggers the rest of the actions at the obstacle. Fire control measures ensure that all fires are synchronized with other actions at the obstacle. Although suppressing the enemy overwatching the obstacle is the mission of the support force, the breach force should provide additional suppression against an enemy that the support force cannot effectively suppress.

Obscure

F-16. Obscuration must be employed to protect forces conducting obstacle reduction and the passage of assault forces. Obscuration hampers enemy observation and target acquisition by concealing friendly activities and movement. Obscuration smoke deployed on or near the enemy's position minimizes its vision. Screening smoke employed between the reduction area and the enemy conceals movement and reduction activities. It also degrades enemy ground and aerial observations. Obscuration must be carefully planned to provide maximum degradation of enemy observation and fires, but it must not significantly degrade friendly fires and control.

Secure

F-17. Friendly forces secure reduction areas to prevent the enemy from interfering with obstacle reduction and the passage of the assault force through lanes created during the reduction. Security must be effective against outposts and fighting positions near the obstacle and against overwatching units as necessary. The far side of the obstacle must be secured by fires or be occupied before attempting any effort to reduce the obstacle. The attacking unit's higher headquarters is responsible for isolating the breach area by fixing adjacent units, attacking enemy reserves in depth, and providing counterfire support.

F-18. Identifying the extent of the enemy's defenses is critical before selecting the appropriate technique to secure the point of breach. If the enemy controls the point of breach and cannot be adequately suppressed, the force must secure the point of breach before it can reduce the obstacle.

F-19. The breach force must be resourced with enough maneuver assets to provide local security against the forces that the support force cannot sufficiently engage. Elements within the breach force that secure the reduction area may also be used to suppress the enemy once reduction is complete. The breach force may also need to assault to the far side of the breach and provide local security so the assault element can seize its initial objective.

Reduce

F-20. Reduction is the creation of lanes through or over an obstacle to allow an attacking force to pass. The number and width of lanes created varies with the enemy situation, the assault force's size and composition, and the scheme of maneuver. The lanes must allow the assault force to rapidly pass through the obstacle. The breach force will reduce, proof (if required), mark, and report lane locations and the lane-marking method to higher command headquarters. Follow-on units will further reduce or clear the obstacle when required. Reduction cannot be accomplished until effective suppression and obscuration are in place, the obstacle has been identified, and the point of breach is secure.

Assault

F-21. A breaching operation is not complete until—

- Friendly forces have assaulted to destroy the enemy on the far side of the obstacle as the enemy is capable of placing or observing direct and indirect fires on the reduction area.
- Battle handover with follow-on forces has occurred, unless no battle handover is planned.

BREACHING ORGANIZATION

F-22. A commander or platoon leader organizes friendly forces to accomplish breaching fundamentals quickly and effectively. This requires him to organize support, breach, and assault forces with the necessary assets to accomplish their roles. For tactical obstacle breaches, platoons and squads are normally assigned as either one or part of the following forces (Table F-1).

SUPPORT FORCE

F-23. The support force's primary responsibility is to eliminate the enemy's ability to place direct or indirect fire on friendly force and interfere with a breaching operation. It must—

- Isolate the reduction area with fires and establish a support-by-fire position to destroy, fix, or suppress the enemy. Depending on METT-TC, this may be the weapons squad or the entire platoon.
- Mass and control direct and indirect fires to suppress the enemy and to neutralize any weapons that are able to bring fires on the breach force.
- Control obscuring smoke to prevent enemy-observed direct and indirect fires.

Breach Force

F-24. The breach force assists in the passage of the assault force by creating, proofing (if necessary), and marking lanes. The breach force may be a combined-arms force. It may include engineers, reduction assets, and enough maneuver forces to provide additional suppression and local security. The entire Infantry platoon may be part of the breach force. The breach force may apply portions of the following breaching fundamentals as it reduces an obstacle.

Suppress

F-25. The breach force must be allocated enough maneuver forces to provide additional suppression against various threats, including—

- Enemy direct-fire systems that cannot be effectively observed and suppressed by the support force due to the terrain or the masking of the support force's fires by the breach force as it moves forward to reduce the obstacle.
- Counterattacking and or repositioning forces that cannot be engaged by the support force.

Obscure

F-26. The breach force employs smoke pots, if necessary, for self-defense and to cover lanes while the assault force is passing.

Secure

F-27. The breach force secures itself from threat forces that are providing close-in protection of the obstacle. The breach force also secures the lanes through the tactical obstacles once they are created to allow safe passage of the assault force.

Reduce

F-28. The breach force performs its primary mission by reducing the obstacle. To support the development of a plan to reduce the obstacle, the composition of the obstacle system must be an information requirement. If the obstacles are formidable, the Infantry platoon will be augmented with engineers to conduct reduction. Without engineers and special equipment such as Bangalore torpedoes and line charges, mine fields must be probed.

Assault Force

F-29. The breach force assaults through the point of breach to the far side of an obstacle and seizes the foothold. The assault force's primary mission is to destroy the enemy and seize terrain on the far side of the obstacle to prevent the enemy from placing direct fires on the created lanes. The assault force may be tasked to assist the support force with suppression while the breach force reduces the obstacle.

F-30. The assault force must be sufficient in size to seize the point of penetration. Combat power is allocated to the assault force to achieve a minimum 3:1 ratio on the point of penetration. The breach and assault assets may maneuver as a single force when conducting breaching operations as an independent company team conducting an attack.

F-31. If the obstacle is defended by a small enemy force, assault and breach forces' missions may be combined. This simplifies C2 and provides more immediate combat power for security and suppression.

F-32. Fire control measures are essential because support and breach forces may be firing on the enemy when the assault force is committed. Suppression of overwatching enemy positions must continue and other enemy forces must remain fixed by fires until the enemy has been destroyed. The assault force must assume control for direct fires on the assault objective as support and breach force fires are ceased or shifted. Table F-1 illustrates the relationship between the breaching organization and breaching fundamentals.

Table F-1. Relationship between breaching organization and breaching fundamentals.

Breaching Organization	Breaching Fundamentals	Responsibilities
Support force	Suppress Obscure	Suppress enemy direct fire systems covering the reduction area. Control obscuring smoke. Prevent enemy forces from repositioning or counterattacking to place direct fires on the breach force.
Breach force	Suppress (provides additional suppression) Obscure (provides additional obscuration in the reduction area) Secure (provides local security) Reduce	Create and mark the necessary lanes in an obstacle. Secure the near side and far side of an obstacle. Defeat forces that can place immediate direct fires on the reduction area. Report the lane status/location.
Assault force	Assault Suppress (if necessary)	Destroy the enemy on the far side of an obstacle if the enemy is capable of placing direct fires on the reduction area. Assist the support force with suppression if the enemy is not effectively suppressed. Be prepared to breach follow-on and or protective obstacles after passing through the reduction area.

DETAILED REVERSE PLANNING

F-33. The platoon leader must develop the breaching plan using the following sequence when planning for a protective obstacle breach. The platoon leader can plan to breach wire, mine fields, trenches, and craters (Figure F-4).

- Reverse planning begins with actions on the objective.
- Actions on the objective drive the size and composition of the assault force.
- The size of the assault force determines the number and location of lanes to be created.
- The ability of the enemy to interfere with the reduction of the obstacle determines the size and composition of the security element in the breach force.
- The ability of the enemy to mass fires on the point of breach determines the amount of suppression and the size and composition of the support force.

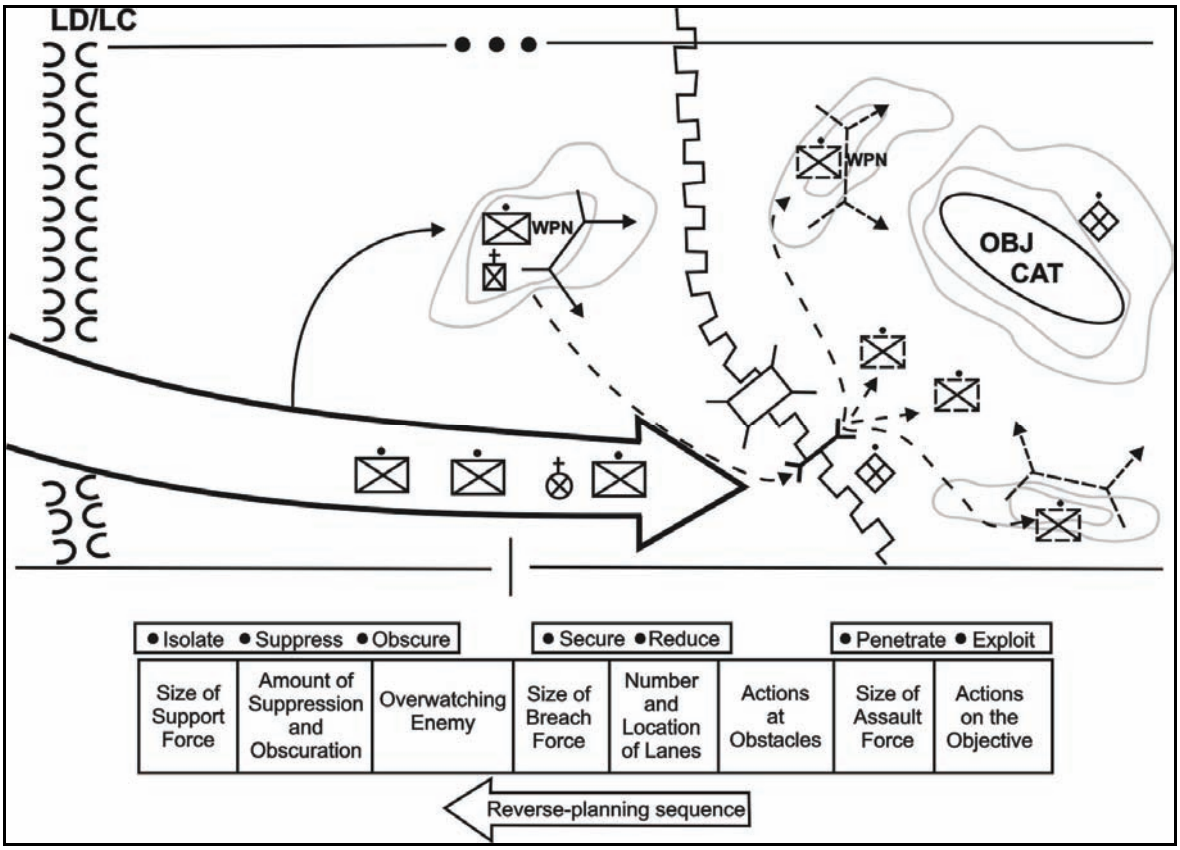

Figure F-4. Reverse planning.

F-34. The approved technique for conducting obstacle breaching operations is suppress, obscure, secure, reduce, assault (SOSRA). The section focuses specifically on platoon reduction techniques of land mines, construction obstacles, urban obstacles, and booby traps and expedient devices.

F-35. As part of reducing obstacles, units must also detect, report, proof, and mark.

F-36. *Detection* is the actual confirmation of the location of obstacles. It may be accomplished through reconnaissance. It can also be unintentional (such as a vehicle running into a mine or wire). Detection is used in conjunction with intelligence-gathering operations, bypass reconnaissance, and breaching/clearing operations. Specific detection methods for mines and booby traps are discussed further in this section.

F-37. Intelligence concerning enemy minefields is *reported* by the fastest means available. A SPOTREP should be sent to higher headquarters when the Infantry platoon or squad has detected a minefield or any other obstacle. This should be done whether they are sent on a specific minefield or obstacle reconnaissance mission, or if they encounter one in the course of normal operations. The SPOTREP should contain as much information as possible including the type, location, and size of the obstacle, and the results of any reduction efforts.

F-38. *Proofing* is normally done by engineers by passing a mine roller or another mine-resistant vehicle through the minefield to verify that a lane is free of mines. If the risk of live mines remaining in the lane does not exceed the risk of loss to enemy fires while waiting, proofing may not be practical. Some mines are resistant to specific breaching techniques. For example, magnetically fused mines may be resistant to some explosive blasts. So proofing should be done when the time available, the threat, and the mission allow. Proofing also involves verifying that other obstacles (such as wire) are free of explosive or injurious devices.

F-39. *Marking* breach lanes and bypasses is critical to obstacle reduction.

REDUCE A MINEFIELD

F-40. Most types of obstacles do not cause casualties directly. Minefields do have this potential, and will cause direct casualties if not reduced effectively. Buried mines are usually found in a highly prepared defense. When training for the reduction of surface-laid and buried minefields, always assume the presence of antihandling devices (AHDs) and trip wires until proven otherwise.

MINEFIELD DETECTION

F-41. The three types of minefield detection methods the platoon might employ are visual, physical (probing), and electronic.

Visual Detection

F-42. Visual detection is part of all combat operations. Soldiers should constantly be alert for minefields and all types of enemy obstacles. Soldiers visually inspect the terrain for the following obstacle indicators:

- Trip wires and wires leading away from the side of the road. They may be firing wires that are partially buried.
- Signs of road repair (such as new fill or paving, road patches, ditching, and culvert work).
- Signs placed on trees, posts, or stakes. Threat forces mark their minefields to protect their own forces.
- Dead animals or damaged vehicles.
- Disturbances in previous tire tracks or tracks that stop unexplainably.
- Odd features in the ground or patterns that are not present in nature. Plant growth may wilt or change color; rain may wash away some of the cover; the cover may sink or crack around the edges; or the material covering the mines may look like mounds of dirt.
- Civilians who may know where mines or booby traps are located in the residential area. Civilians staying away from certain places or out of certain buildings are good indications of the presence of mines or booby traps. Question civilians to determine the exact locations.
- Pieces of wood or other debris on a road. They may be indicative of pressure or pressure-release firing devices. These devices may be on the surface or partially buried.
- Patterns of objects that could be used as a sighting line. An enemy can use mines that are fired by command, so road shoulders and areas close to the objects should be searched.
- Berms may indicate the presence of an AT ditch.

