Change 2

Headquarters
Department of the Army
Washington, DC, 22 August 2001

Mine/Countermine Operations

1. Change FM 20-32, 30 September 1992, as follows:

Remove Old Pages	Insert New Pages
i through xviii	i through xviii
1-5 through 1-8	1-5 through 1-8
2-9 and 2-10	2-9 and 2-10
2-21 and 2-22	2-21 and 2-22
2-45 and 2-46	2-45 and 2-46
3-1 through 3-8	3-1 through 3-8
3-13 and 3-14	3-13 and 3-14
3-17 through 3-33	3-17 through 3-28
4-1 through 4-4	4-1 through 4-4
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Remove Old Pages	Insert New Pages
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F-9 and F-10	F-9 and F-10
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Glossary-7 through Glossary-10	Glossary-7 through Glossary-10
References-1 and References-2	References-1 and References-2
Index-1 through Index-6	Index-1 through Index-6
DA Form 1355-1-R	DA Form 1355-1-R

2. A bar (❙) marks new or changed material.
3. File this transmittal sheet in front of the publication.
4. This change includes Change 1, 30 June 1999.

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*FM 20-32

Field Manual
No. 20-32

Headquarters
Department of the Army
Washington, DC, 29 May 1998

MINE/COUNTERMINE OPERATIONS

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DISTRIBUTION RESTRICTION: Approved for public release; distribution is unlimited.

*This manual supersedes FM 20-32, 30 September 1992.

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Preface

Field Manual (FM) 20-32 provides United States (US) armed forces with tactical, technical, and procedural guidance for conducting mine and countermine operations. It applies to all elements of the combined arms team for maneuver and engineer staff planning and coordination. The manual is presented in three parts—mine operations, counteroperations, and special-mining operations.

The guidance provided focuses on individual skills of emplacing and removing mines, team and squad tasks, platoon and company organization and planning, and battalion/task force (TF) organization and coordination for successful obstacle reduction and breaching operations.

The provisions of this publication support existing doctrine established by FMs 5-34, 5-100, 90-7, and 90-13-1. It also contains new and improved techniques for emplacing row mines; marking, reporting, and recording minefields; reducing simple and complex obstacles; and emplacing a standard-pattern minefield. This manual reflects new doctrine from FMs 5-10, 5-71-2, and 5-71-3.

This publication implements the following International Standardization Agreements (STANAGs) between North Atlantic Treaty Organization (NATO) forces:

- STANAG 2036. *Land Minefield Laying, Marking, Recording, and Reporting Procedures*. Edition 5.
- STANAG 2889. *Marking of Hazardous Areas and Routes Through Them*. Edition 3.
- STANAG 2990. *Principles and Procedures for the Employment in Land Warfare of Scatterable Mines with a Limited Laid Life.* Edition 1.

NOTE: US policy regarding the use and employment of antipersonnel land mines (APLs) outlined in this FM is subject to the Convention on Certain Conventional Weapons and Executive Orders. Current US policy limits the use of non-self-destructing APLs to (1) defending the US and its allies from armed aggression across the Korean demilitarized zone and (2) training personnel engaged in demining and countermine operations. The use of the M18A1 claymore in the command-detonation mode is not restricted under international law or Executive Order.

All references to US employment of non-self-destructing APLs (such as row mining) in this manual are intended to provide doctrine for use in Korea only. This information is provided in bold lettering throughout the manual. Detailed doctrine on APLs is also provided to ensure that US forces recognize how the enemy can employ these weapons.

As the US military seeks to end its reliance on APLs, commanders must consider the increased use of other systems such as the M18A1 claymore, nonlethal barriers (such as wire obstacles), sensors and surveillance platforms, and direct and indirect fires.

This publication includes the following appendixes:

- Appendix A. Installation and Removal of US Mines and Firing Devices.
- Appendix B. Controls and Components of Special-Purpose Munitions.
- Appendix C. Threat Mine/Countermine Operations.
- Appendix D. Air Volcano.
- Appendix E. Safety and Training.
- Appendix F. Mine Awareness.
- Appendix G. Countermine Data.
- Appendix H. Metric Conversion Chart.

The proponent for this publication is Headquarters, US Army Training and Doctrine Command (TRADOC). Forward comments and recommendations on Department of the Army (DA) Form 2028 to Commandant, US Army Engineer School, ATTN: ATSE-DME-MWF, Fort Leonard Wood, Missouri 65473-5000.

Unless this publication states otherwise, nouns and pronouns do not refer exclusively to men.

example, breaks a track on a tank) and immobilizes the target. An M-Kill does not