Physical (Probing) Detection

F-43. Physical detection (probing) is very time-consuming and is used primarily for mine-clearing operations, self-extraction, and covert breaching operations. Detection of mines by visual or electronic methods should be confirmed by probing. Detailed probing instructions can be referenced in FM 21-75.

Electronic Detection

F-44. Electronic detection is effective for locating mines, but this method is time-consuming and exposes personnel to enemy fire. In addition, suspected mines must be confirmed by probing. As in probing, 20 to 30 minutes is the maximum amount of time an individual can use the detector effectively.

F-45. The AN/PSS-12 mine detector (Figure F-5) is very effective at finding metallic mines, but is less effective against low-metal mines. Employment and operation procedures for the AN/PSS-12 are discussed in FM 20-32. Technical data is available in TM 5-6665-298-10, *Operator's Manual for Mine Detecting Set AN/PSS-12.* The detector is handheld and identifies suspected mines by an audio signal in the headphones.

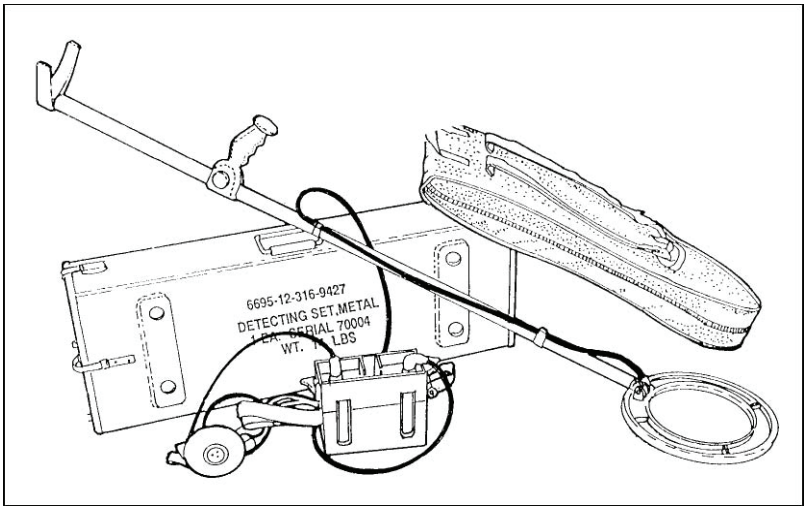

Figure F-5. AN/PSS-12 mine detector.

MINEFIELD REDUCTION AND CLEARING EQUIPMENT

F-46. Minefield reduction and clearing equipment is broken down into explosive, manual, mechanical, and electronic. While chiefly an engineer task, the platoon unit might need to reduce a minefield depending on the situation. The leader masses reduction assets to ensure it will successfully create as many lanes as necessary to ensure the rapid passage of the assault force through the obstacle system. If necessary, the leader must carefully plan and synchronize the creation of additional lanes to reduce the potential for fratricide with assaulting troops. The distance between lanes depends on the enemy, the terrain, the need to minimize the effects of enemy artillery, the direct-fire plan of the support force, C2, and the reduction-site congestion.

F-47. The breach force should be organized and equipped to use several different reduction techniques in case the primary technique fails. Additional reduction assets should be present to handle the unexpected. Normally, 50 percent more reduction assets than required for obstacle reduction are positioned with the breach force. Mechanical and electronic reduction techniques and equipment are employed by engineers and can be found in FM 20-32.

Explosive Minefield Reduction

F-48. FM 20-32 lists all explosive minefield reduction techniques and equipment. The different types of explosive minefield-reduction equipment that the platoon might use to breach obstacles are discussed below.

M1A1/M1A2 Bangalore Torpedo

F-49. The Bangalore torpedo (Figure F-6) is a manually emplaced, explosive-filled pipe designed as a wire breaching device that is also effective against simple pressure-activated AP mines. It is issued as a demolition kit and consists of 10 1.5-meter tubes, 10 connecting sleeves, and 1 nose sleeve. Each tube contains 4 kilograms of HE and weighs 6 kilograms. The kit clears a 1-by 15-meter lane.

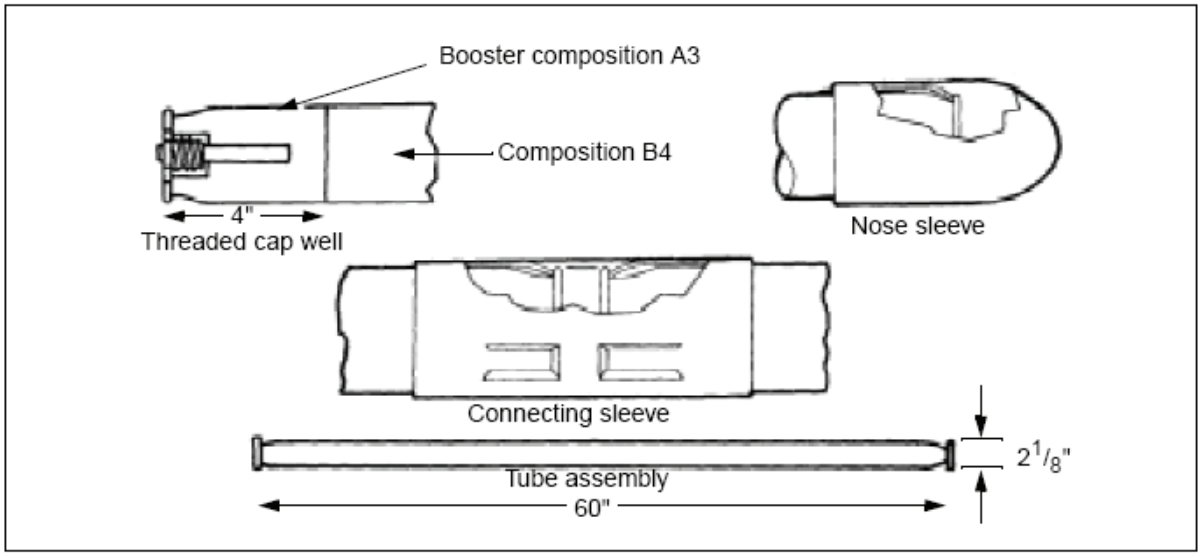

Figure F-6. Bangalore torpedo.

F-50. All torpedo sections have a threaded cap well at each end so they can be assembled in any order. The connecting sleeves are used to connect the torpedo sections together. An individual or pair of Soldiers connect the number of sections needed, and then push the torpedo through the AP minefield before priming the torpedo. A detailed reconnaissance is conducted before using the Bangalore torpedo to ensure trip wires have not been used. The Bangalore torpedo generates one short impulse. It is not effective against pronged, double-impulse, or pressure-resistant AP/AT mines.

WARNING

Do not modify the Bangalore torpedo. Cutting the Bangalore in half or performing any other modification could cause the device to explode.

Antipersonnel Obstacle Breaching System

F-51. The Antipersonnel Obstacle Breaching System (APOBS) (Figure F-7) is a man-portable device that is capable of quickly creating a footpath through AP mines and wire entanglements. It provides a lightweight, self-contained, two-man, portable line charge that is rocket-propelled over AP obstacles away from the obstacle's edge from a standoff position

F-52. For dismounted operations, the APOBS is carried in 25-kilogram backpacks by no more than two Soldiers for a maximum of 2 kilometers. One backpack assembly consists of a rocket-motor launch mechanism containing a 25-meter line-charge segment and 60 attached grenades. The other backpack assembly contains a 20-meter line-charge segment and 48 attached grenades.

F-53. The total weight of the APOBS is about 54 kilograms. It is capable of breaching a footpath about 0.6 by 45 meters and is fired from a 25-meter standoff.

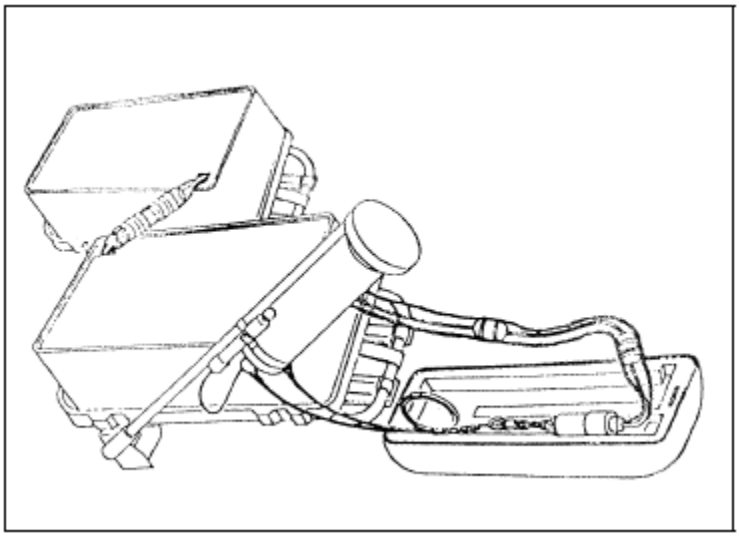

Figure F-7. Antipersonnel obstacle breaching system (APOBS).

Manual Minefield Reduction

F-54. Manual procedures are normally conducted by engineers (but can also be performed by Infantry units) and are effective against all obstacles under all conditions. Manual procedures involve dismounted Soldiers using simple explosives or other equipment to create a lane through an obstacle or to clear an obstacle. These procedures expose the Soldier and may be manpower and time-intensive. While mechanical and explosive reduction procedures are normally preferred, the Infantry platoon may have to use manual procedures for the following reasons:

- Explosive, mechanical, and electronic reduction assets are unavailable or ineffective against the type of obstacle.
- Terrain limitations.
- Stealth is required.

F-55. Different manual reduction techniques for surface-laid and buried minefields are discussed below.

Surface-Laid Minefield

F-56. First use grappling hooks from covered positions to check for trip wires in the lane. The limited range of the tossed hook requires the procedure to be repeated through the estimated depth of the obstacle. A demolition team then moves through the lane. The team places a line main down the center of the lane, ties the line from the explosive into the line main, and places blocks of explosive next to surface-laid mines. After the mines are detonated, the team makes a visual check to ensure that all mines were cleared before directing a proofing roller and other traffic through the lane. Members of the demolition team are assigned special tasks such as grappler, detonating-cord man, and demolitions man. All members should be cross-trained on all procedures. Demolitions are prepared for use before arriving at the point of breach (refer back to Table F-1). The platoon must rehearse reduction procedures until execution is flawless, quick, and technically safe. During reduction, the platoon will be exposed in the lane for five minutes or more depending on the mission, the minefield depth, and the Infantry platoon's level of training.

Buried Minefield

F-57. Manually reducing a buried minefield is extremely difficult to perform as part of a breaching operation. If mine burrows are not easily seen, mine detectors and probes must be used to locate mines. Mines are then destroyed by hand-emplaced charges. As an alternative, mines can be removed by using a grappling hook and, if necessary, a tripod (Figure F-8). Using a tripod provides vertical lift on a mine, making it easier to pull the mine out of the hole.

F-58. The leader organizes Soldiers into teams with distinct, rehearsed missions including grappling, detecting, marking, probing, and emplacing demolitions and detonating cord. The platoon is exposed in the obstacle for long periods of time.

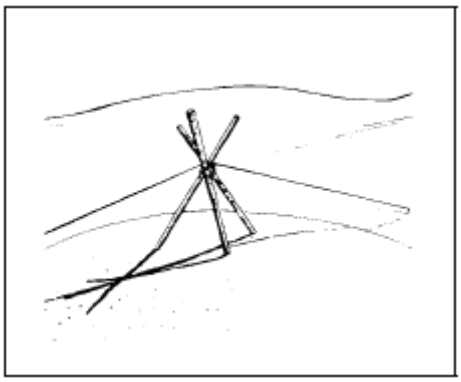

Figure F-8. Tripod.

Grappling Hook

F-59. The grappling hook is a multipurpose tool used for manual obstacle reduction. Soldiers use it to detonate mines from a standoff position by activating trip wires and AHDs. After the grapnel is used to clear trip wires in a lane, dismounted Soldiers can move through the minefield, visually locate surface-laid mines, and prepare mines for demolition. In buried minefields, Soldiers grapple and then enter the minefield with mine detectors and probes.

F-60. Multiple grapplers can clear a lane of trip wires quickly and thoroughly, but they must time their efforts and follow procedures simultaneously. A hit on a trip wire or a pressure fuse can destroy the grappling hook and the cord, so the platoon should carry extras.

F-61. There are two types of grappling hooks: hand-thrown; and weapon-launched.

F-62. **Hand-Thrown.** A 60+-meter light rope is attached to the grappling hook for hand throwing. The throwing range is usually no more than 25 meters. The excess rope is used for the standoff distance when the thrower begins grappling. The thrower tosses the grappling hook and seeks cover before the grappling hook and rope touch the ground in case their impact detonates a mine. He then moves backward, reaches the end of the excess rope, takes cover, and begins grappling. Once the grappling hook is recovered, the thrower moves forward to the original position, tosses the grapnel, and repeats the procedure at least twice. He then moves to the end of the grappled area and repeats this sequence through the depth of the minefield.

F-63. **Weapon-Launched.** A 150-meter lightweight rope is attached to a lightweight grappling hook that is designed to be fired from an M16-series rifle using an M855 cartridge. The grappling hook is pushed onto the rifle muzzle with the opening of the retrieval-rope bag oriented toward the minefield. The firer is located 25 meters from the minefield's leading edge and aims the rifle muzzle at a 30-to 40-degree angle for maximum range. Once fired, the grappling hook travels 75 to 100 meters from the firer's position. After the weapon-launched grappling hook (WLGH) has been fired, the firer secures the rope, moves 60 meters from the minefield, moves into a prone position, and begins to grapple. The WLGH can be used only once to clear a minefield, but it can be reused up to 20 times for training because blanks are used to fire it.

Demolitions

F-64. Different types of demolitions can be used for minefield obstacle reduction (Table F-2). FM 5-250 covers each different type of demolition available to support all Infantry missions. Demolitions are used differently against certain types of mines:

- **Pressure-Fused AP Mine.** Place at least a 1-pound charge within 15.2 centimeters of simple pressure-fused mines. Ensure that the charge is placed within 2.54 centimeters of blast-hardened mines.

- **Trip-Wire/Break-Wire-Fused AP Mine.** Place at least a 1-pound charge within 15.2 centimeters of the mine after the mine at the end of a trip wire has been located. Soldiers can use elevated charges if necessary against the Claymore and stake-type mines.
- **Influence-Fused AP Mine.** Do not use demolitions.
- **Command-Detonated Blast Mine.** Ensure that the observer is neutralized before approaching. Elevated charges can be used if necessary against Claymore mines.

Table F-2. Demolitions.

Item	Description
M183 Satchel Charge	Consists of 16 M112 (C4) charges and four priming assemblies. Total explosive weight of 20 pounds. Used primarily for breaching obstacles or demolishing structures when large charges are required. Also is effective on smaller obstacles such as small dragon's teeth.
M112 Charge	Consists of 1.25 pounds of C4 packed in an olive drab Mylar film container with a pressure-sensitive adhesive tape on one surface. Primarily used for cutting and breaching. Because of its ability to cut and be shaped, the M112 is ideally suited for cutting irregularly-shaped targets such as steel. The adhesive backing allows you to place the charge on any relatively flat surface.
Modernized Demolition Initiator (MDI)	MDI is a new family of nonelectric blasting caps and associated items. Components simplify initiation systems and improve reliability and safety. Components include the M11 high strength blasting cap, the M12 and M13 low strength blasting caps, and the M14 high strength time delay cap.
Detonating Cord	Consists of a core of HE (6.4 pounds of PETN per 1,000 feet) wrapped in a reinforced and waterproof olive drab coating. Can be used to prime and detonate single or multiple explosive charges simultaneously. Can be used in conjunction with the MDI components.

MARKING AND CROSSING THE MINEFIELD

F-65. Effective lane marking allows the leader to project the platoon through the obstacle quickly with combat power and C2. It also gives the Infantry platoon or squad confidence in the safety of the lane and helps prevent unnecessary minefield casualties.

F-66. Once a footpath has been probed and the mines marked or reduced, a security team should cross the minefield to secure the far side. After the far side is secure, the rest of the unit should cross. If mines and any trip wires have been identified but not reduced, the mine and the line of the trip wire are marked along the ground surface, 12 inches before the trip wire (Figure F-9).

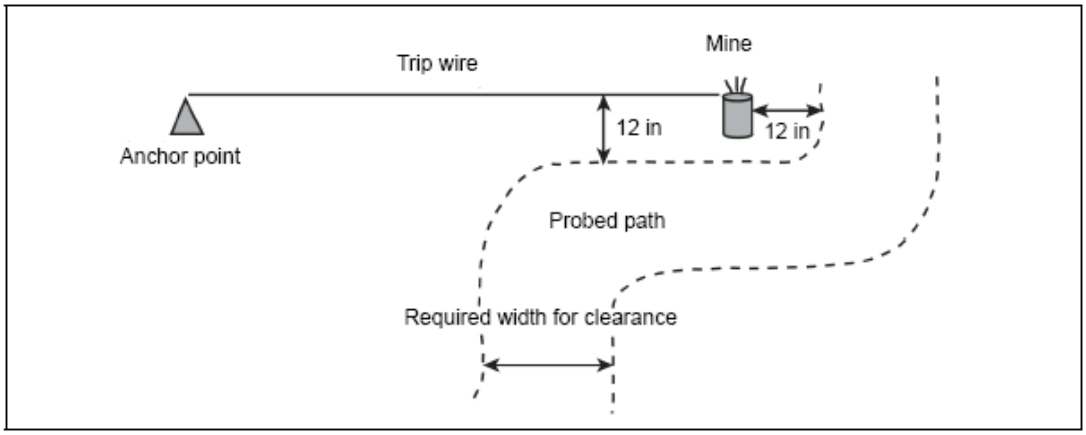

Figure F-9. Marking a footpath.

REDUCE A CONSTRUCTED OBSTACLE

F-67. Reduction methods for enemy wire and tank ditch obstacles are as follows.

REDUCE A WIRE OBSTACLE

F-68. The enemy uses wire and concertina obstacles to separate Infantry from tanks and to slow or stop the Infantry movement. His wire obstacles are similar to ours. On patrol, reducing a wire obstacle may require stealth and is conducted using wire cutters or by crawling under or crossing over the wire. It may not require stealth during an attack and can be accomplished with Bangalore torpedoes and wire cutters.

Cut the Wire

F-69. To cut through a wire obstacle with stealth—

- Cut only the lower strands and leave the top strand in place. That makes it less likely that the enemy will discover the gap.
- Cut the wire near a picket. To reduce the noise of a cut, have another Soldier wrap cloth around the wire and hold the wire with both hands. Cut part of the way through the wire between the other Soldier's hands and have him bend the wire back and forth until it breaks. If you are alone, wrap cloth around the wire near a picket, partially cut the wire, and then bend and break the wire.

F-70. To reduce an obstacle made of concertina—

- Cut the wire and stake it back to keep the breach open.
- Stake the wire back far enough to allow room to crawl through or under the obstacle.

Bangalore Torpedo

F-71. After the Bangalore torpedo has been assembled and pushed through the wire obstacle, prime it with either an electric or nonelectric firing system (Figure F-10). To prevent early detonation of the entire Bangalore torpedo if you hit a mine while pushing it through the obstacle, attach an improvised (wooden) torpedo section to its end. That section can be made out of any wooden pole or stick that is the size of a real torpedo section. Attach the nose sleeve to the end of the wooden section. Once the Bangalore torpedo has been fired, use wire cutters to cut away any wire not cut by the explosion.

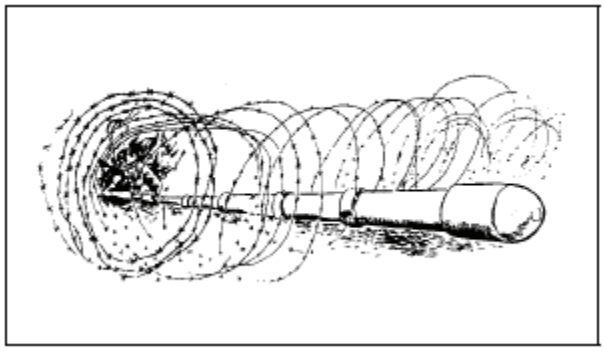

Figure F-10. Reducing wire obstacles with bangalore torpedos.

REDUCE AN URBAN OBSTACLE

F-72. Understanding how to employ and incorporate reduction techniques is an important part of urban operations. Gaining quick access to targeted rooms is integral to room clearing. Reduction teams need to be supported by fires or obscurants. Reduction operations should be performed during hours of limited visibility whenever possible. Reduction techniques vary based on construction encountered and munitions available.

F-73. The assault team's order of march to the breach point is determined by the method of reduction and its intended actions at the entry point. This preparation must be completed prior to or in the last covered and concealed location before reaching the entry point. Establishing an order of march aids the team leader with C2 and minimizes exposure time in open areas and at the entry point. One order of march technique is to number the assault team members one through four. The number-one man should always be responsible for frontal and door security. If the reduction has been conducted prior to its arrival, the assault team quickly moves through the entry point. If a reduction has not been made prior to its arrival at the entry point, depending on the type of breach to be made, the team leader conducts the reduction himself or signals forward the breach man or element. One option is to designate the squad leader as the breach man. If the breach man is part of the assault team, he will normally be the last of the four men to enter the building or room. This allows him to transition from his reduction task to his combat role. See FM 3-06.11, *Combined Arms Operations in Urban Terrain,* for more information on movement and breaching methods.

F-74. The three urban reduction methods discussed in this appendix are mechanical, ballistic, and explosive.

BREACH LOCATIONS

F-75. The success of the assault element often depends on the speed with which they gain access into the building. It is important that the breach location provide the assault element with covered or concealed access, fluid entry, and the ability to be overwatched by the support element.

Creating Mouseholes

F-76. Mouseholes provide a safe means of moving between rooms and floors. C4 plastic explosive can be used to create mouseholes when lesser means of mechanical reduction fail. Because C4 comes packaged with an adhesive backing or can be emplaced using pressure-sensitive tape, it is ideal for this purpose. When using C4 to blow a mousehole in a lath and plaster wall, one block or a strip of blocks should be placed on the wall from neck-to-knee height. Charges should be primed with detonating cord or MDI to obtain simultaneous detonation that will blow a hole large enough for a man to fit through.

Expedient Reduction Methods

F-77. Because the internal walls of most buildings function as partitions rather than load-bearing members, smaller explosive charges can be used to reduce them. When C4 or other military explosives are not available, one or more fragmentation grenades or a Claymore mine can be used to reduce some internal walls. These field-expedient reduction devices should be tamped to increase their effectiveness and to reduce the amount of explosive force directed to the rear. Take extreme care when attempting to perform this type of reduction because fragments may penetrate walls and cause friendly casualties. If walls are made of plaster or dry wall, mechanical reduction may be more effective.

Windows and Restrictive Entrances

F-78. Regardless of the technique used to gain entry, if the breach location restricts fundamental movement into the room or building, local or immediate support must be used until the assault team can support itself. For example, as a Soldier moves through a window and into the room, he may not be in a position to engage an enemy. Therefore, another window that has access to the same room may be used to overwatch the lead team's movement into the room. The overwatching element can come from the initial clearing team or from the team designated to enter the breach location second.

MECHANICAL REDUCTION

F-79. This method requires increased physical exertion by one or more Soldiers using hand tools such as axes, saws, crowbars, hooligan's tools, or sledgehammers to gain access. Although most Soldiers are familiar with these tools, practice on various techniques increases speed and effectiveness. The mechanical reduction is not the preferred primary breaching method because it may be time consuming and defeat the

element of surprise. However, the ROE and situation may require the use of these tools, so Soldiers should be proficient in their use.

F-80. Typically, the order of movement for a mechanical breach is the initial assault team, followed by the breach man or element. At the breach point, the assault team leader brings the breach team forward while the assault team provides local security. After the reduction is conducted, the breach team moves aside and provides local security as the assault team enters the breach. See FM 3-06.11 for additional information concerning mechanical reduction and breaching.

F-81. When developing an urban operations mechanical breach kit SOP, Infantry units must consider their METL and the unit tactical SOP.

BALLISTIC REDUCTION

F-82. Ballistic reduction requires the use of a weapon firing a projectile at the breach point. Ballistic reduction is not a positive means of gaining entry and should not be considered the primary method for gaining initial entry into a structure. It may not supply the surprise, speed, and violence of action necessary to minimize friendly losses on initial entry. In certain situations, it may become necessary to use ballistic reduction as a back-up entry method. A misfire of an explosive charge or the compromise of the assault element during its approach to the target may necessitate the use of ballistic reduction as a means of initial entry into the structure. Ballistic reduction may have to be followed up with a fragmentation, concussion, or stun grenade before entry.

F-83. Once initial entry is gained, shotgun ballistic reduction may become the primary method for gaining access to subsequent rooms within the structure. Surprise is lost upon initial entry, and other reduction methods are often too slow, tending to slow the momentum of the assault team. If a door must be used for entry, several techniques can be used to open the door. Doors should be considered a fatal funnel because they are usually covered by fire, or may be booby-trapped. See FM 3-06.11 for more information concerning weapon employment and effects.

F-84. Unless a deliberate breach is planned, the platoon can employ a series of progressive reductions. An example is an attempt to open a door by using the doorknob first, then shotgun reduction, then explosive reduction as a final option. Mechanical reduction can be used to clean up a failed attempt of a shotgun or explosive reduction, but can also be used as the primary reduction technique. Based on the multiple situations that the complex urban environment presents, the leader needs latitude in his options.

Exterior Walls

F-85. For exterior walls, the use of a BFV or artillery piece in the direct fire role is ideal if the structure will support it and if the ROE will allow it. The BFV's 25-mm cannon is an effective reduction weapon when using HE rounds and firing a spiral firing pattern (Figure F-11). The main gun of an M1A1/A2 tank is very effective when using the high explosive antitank (HEAT) round. However, the armor-piercing discarding-sabot (APDS) round rarely produces the desired effect because of its penetrating power.

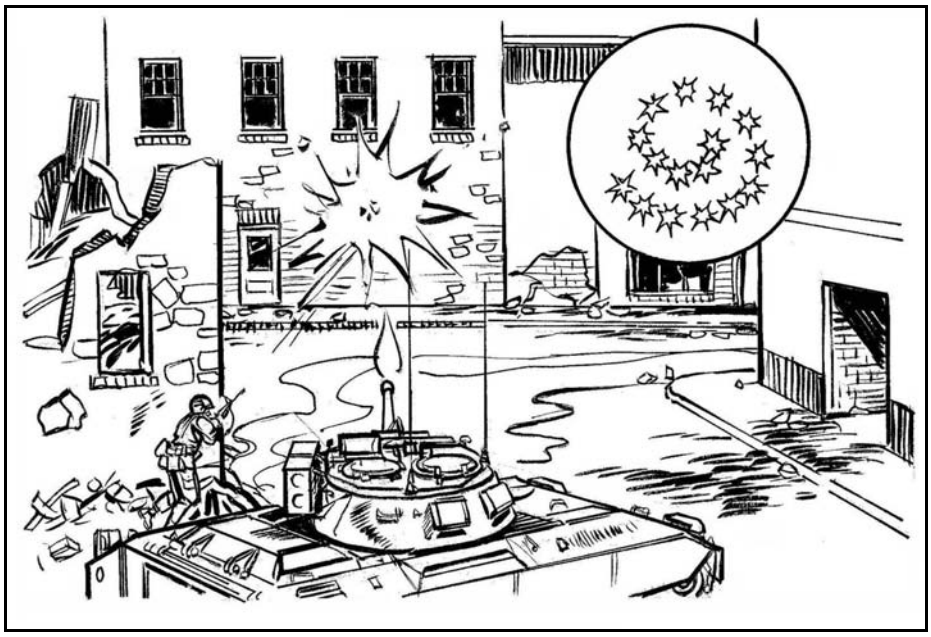

Figure F-11. Spiral firing pattern.

Doors, Windows, and Interior Walls

F-86. The 12-gauge shotgun breaching round is effective on doorknobs and hinges, while standard small arms (5.56 mm and 7.62 mm) have proven to be virtually ineffective for reducing obstacles. These should not be used except as a last resort because of their ricochet potential and shoot-through capability. Ballistic reduction of lightly-constructed interior walls by shotgun fire is normally an alternate means of gaining entry.

WARNING

The fragmentation and ricochet effects of standard small arms (5.56 mm and 7.62 mm) as breaching rounds is unpredictable and considered extremely dangerous. Do not attempt in training.

Rifle-Launched Entry Munitions

F-87. Rifle-launched entry munitions (RLEM) allow a remote ballistic reduction of an exterior door or window without having the assault or breaching element physically present at the entry point. This allows the assault element to assume a posture for entry in the last covered and concealed position before the breach. The RLEM firer is not normally part of the assault element but rather a part of the breaching or support element. This allows the RLEM to be fired from one position while the assault element waits in another position. In the event that the first round does not affect the reduction, the firer should prepare a second round for the reduction or a second firer should be prepared to engage the target.

WARNING

The firer must be a minimum of 10 meters from the target to safely employ a 150-gram round.

NOTE: Exact minimum safe distances for firers and assault elements have not been established for the 150-gram round.

Shotgun Reduction

F-88. Various shotgun rounds can be used for ballistic reduction. Breaching and clearing teams need to be familiar with the advantages as well as the disadvantages of each type of round. Leaders must consider the potential for over penetration on walls and floors in multi-story buildings to avoid potential fratricide incidents or killing of noncombatants.

- **Rifled Slugs.** Rifled slugs defeat most doors encountered, including some heavy steel doors. However, rifled slugs present a serious over penetration problem and could easily kill or injure anyone inside the room being attacked. Rifled slugs are excellent antipersonnel rounds and can be used accurately up to 100 meters.
- **Bird Shot.** Bird shot (number 6 through number 9 shot) is used in close-range work up to 15 meters. A 2 ¾-inch shell of number 9 shot typically contains an ounce of shot (though it can be loaded to 1 ½-ounce with an accompanied increase in recoil). The major advantage of bird shot is it does not over penetrate. Therefore, bird shot poses little hazard to fellow team members in adjoining rooms. When used at close range, bird shot offers the same killing potential as buckshot, especially in a full choke shotgun intended for dense shot patterns. Another advantage of bird shot is low recoil. This feature allows for faster recovery and quicker multi-target engagements. A disadvantage with bird shot is rapid-energy bleed-off that reduces penetration at medium and long ranges. Moreover, the small size of the individual pellets requires hits be made with a majority of the shot charge to be effective. A hit with one-third of the number 9 shot charge may not be fatal, unless the shot is at extremely close range. These disadvantages are negated when birdshot is fired from a full choke shotgun where it will produce a pattern that is quite small inside of 10 meters. Inside 5 meters, all of the shot will be clumped like a massive single projectile.
- **Buckshot.** Buckshot is used in close- to medium-range work, up to 30 meters. Because of its larger size, buckshot is more lethal than bird shot. A 2 ¾-inch shell of 00 buckshot contains nine .30-caliber balls. One .30-caliber ball of the 00 buckshot charge hit can prove fatal. Buckshot also retains its energy longer. Therefore, it is lethal at longer ranges than bird shot. A disadvantage of buckshot is over penetration. Because buckshot is typically loaded with heavier shot charges, it also has very heavy recoil. This problem becomes apparent when numerous shots have been taken and can result in fatigue.
- **Ferret Rounds.** Ferret rounds contain a plastic slug filled with liquid chemical irritant (CS). When shot through a door or wall (drywall or plywood), the plastic slug breaks up and a fine mist of CS is sprayed into the room. The effectiveness of one round is determined by the size of the room on the other side of the door or the wall and also the ventilation in that room.

F-89. When using the shotgun as an alternate reduction method to gain entry, shooters must consider the following target points on the door.

- **Doorknob.** Never target the doorknob itself because when the round impacts, the doorknob has a tendency to bend the locking mechanism into the doorframe. In most cases this causes the door to be bent in place and prevents entry into the room.
- **Locking Mechanism.** When attacking the locking mechanism, focus the attack on the area immediately between the doorknob and the doorframe. Place the muzzle of the shotgun no more than one inch away from the face of the door directly over the locking mechanism. The angle of attack should be 45 degrees downward and at a 45-degree angle into the doorframe. After breaching the door, kick it swiftly. This way, if the door is not completely open, a strong kick will usually open it. When kicking the door open, focus the force of the kick at the locking mechanism and close to the doorjamb. After the locking mechanism has been reduced, this area becomes the weakest part of the door.

- **Hinges.** The hinge breach technique is performed much the same as the doorknob reduction, except the gunner aims at the hinges. He fires three shots per hinge—the first at the middle, then at the top and bottom. He fires all shots from less than an inch away from the hinge. Because the hinges are often hidden from view, the hinge reduction is more difficult. Hinges are generally 8 to 10 inches from the top and bottom of the door. The center hinge is generally 36 inches from the top, centered on the door. Regardless of technique used, immediately after the gunner fires, he kicks the door in or pulls it out. He then pulls the shotgun barrel sharply upward and quickly turns away from the doorway to signal that the breach point has been reduced. This rapid clearing of the doorway allows the following man in the fire team a clear shot at any enemy who may be blocking the immediate breach site. See FM 3-06.11 for more information.

F-90. When the assault team members encounter a door to a "follow-on" room, they should line up on the side of the door that gives them a path of least resistance upon entering. When the door is encountered, the first Soldier to see it calls out the status of the door, OPENED, or CLOSED. If the door is open, Soldiers should never cross in front of it to give themselves a path of least resistance. If the door is closed, the number-one man maintains security on the door and waits for the number-two man to gain positive control of the number-one man. The number-one man begins the progressive breaching process by taking his nonfiring hand and checking the doorknob to see if it is locked. If the door is unlocked, the number-one man (with his hand still on the door) pushes the door open as he enters the room. If the door is locked, the number-one man releases the doorknob (while maintaining security on the door) and calls out for the breacher, BREACHER UP.

F-91. Once the breacher arrives at the door (with round chambered), he places the muzzle of the shotgun at the proper attack point, takes the weapon off safe, and signals the number-two man by nodding his head. At that time, the number-two man (with one hand maintaining positive control of the number-one man) takes his other hand (closest to the breacher) and forming a fist, places it within the periphery of the breacher and pumps his fist twice saying, READY BREACH. This action allows the breacher to see if a flashbang or grenade is to be used. Once the breacher defeats the door, he steps aside and allows the assault team to enter. He then either assumes the position of the number-four man if he is acting as a member of the assault team or remains on call as the breacher for any follow-on doors. He should keep the shotgun magazine full at all times. There may be numerous doors, and stopping to reload will slow the momentum of the assault.

NOTE: The shotgun should not be used as a primary assault weapon because of its limited magazine capacity and the difficulty of reloading the weapon.

Exterior Walls

F-92. One of the most difficult breaching operations for the assault team is reducing masonry and reinforced concrete walls. C4 is normally used for explosive reduction because it is safe, easy to use, and readily available. Engineers are usually attached to the platoon if explosive reduction operations are expected. The attached engineers will conduct the reduction themselves or provide technical assistance to the Infantrymen involved. The typical thickness of exterior walls is 15 inches or less, although some forms of wall construction are several feet thick. Assuming that all outer walls are constructed of reinforced concrete, a rule of thumb for reduction is to place 10 pounds of C4 against the target between waist and chest height. When detonated, this charge normally blows a hole large enough for a man to go through. On substandard buildings, however, a charge of this size could rubble the building. When explosives are used to reduce windows or doors, the blast should eliminate any booby traps in the vicinity of the window or doorframe. See FM 3-06.11 for information concerning demolitions.

Charge Placement

F-93. Place the charges (other than shape charges) directly against the surface that is to be reduced. When enemy fire prevents an approach to the wall, a potential technique is to attach the charge, untamped, to a pole and slide it into position for detonation at the base of the wall. Small-arms fire will not detonate C4 or TNT. Take cover before detonating the charge.

Tamping

F-94. Whenever possible, explosives should be tamped or surrounded with material to focus the blast to increase effectiveness. Tamping materials could be sandbags, rubble, desks, chairs, and even intravenous bags. For many exterior walls, tamping may be impossible due to enemy fire. An untamped charge requires approximately twice the explosive charge of a tamped charge to produce the same effect.

Second Charges

F-95. Charges will not cut metal reinforcing rods inside concrete targets. If the ROE permit, hand grenades should be thrown into the opening to clear the area of enemy. Once the area has been cleared of enemy, the reinforcing rods can be removed using special steel-cutting explosive charges or mechanical means.

Door Charges

F-96. Various charges can be utilized for explosive reduction of doors. Leaders must conduct extensive training on the use of the charges to get proper target feedback.

F-97. The general-purpose charge, rubber band charge, and the flexible linear charge are field-expedient charges that can be used to reduce interior and exterior doors. These charges give the breach element an advantage because they can be made ahead of time and are simple, compact, lightweight, and easy to emplace. See FM 3-06.11 for more information.

General-Purpose Charge

F-98. This charge is the most useful ready charge for reducing a door or other barrier. It can cut mild steel chain and destroy captured enemy equipment. To construct the general purpose charge—

- Take a length of detonation cord about 2 feet long. Using another length of detonation cord, tie two uli knots around the 2-foot long cord.
  - The uli knots need to have a minimum of six wraps and be loose enough for them to slide along the main line, referred to as an uli slider.
  - Trim the excess cord from the uli knots and secure them with tape.
- Cut a block of C4 explosive to a 2-inch square.
- Tape one slider knot to each side of the C4 block, leaving the length of detonation cord free to slide through the knots.

F-99. To place the charge, perform the following:

- To reduce a standard door, place the top loop of the charge over the doorknob. Slide the uli knots taped to the C4 so the charge is tight against the knob.
- Prime the loose ends of the detonation cord with an MDI firing system and detonate.

NOTE: To cut mild steel chain, place the loop completely around the chain link to form a girth hitch. Tighten the loop against the link by sliding the uli knots.

Rubber Band Charge

F-100. The rubber band charge is an easily fabricated lightweight device that can be used to remove the locking mechanism or doorknob from wooden/light metal doors, or to break a standard-size padlock at the shackle. To construct the rubber band charge—

- Cut a 10-inch piece of detonation cord and tie an overhand knot in one end.
- Using another piece of detonation cord, tie an uli knot with at least eight wraps around the first length of cord.
- Slide the uli knot tightly up against the overhand knot. Secure it in place with either tape or string.
- Loop a strong rubber band around the base of the uli knot tied around the detonation cord.
- Tie an overhand knot in the other end of the cord to form a pigtail for priming the charge.

F-101. To place the charge, attach the charge to the doorknob (or locking mechanism) by putting the loose end of the rubber band around the knob. The charge must be placed between the knob and the doorframe. This ensures the explosive is over the bolt that secures the door to the frame.

Flexible Linear Charge

F-102. The simplest field-expedient charge for reducing wooden doors is the flexible linear charge. See Tables F-3 and F-4 for charge use and system components. It can be made in almost any length and is easily carried until needed. It is effective against hollow-core, particle-filled, and solid wood doors. When detonated, the flexible linear charge cuts through the door near the hinges

F-103. To construct the flexible linear charge, lay out a length of double-sided contact tape with the topside adhesive exposed. Place the necessary number of strands of detonation cord down the center of the double-sided tape, pressing them firmly in place. Military detonation cord has 50 grains of explosives per foot and there are 7,000 grains in a pound. Most residential doors are 80 inches tall. Commercial doors are 84 inches tall. This must be considered when calculating the quantities of explosives, overpressure, and MSDs. For hollow-core doors, use a single strand; for particle-filled doors, use two strands; and for solid wood doors, use three strands. If the door type is unknown, use three strands. One of the strands must be cut about a foot longer than the others and should extend past the end of the double-sided tape. This forms a pigtail where the initiating system is attached once the charge is in place. Cover the strands of detonation cord and all the exposed portions of the double-sided tape with either sturdy single-sided tape or another length of double-sided tape. Roll the charge, starting at the pigtail, with the double-sided tape surface that is to be placed against the door on the inside.

F-104. At the breach site, place the charge straight up and down against the door tightly. If it is too short, place it so it covers at least half of the door's height. Prime and fire the charge from the bottom.

Table F-3. Charges.

Charge	Obstacle	Explosives Needed	Advantages	Disadvantages
Wall breach charge (satchel or U-shaped charge)	Wood, masonry, brick, and reinforced concrete walls	– Detonation cord – C4 or TNT	– Easy and quick to make – Quick to place on target	– Does not destroy rebar – High overpressure – Appropriate attachment methods needed – Fragmentation
Silhouette charge	Wooden doors (creates man-sized hole); selected walls (plywood, sheet-rock, CMU)	Detonation cord	– Minimal shrapnel – Easy to make – Makes entry hole to exact specifications	– Bulky; not easily carried
General purpose charge	Door knobs, mild steel chain, locks, and equipment	– C4 – Detonation cord	– Small, lightweight – Easy to make – Very versatile	Other locking mechanisms may make charge ineffective
Rubber strip charge	Wood or metal doors (dislodges doors from the frame); windows with a physical security system	– Sheet explosive – Detonation cord	– Small, lightweight – Quick to place on target – Uses small amounts of explosives	
Flexible linear charge	Wooden doors (widow cuts door along the length of the charge)	Detonation cord	– Small, lightweight – Quick to place on target – One man can carry several charges – Defeats most doors regardless of locking systems	Proper two-sided adhesive required
Doorknob charge	Doorknobs on wood or light metal doors	Detonation cord or flexible linear shaped charge	– Small, lightweight – Easily transported – Quick to place on door	Other locking mechanisms may make charge ineffective
Chain-link ladder charge	Chain link fence (rapidly creates a hole large enough to run through)	– C4 – Detonation cord	Cuts chain link quickly and effectively	Must stand to emplace it

Table F-4. Firing system components.

Firing System	Components
Time system	2 x M81 or M60; time fuze or M-14; 2 x M7 caps; detonation cord loop; red devil (detonation cord connector)
Command detonated	2 x M81; 2 x shock tube with caps (M11 or M12); detonation cord loop; red devil (desired length)
Delay system	1 x M81 or M60 (gutted); black adapter cap; direct shoot shock tube (NONEL); M11 MDI; detonation cord loop; red devil (STI may be used instead of a direct shoot with an M60)

Explosive Safety Factors

F-105. When employing explosives during breaching operations, leaders must consider three major safety factors: overpressure; missile hazard; and minimum safe distance requirements.

1 - Overpressure

F-106. Overpressure is the pressure per square inch (PSI) released from the concussion of the blast, both outside and into the interior of the building or room, that can injure, incapacitate, or kill.

2 - Missile Hazard

F-107. Missile hazards are fragmentation or projectiles sent at tremendous speed from the explosion area. This occurs from either the charge or target being breached.

3 - Minimum Safe Distance Requirements

F-108. When using explosives in the urban environment, Soldiers must consider the presence of noncombatants and friendly forces. Additionally, there are many hazardous materials located in the urban environment, including chemicals and construction materials. There is always a risk of secondary explosions and fires when employing explosive breaching techniques.

CAUTION

Always handle explosives carefully. Never divide responsibility for preparing, placing, priming, and firing charges. Always use proper eye and ear protection and cover exposed skin to prevent injuries. Explosives may produce hazardous fumes, flames, fragments, and overpressure. Use AR 385-63, FM 5-34, FM 5-250, and risk assessment to determine minimum safe distances (MSDs). Take into consideration whether the door is flush or receded when considering MSD.

REDUCE BOOBY TRAPS

F-109. Soldiers must be aware of the threat presented by booby traps that can be found in any operating environment in which the platoon might operate. The platoon must receive sufficient training to recognize locations and items that lend themselves to booby-trapping, striking a balance between what is possible and what is probable. See FM 20-32 for more information on booby traps and expedient devices.

F-110. When dealing with booby traps, the following rules and safety procedures can save lives:

- Suspect any object that appears to be out of place or artificial in its surroundings. Remember, what you see may well be what the enemy wants you to see. If you did not put it there, do not pick it up.
- Examine mines and booby traps from all angles, and check for alternative means of detonating before approaching them.
- Ensure that only one man works on a booby trap.
- Do not use force. Stop if force becomes necessary.
- Do not touch a trip wire until both ends have been investigated and all devices are disarmed and neutralized.
- Trace trip wires and check for additional traps along and beneath them.
- Treat all parts of a trap with suspicion, because each part may be set to actuate the trap.
- Wait at least 30 seconds after pulling a booby trap or a mine. There might be a delay fuse.
- Mark all traps until they are cleared.
- Expect constant change in enemy techniques.
- Never attempt to clear booby traps by hand if pulling them or destroying them in place is possible and acceptable.

F-111. Booby traps might be found in recently contested areas, so no items or areas that have not been cleared should be considered safe. By anticipating the presence of traps, it might be possible to isolate and bypass trapped areas. If this is not possible, employ countermeasures such as avoiding convenient and covered resting places along routes where mines or other explosive devices can be located. Collective training in booby-trap awareness and rapidly disseminating booby-trap incident reports to all levels is vital. This allows Soldiers to develop an understanding of the enemy's method of operation and a feel for what might or might not be targets.

INDICATIONS AND DETECTION

F-112. Successful detection depends on two things: being aware of what might be trapped and why, and being able to recognize the evidence of setting. The first requirement demands a well developed sense of intuition; the second, a keen eye. Intuition is gained through experience and an understanding of the enemy's techniques and habits. A keen eye is the result of training and practice in the recognition of things that might indicate the presence of a trap.

F-113. Detection methods depend on the nature of the environment. In open areas, methods used to detect mines can usually detect booby traps. Look for trip wires and other signs suggesting the presence of an actuating mechanism. In urban areas, mine detectors are probably of little use. The platoon will have to rely on manual search techniques and, if available, special equipment. The presence of booby traps or nuisance mines is indicated by—

- Disturbance of ground surface or scattered, loose soil.
- Wrappers, seals, loose shell caps, safety pins, nails, and pieces of wire or cord.
- Improvised methods of marking traps, such as piles of stones or marks on walls or trees.
- Evidence of camouflage, such as withered vegetation or signs of cutting.
- Breaks in the continuity of dust, paint, or vegetation.
- Trampled earth or vegetation; foot marks.
- Lumps or bulges under carpet or in furniture.

REDUCTION METHODS

F-114. Reducing booby traps and nuisance mines in AOs is done primarily by engineers, especially in secured areas. However, some booby traps may have to be cleared by Infantry Soldiers to accomplish a mission during combat. The method used to disarm a trap depends on many things including, time constraints, personnel assets, and the type of trap. A trap cannot be considered safe until the blasting cap or the detonation cord has been removed from the charge.

F-115. Use the safest method available to neutralize a trap. For example, if the firing device and the detonation cord are accessible, it is usually safer to cut the detonation cord. This method does not actuate the trap, but inserting pins in the firing device might. Unit resources or locally-manufactured or acquired aids are often used to clear traps. In areas with a high incidence of booby traps, assemble and reserve special clearing kits. Mark all booby traps found.

F-116. Nonexplosive traps are typically used in tropical or rain forest regions. Ideal construction materials abound and concealment in surrounding vegetation is relatively easy. No prescribed procedures exist for clearing nonexplosive traps. Each trap must be cleared according to its nature.

SECTION III — OBSTACLE EMPLOYMENT

F-117. Obstacles are used to reinforce the terrain. When combined with fires, they disrupt, fix, turn, or block an enemy force. Obstacles are used in all operations, but are most useful in the defense. Leaders must always consider what materials are needed and how long the obstacle will take to construct. See FM 5-34 for detailed instructions on specific types of obstacle construction methods.

F-118. A primary concern for the platoon in the defense is to supplement their fortified positions with extensive protective obstacles, both antipersonnel and antivehicle (particularly antipersonnel).

Antipersonnel obstacles, both explosive and nonexplosive, include all those mentioned in Section I (such as wire entanglements, antipersonnel mines, and field expedient devices), and are used to prevent enemy troops from entering a friendly position. Antipersonnel obstacles are usually integrated with fires and are close enough to the fortification for adequate surveillance by day or night, but beyond effective hand grenade range. Obstacles are also used within the position to compartmentalize the area in the event outer protective barriers are breached.

F-119. In the offense, the platoon/squad uses obstacles to—

- Aid in flank security.
- Limit enemy counterattack.
- Isolate objectives.
- Cut off enemy reinforcement or routes of withdrawal.

F-120. In the defense, the platoon uses obstacles to—

- Slow the enemy's advance to give the Infantry platoon more time to mass fires on him.
- Protect defending units.
- Canalize the enemy into places where he can more easily be engaged.
- Separate the enemy's tanks from his Infantry.
- Strengthen areas that are lightly defended.

MINES

U.S. NATIONAL POLICY ON ANTIPERSONNEL LAND MINES

On 16 May 1996, The President of the United States announced a national policy that eliminates or restricts the use of antipersonnel land mines, beginning with those that do not self-destruct, but eventually including all types. This policy is now in effect. It applies to all Infantry units either engaged in, or training for, operations worldwide.

Current U.S. policy allows the use of non-self-destructing antipersonnel land mines only along internationally recognized national borders or in established demilitarized zones, specifically for the defense of South Korea. Such mines must be within an area having a clearly marked perimeter. They must be monitored by military personnel and protected by adequate means to ensure the exclusion of civilians.

U.S. national policy also forbids U.S. forces from using standard or improvised explosive devices such as booby traps.

Except for South Korea based units and units deploying there for designated exercises, this policy specifically forbids all training on or actual employment of inert M14 and M16 antipersonnel land mines. Policy applies at the unit's home station and at Combat Training Centers, except in the context of countermine or de-mining training. No training with live M14 mines is authorized, and training with live M16 mines is authorized only for Soldiers actually on South Korean soil.

This policy does not affect the standard use of antivehicular mines. Nor does it affect training and use of the M18 Claymore mine in the command detonated mode.

When authorized by the appropriate commander, units may still use self-destructing antipersonnel mines such as the ADAM. Authorized units may also continue to emplace mixed minefields containing self-destructing antipersonnel land mines and antivehicular land mines such as MOPMS or Volcano.

The terms “mine”, “antipersonnel obstacle”, “protective minefield”, or “minefield” contained in this FM should not be construed to mean an obstacle that contains non-self-destructing antipersonnel land mines or booby traps. Also, all references to antipersonnel mines and the employment of minefields should be considered in accordance with national policy that limits the use of non-self-destructing antipersonnel land mines.

F-121. Mines are one of the most effective tank and personnel killers on the battlefield. The type of minefield that a platoon or squad most commonly emplaces is the hasty protective.

F-122. It is important to distinguish the difference between the types of minefield and the means of emplacement. Volcano, Modular Pack Mine System (MOPMS), standard-pattern, and row mining are not types of minefields; they are just some of the means used to emplace tactical, nuisance, and protective minefields. They may also be the method of emplacement that is replicated by a phony minefield. Land-based mines and munitions are hand-emplaced, remote-delivered, air-delivered, or ground-delivered (Table F-5). FM 20-32 provides detailed instructions on the installation and removal of U.S. mines and firing devices.

Table F-5. Mine delivery methods.

Delivery Method	Characteristics
Hand-emplaced	Require manual arming and are labor-, resource-, and transport-intensive.
Remote- and Air-delivered	Require less time and labor; however, they are not as precisely placed as hand-emplaced mines and munitions.
Ground-delivered	Less resource-intensive than hand-emplaced mines. They are not precisely placed; however, the minefield boundaries are.

SCATTERABLE MINES

F-123. SCATMINEs are laid without regard to a classical pattern. They are designed to be delivered remotely by aircraft, artillery, missile, or a ground dispenser. All U.S. SCATMINEs have a limited active life and self-destruct (SD) after that life has expired. The duration of the active life varies with the type of mine and the delivery system.

F-124. SCATMINEs enable minefield emplacement in enemy-held territories, contaminated territories, and in most other areas where it is impossible for engineers or the platoon to emplace conventional minefields. They may be used to support the platoon's mission by turning, fixing, disrupting, and blocking the enemy. However they are used, they must be planned and coordinated to fit into the overall obstacle plan. Characteristics of AP SCATMINE systems are listed in Table F-6. Table F-7 lists AT SCATMINE characteristics. SCATMINE placement authority is shown in Table F-8.

Table F-6. Characteristics of AP SCATMINE systems.

Mine	Delivery System	DODIC	Arming Time	Fuse	Warhead	AHD	SD Time	Explosive Weight	Mine Weight	Number of Mines
M67	155-mm artillery (ADAM)	D502	within 1 min after ground impact	trip wire	bounding frag	20%	4 hr	21 g Comp A5	540 g	36 per M731 projectile
M72	155-mm artillery (ADAM)	D501	within 1 min after ground impact	trip wire	bounding frag	20%	48 hr	21 g Comp A5	540 g	36 per M692 projectile
BLU 92/B	USAF (Gator)	K291 K292 K293	2 min	trip wire	blast frag	100%	4 hr 48 hr 15 days	540 g Comp B4	1.44 kg	22 per CBU 89/B dispenser
M77	MOPMS	K022	2 min	trip wire	blast frag	0%	4 hr (recycle up to 3 times)	540 g Comp B4	1.44 kg	4 per M131 dispenser
Volcano	Ground/ air	K045	2 min	trip wire	blast frag	0%	4hr 48 hr 15 days	540 g Comp B4	1.44 kg	1 per M87 canister

Table F-7. AT SCATMINE characteristics.

Mine	Delivery System	DODIC	Arming Time	Fuse	Warhead	AHD	SD Time	Explosive Weight	Mine Weight	Number of Mines
M73	155-mm artillery (RAAM)	D503	within 1 min after ground impact	magnetic	M-S plate	20%	48 hr	585 g RDX	1.7 kg	9 per M718 projectile
M70	155-mm artillery (RAAM)	D509	within 1 min after ground impact	magnetic	M-S plate	20%	4 hr	585 g RDX	1.7 kg	9 per M741 projectile
BLU 91/B	USAF (Gator)	K291 K292 K293	2 min	magnetic	M-S plate	NA	4 hr 48 hr 15 days	585 g RDX	1.7 kg	72 per CBU 89/B dispenser
M76	MOPMS	K022	2 min	magnetic	M-S plate	NA	4 hr (recycle up to 3 times)	585 g RDX	1.7 kg	17 per M131 dispenser
Volcano	Ground/ air	K045	2 min 30 sec	magnetic	M-S plate	NA	4 hr 48 hr 15 days	585 g RDX	1.7 kg	5 per M87 canister; 6 per M87A1 canister

Table F-8. SCATMINE emplacement authority.

Scatterable Mine System	Emplacement Authority
Ground- or artillery-delivered, with self-destruct time greater than 48 hours (long duration).	The corps commander may delegate emplacement authority to division level, which may further delegate to brigade level.
Ground- or artillery-delivered, with self-destruct time of 48 hours or less (short duration).	The corps commander may delegate emplacement authority to division level, which may further delegate to brigade level, which may further delegate to battalion level.
Aircraft-delivered (Gator), regardless of self-destruct time.	Emplacement authority is normally at corps, theater, or army command level, depending on who has air-tasking authority.
Helicopter-delivered (Volcano), regardless of self-destruct time.	Emplacement authority is normally delegated no lower than the commander who has command authority over the emplacing aircraft.
MOPMS when used strictly for a protective minefield.	Emplacement authority is usually granted to the company or base commander. Commanders at higher levels restrict MOPMS use only as necessary to support their operations.

Modular Pack Mine System (MOPMS), Man-Portable

F-125. The man-portable, 162-pound, suitcase-shaped MOPMS dispenses a total of 21 mines (17 antitank mines and 4 antipersonnel mines). It propels them in a 35-meter, 180-degree semicircle from the container. Mines are dispensed on command using the M71 remote control unit (RCU) or an electronic initiating device such as the M34 blasting machine. When dispensed, an explosive propelling charge at the bottom of each tube expels mines through the container roof (Figure F-12). The Infantry platoon can use MOPMS to create a protective minefield or to close lanes in tactical obstacles. The safety zone around one container is 55 meters to the front and sides, and 20 meters to the rear. MOPMS has a duration of 4 hours, which can be extended up to three times for a total of 16 hours. Once mines are dispensed, they cannot be recovered or reused. If mines are not dispensed, the container may be disarmed and recovered for later use. The RCU can also self-destruct mines on command, allowing a unit to counterattack or withdraw through the minefield. The RCU can control up to 15 MOPMS containers or groups of MOPMS containers from a distance of 300 to 1,000 meters.

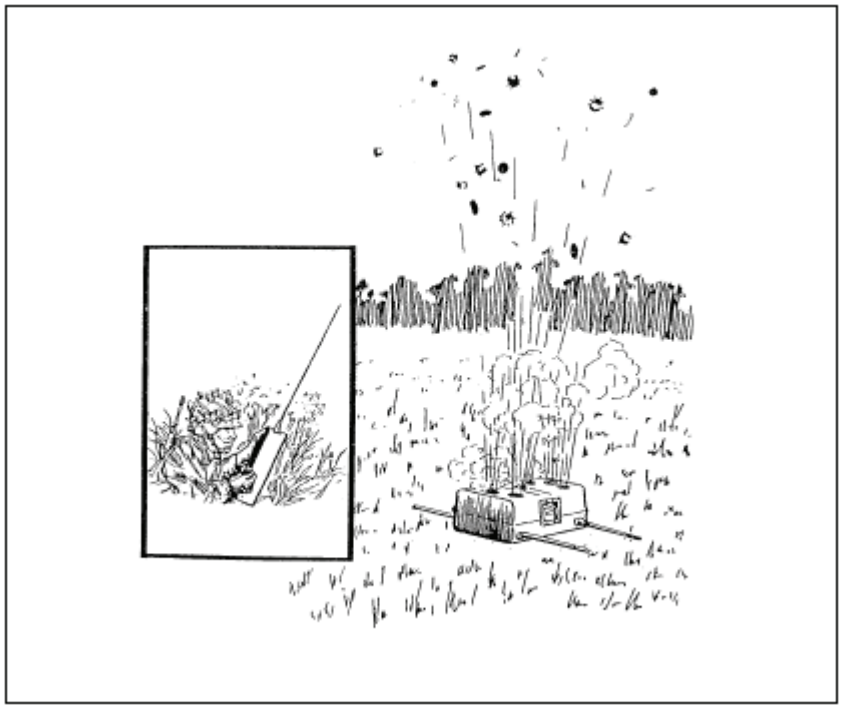

Figure F-12. MOPMS.

Hornet

F-126. The Hornet is a man-portable, nonrecoverable, AT/antivehicular, off-route munition made of lightweight material (35 pounds) that one person can carry and employ. It is capable of destroying vehicles by using sound and motion detection methods. It will automatically search, detect, recognize, and engage moving targets by using top attack at a standoff distance up to 100 meters. It can be a stand-alone tactical obstacle or can reinforce other conventional obstacles. It disrupts and delays the enemy, allowing long-range, precision weapons to engage more effectively. This feature is particularly effective in non-line-of-sight (LOS) engagements. It is normally employed by combat engineers, Rangers, and SOF. The remote control unit (RCU) is a handheld encoding unit that interfaces with the Hornet when the remote mode is selected at the time of employment. After encoding, the RCU can be used to arm the Hornet, reset its SD times, or destroy it. The maximum operating distance for the RCU is 2 kilometers.

CONVENTIONAL MINES

F-127. Conventional mines are hand-emplaced mines that require manual arming. This type of mine laying is labor-, resource-, and transport-intensive. Soldiers emplace conventional mines within a defined, marked boundary and lay them individually or in clusters. They record each mine location so the mines can be recovered. Soldiers can surface lay or bury conventional mines and may place AHDs on AT mines. FM 21-75 has complete information on emplacement of conventional AT mines.

NOTE: U.S. Soldiers can surface lay or bury AT mines and munitions and can place AHDs on hand-emplaced AT mines. Some countries employ conventional AP mines (with or without AHDs), but U.S. forces are not authorized to employ conventional AP mines (except on the Korean peninsula).

Antitank Mines

F-128. The M15 and M21 AT mines are used by U.S. forces. They are shown in Figure F-13. Their characteristics are listed in Table F-9.

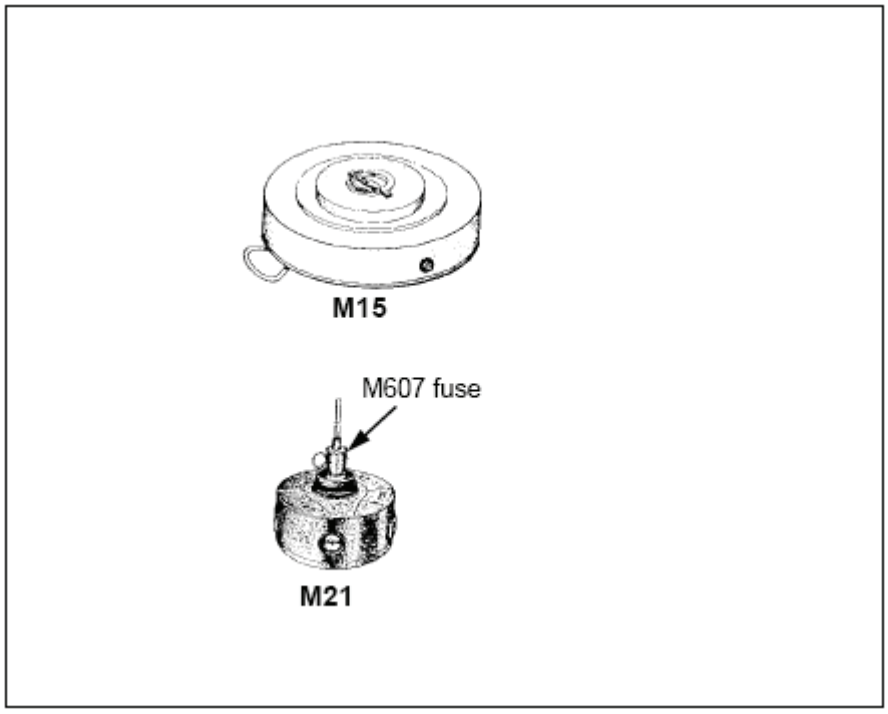

Figure F-13. Antitank (AT) mines.

Table F-9. Characteristics of AT mines.

Mine	DODIC	Fuse	Warhead	AHD	Explosive Weight	Mine Weight	Mines per Container
M15 with M603 fuse	K180	pressure	blast	yes	9.9 kg	13.5 kg	1
M15 with M624 fuse	K180 (mine) K068 (fuse)	tilt rod	blast	yes	9.9 kg	13.5 kg	1
M21	K181	tilt rod or pressure	SFF	yes*	4.95 kg	7.6 kg	4
*Conventional AHDs will not couple with this mine. However, the M142 multipurpose firing device can be emplaced under this mine.							

Antipersonnel Mines

F-129. The M14 and M16 AP mines are used by U.S. forces on the Korean peninsula. They are also used by many other countries. These mines are shown in Figure F-14. Their characteristics are listed in Table F-10.

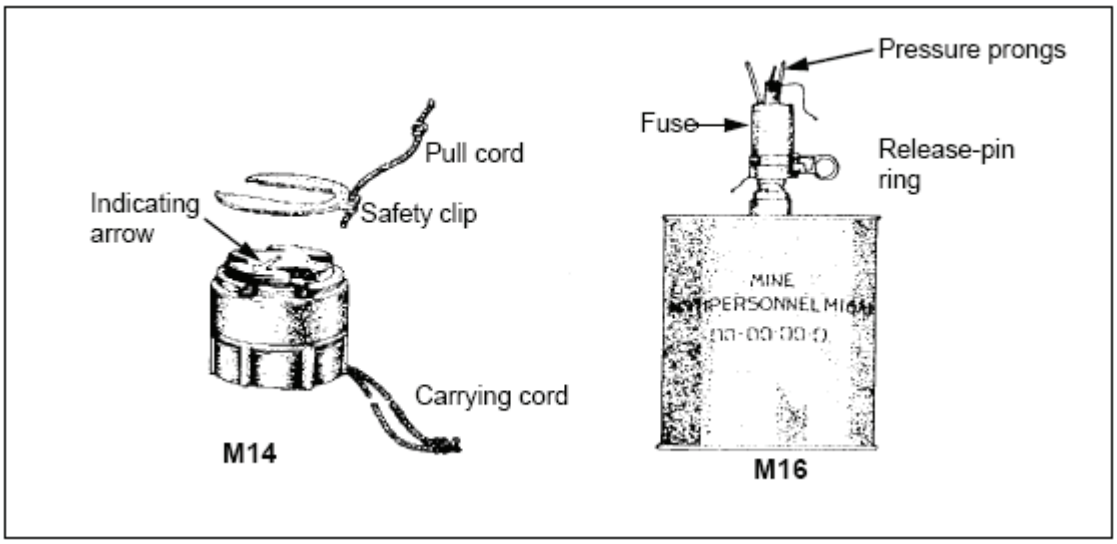

Figure F-14. Antipersonnel (AP) mines.

Table F-10. Characteristics of AP mines.

Mine	DODIC	Fuse	Warhead	AHD	Explosive Weight	Mine Weight	Mines per Container
M14	K121	pressure	blast	no	28.4 g	99.4 g	90
M16-series	K092	pressure or trip wire	bounding frag	no	450 g	3.5 kg	4

SPECIAL-PURPOSE MUNITIONS

F-130. Special-purpose munitions that the platoon might employ include the M18A1 Claymore and the selectable lightweight attack munition (SLAM).

M18A1 CLAYMORE

F-131. The M18A1 Claymore (Figure F-15) is a fragmentation munition that contains 700 steel balls and 682 grams of composition C4 explosive. It weighs 1.6 kilograms and is command detonated.

F-132. When employing the Claymore with other munitions or mines, separate the munitions by the following minimum distances:

- Fifty meters in front of or behind other Claymores.
- Three meters between Claymores that are placed side by side.
- Ten meters from AT or fragmentation AP munitions.
- Two meters from blast AP munitions.

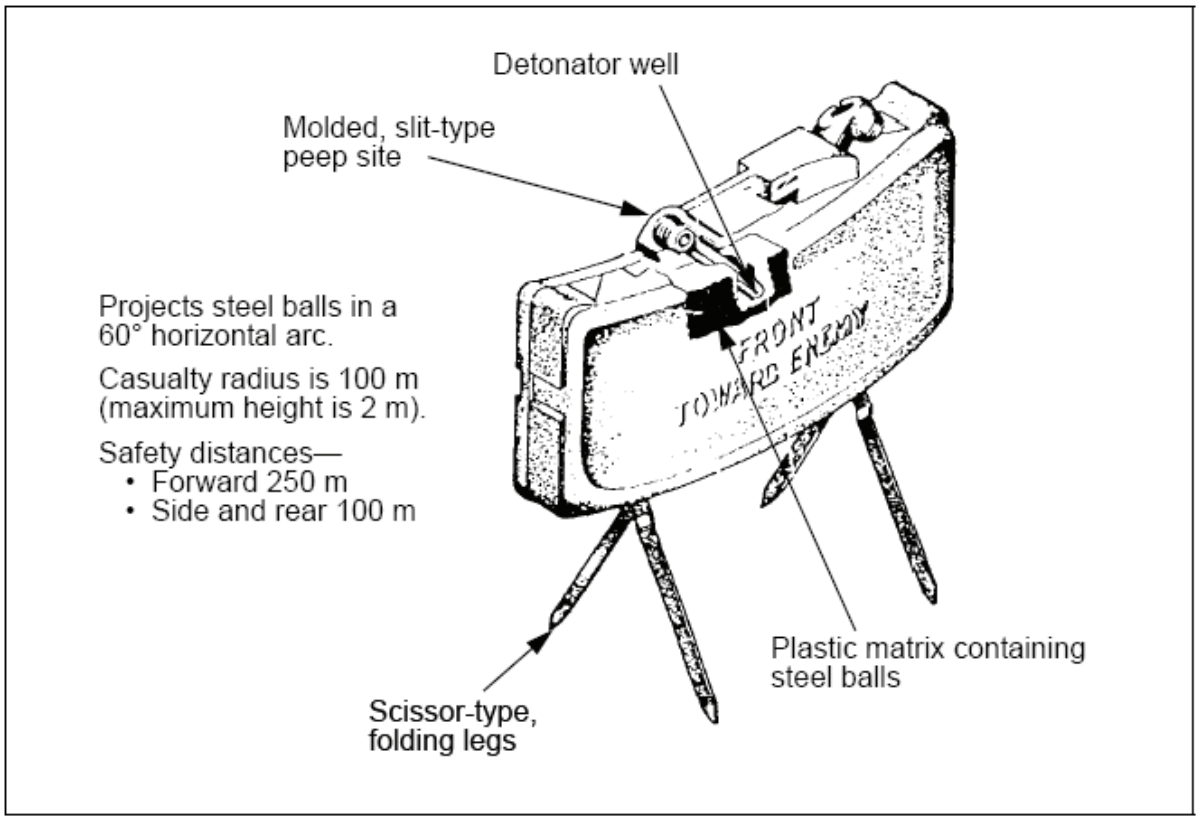

Figure F-15. M18A1 Claymore.

SLAM

F-133. The M4 SLAM is a multipurpose munition with an antitamper feature (Figure F-16). It is compact and weighs only 1 kilogram. It is easily portable and is intended for use against APCs, parked aircraft, wheeled or tracked vehicles, stationary targets (such as electrical transformers), small (less than 10,000-gallon) fuel-storage tanks, and ammunition storage facilities. The explosive formed penetrator (EFP) warhead can penetrate 40 millimeters of homogeneous steel. The SLAM has two models (the self-neutralizing [M2] and self-destructing [M4]). The SLAM's four possible employment methods include: bottom attack, side attack, timed demolition, and command detonation.

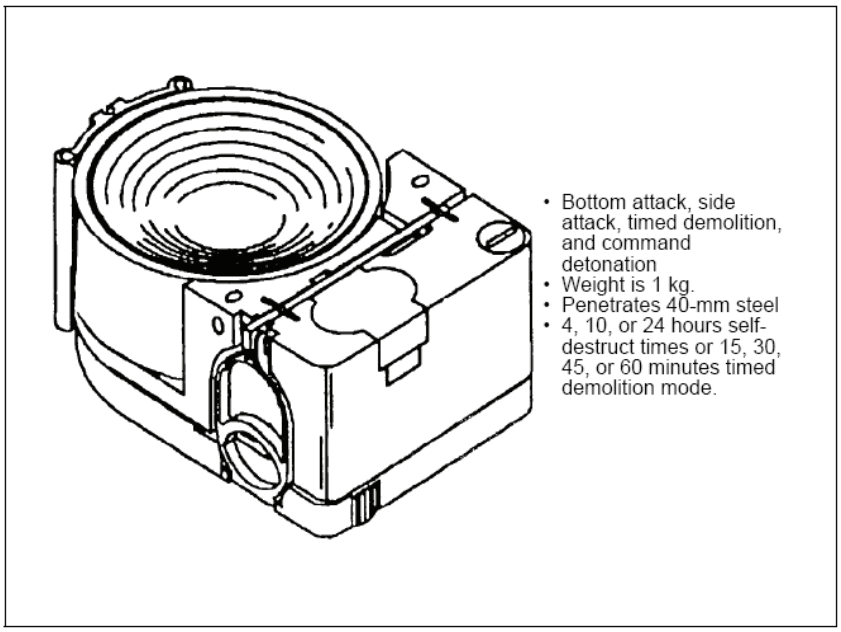

Figure F-16. SLAM.

M93 HORNET

F-134. The M93 Hornet is an AT and antivehicular off-route munition made of lightweight material (35 pounds) that one person can carry and employ (Figure F-17). It is a nonrecoverable munition capable of destroying vehicles through the use of sound and motion detection. It will automatically search, detect, recognize, and engage moving targets by using top attack mode at a standoff distance up to 100 meters from the munition.

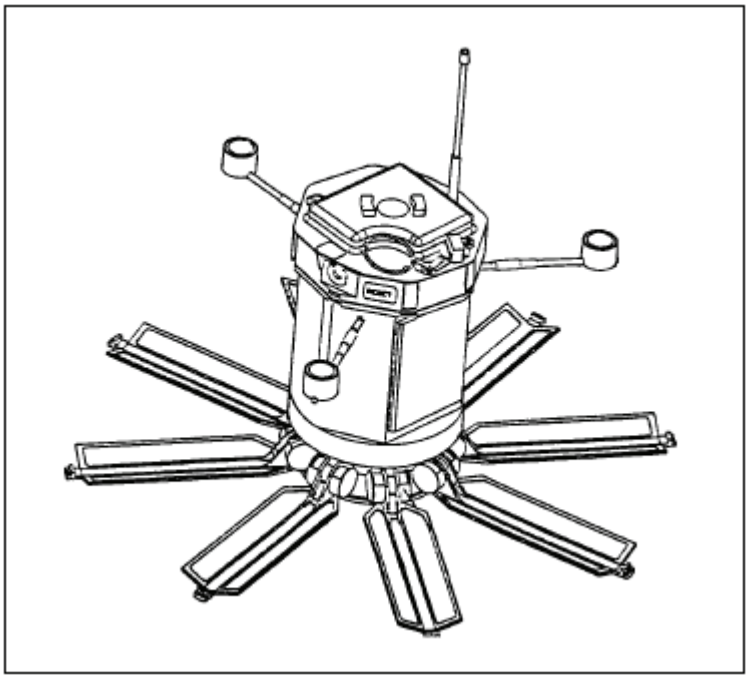

Figure F-17. M93 Hornet.

HASTY PROTECTIVE MINEFIELDS

F-135. Neither AP nor AT mines are used in isolation. The majority of mine composition is designed against the most severe close-combat threat and the likelihood of that threat. The MOPMS automatically dispenses a mix of AT and AP mines.

F-136. In the defense, platoons lay hasty protective minefields to supplement weapons, prevent surprise, and give early warning of enemy advance. A platoon can install hasty protective minefields, but only with permission from the company commander. Conventional hasty protective minefields are reported to the company commander and recorded on DA Form 1355-1-R, *Hasty Protective Row Minefield Record*. The minefield should be recorded before the mines are armed. The leader puts the minefield across likely avenues of approach, within range of and covered by his organic weapons. If time permits, the mines should be buried to increase effectiveness, but they may be laid on top of the ground in a random pattern. The leader installing the minefield should warn adjacent platoons and tell the company commander of the minefield's location. When the platoon leaves the area (except when forced to withdraw by the enemy), it must remove the minefield (if it uses recoverable mines) or transfer the responsibility for the minefield to the relieving platoon leader. Only metallic mines are used in conventional hasty protective minefields. Booby traps are not used in hasty protective minefields because they delay removal of recoverable mines. The employing Infantry platoon must make sure that the minefield can be kept under observation and covered by fire at all times.

F-137. After requesting and receiving permission to lay the minefield, the Infantry platoon leader reconnoiters to determine exactly where to place the mines. While the Soldiers are placing the mines, the Infantry platoon leader finds an easily identifiable reference point in front of the platoon's position. A tree stump is used as the reference point in sample DA Form 1355-1-R shown in Figure F-18. The platoon leader records the minefield. The row of mines closest to the enemy is designated A, and the succeeding rows are B, C, and so on.

F-138. The ends of a row are shown by two markers. They are labeled with the letter of the row and number 1 for the right end of the row and number 2 for the left end of the row. The rows are numbered from right to left, facing the enemy. The marker can be a steel picket or wooden stake with a nail or a can attached so it can be found with a metallic mine detector.

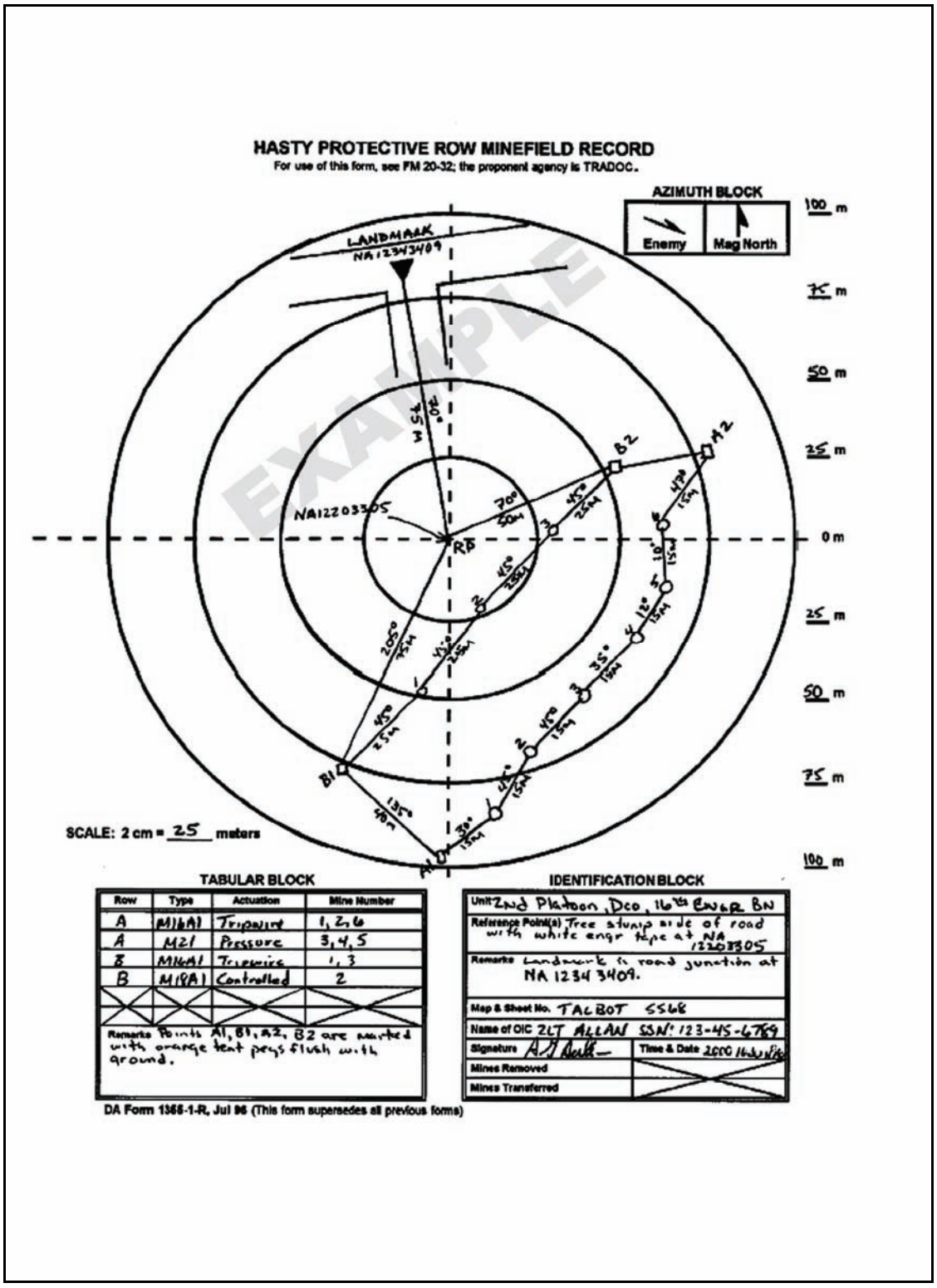

Figure F-18. Sample DA Form 1355-1-R (hasty protective row minefield record).

F-139. The platoon leader places a marker at B-1 and records the azimuth and distance from the reference point to B-1 on DA Form 1355-1-R.

F-140. Next, from B-1 the platoon leader measures the azimuth and distance to a point 15 to 25 paces from the first mine in row A. He places a marker at this point and records it as A-1. The platoon leader then measures the distance and azimuth from A-1 to the first mine in row A and records the location of the mine. He then measures the distance and azimuth from the first mine to the second, and so on until all mine locations have been recorded as shown. The platoon leader gives each mine a number to identify it in the tabular block of DA Form 1355-1-R. When the last mine location in row A is recorded, the platoon leader measures an azimuth and distance from the last mine to another arbitrary point between 15 and 25 paces beyond the last mine. He places a marker here and calls it A-2. The platoon leader follows the same procedure with row B.

F-141. When the platoon leader finishes recording and marking the rows, he measures and records the distance and azimuth from the reference point to B-2 to A-2. If antitank mines are being used, it is recommended that they be used at the A-2/B-2 markers, because their large size facilitates retrieval.

F-142. The platoon leader now ties in the reference point with a permanent landmark that he found on the map. He measures the distance and the azimuth from this landmark to the reference point. The landmark might be used to help others locate the minefield should it be abandoned. Finally, he completes the form by filling in the tabular and identification blocks.

F-143. While the platoon leader is tying in the landmark, the Soldiers arm the mines nearest the enemy first (Row A). The platoon leader reports that the minefield is completed and keeps DA Form 1355-1-R. If the minefield is transferred to another platoon, the gaining platoon leader signs and dates the mines transferred block and accepts the form from the previous leader. When the minefield is removed, the form is destroyed. If the minefield is left unattended or abandoned unexpectedly, the form must be forwarded to the company commander. The company commander forwards it to be transferred at battalion to more permanent records.

F-144. When retrieving the recoverable mines, the Soldiers start at the reference point and move to B-1, using the azimuth and distances as recorded. They then move from B-1 to the first mine in row B. However, if B-1 is destroyed, they move from the reference point to B-2 using that azimuth and distance. They will now have to shoot the back azimuth from B-2 to the last mine. The stakes at A-1, B-1, A-2, and B-2 are necessary because it is safer to find a stake when traversing long distances than to find a live mine.

WIRE OBSTACLES

F-145. The platoon normally employs wire obstacles as part of the protective obstacle plan in the defense. Wire obstacles include barbed-wire, triple-standard concertina, four-strand cattle fences, and tanglefoot. Construction methods for two of the more common wire obstacles that the platoon employs, triple standard concertina, and tanglefoot, are shown in Figures F-19 through F-23. See FM 5-34 for more information on these and other wire obstacles.

TRIPLE STANDARD CONCERTINA FENCE

F-146. The most common wire entanglement a platoon or squad may build is the triple standard concertina fence. It is built of either barbed wire concertina or barbed tape concertina. There is no difference in building methods. The material and labor requirements for a 300-meter triple standard concertina fence are—

- Long pickets – 160.
- Short pickets – 4.
- Barbed wire, 400-meter reels – 3.
- Rolls of concertina – 59.
- Staples – 317.
- Man-hours to erect – 30.

F-147. First, lay out and install pickets from left to right (facing the enemy). Put the long pickets five paces apart, and the short (anchor) pickets two paces from the end of the long pickets (Figure F-19). The enemy and friendly picket rows are offset and are placed 3 feet apart. Now lay out rolls of concertina. Place a roll in front of the third picket on the enemy side, and two rolls to the rear of the third picket on the friendly side. Repeat this step every fourth picket thereafter. Install the front row concertina and horizontal wire (Figure F-20). Place the concertina over the pickets. Install the rear row of concertina and horizontal wire. Install the top row of concertina and join the rear horizontal wire (Figure F-21).

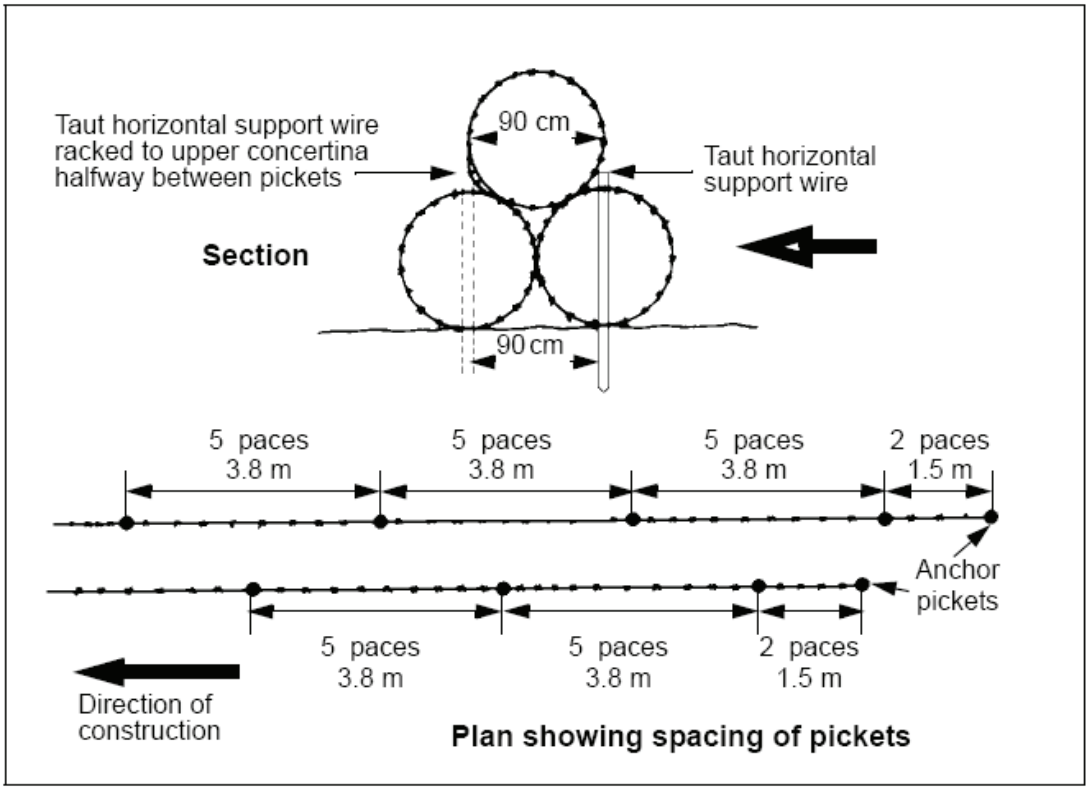

Figure F-19. Triple standard concertina fence.

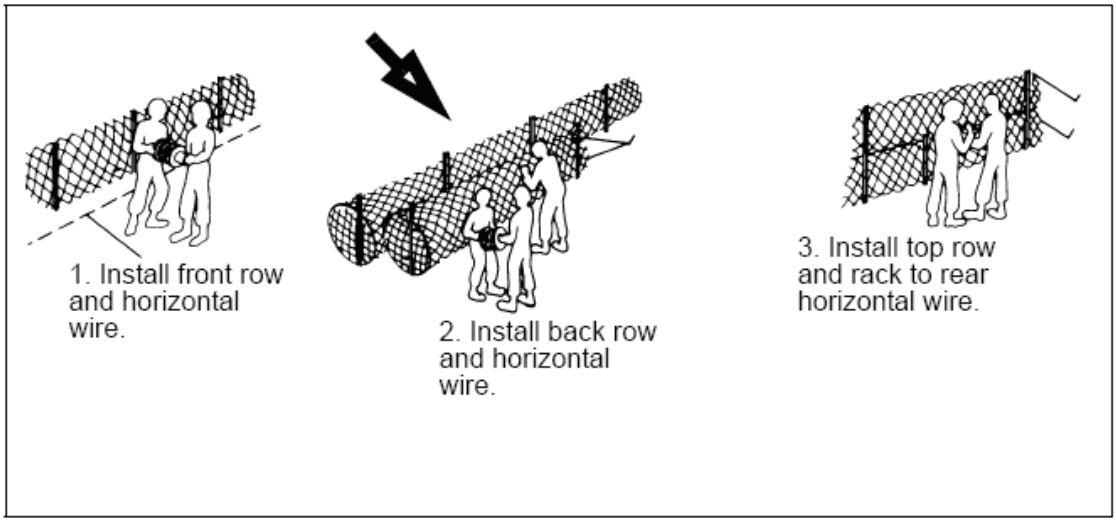

Figure F-20. Installing concertina.

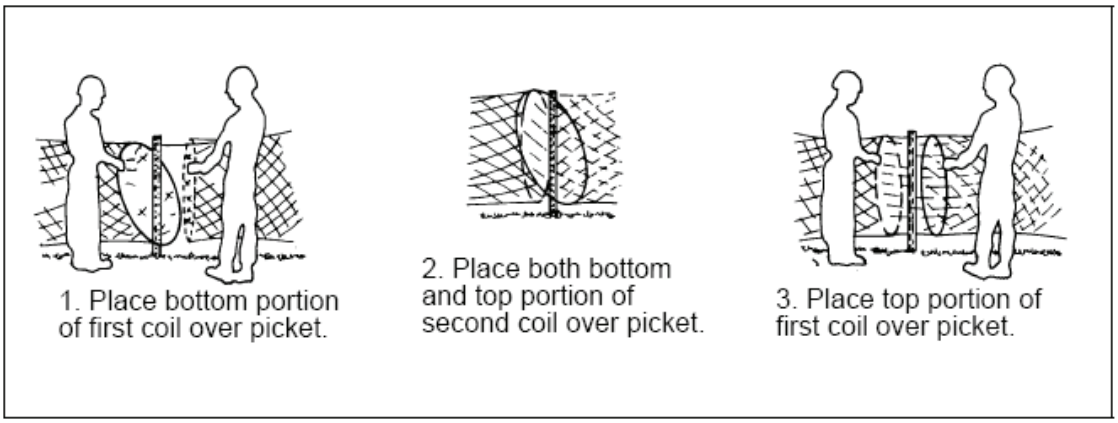

Figure F-21. Joining concertina.

CONCERTINA ROADBLOCK

F-148. The concertina roadblock is placed across roadways and designed to block wheeled or tracked vehicles. The roadblock is constructed of 11 concertina rolls or coils placed together, about 10 meters in depth, reinforced with long pickets five paces apart. The rolls or coils should not be tautly bound allowing them to be dragged and tangled around axles, tank road wheels, and sprockets. Additionally, wire is placed horizontally on top of the concertina rolls or coils (Figure F-22).

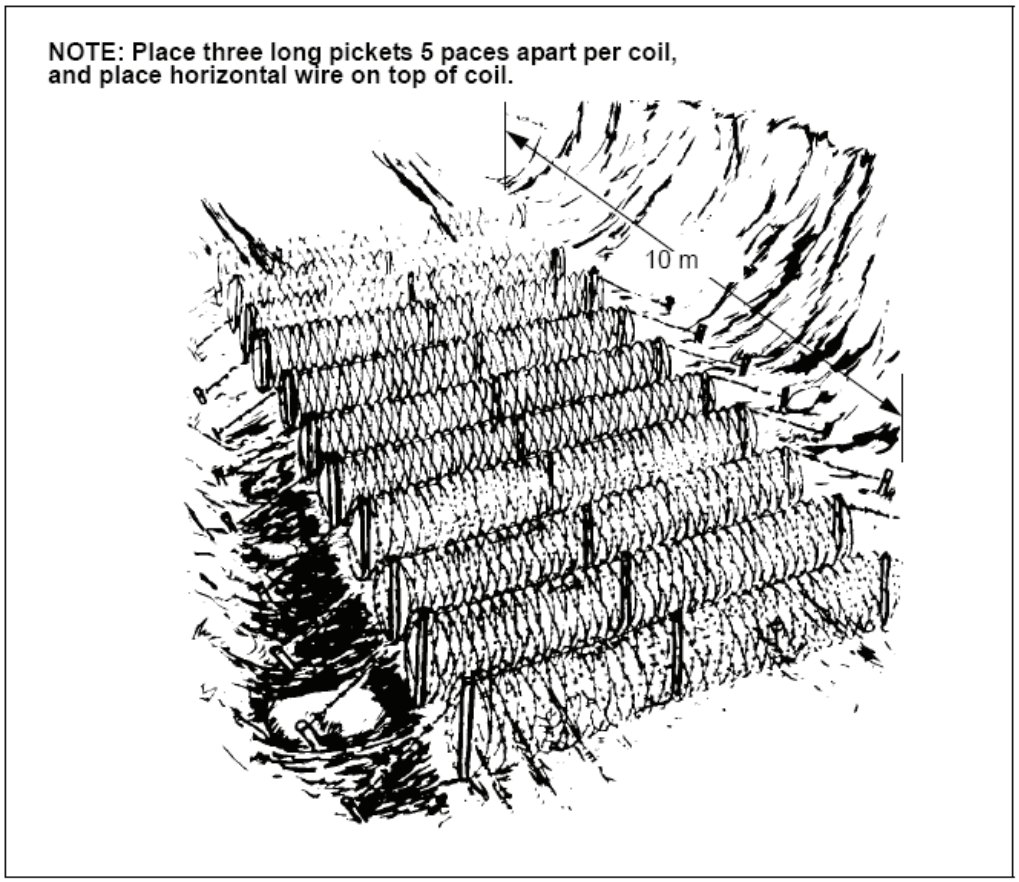

Figure F-22. Eleven-row antivehicular wire obstacle.

TANGLEFOOT

F-149. Tanglefoot is used where concealment is essential and to prevent the enemy from crawling between fences and in front of emplacements (Figure F-23). The obstacle should be employed in a minimum width of 32 feet. The pickets should be placed at irregular intervals of 2 ½ feet to 10 feet. The height of the barbed wire should vary between 9 to 30 inches. Tanglefoot should be sited in scrub, if possible, using bushes as supports for part of the wire. On open ground, short pickets should be used.

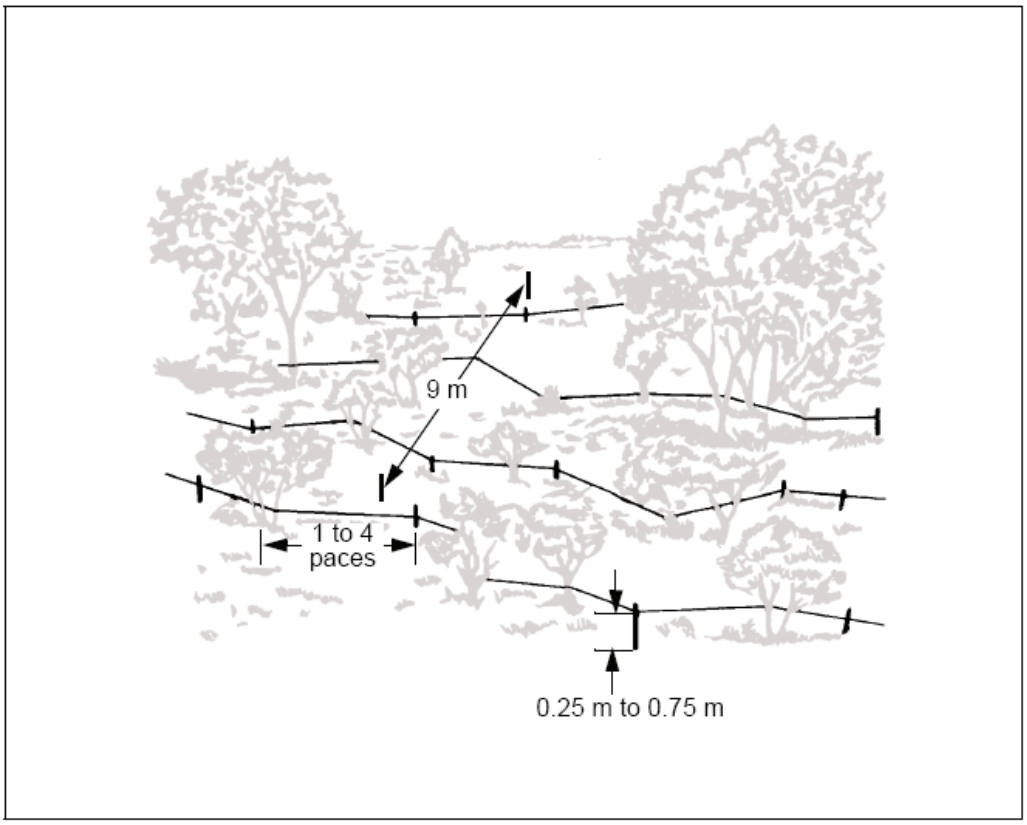

Figure F-23. Tanglefoot.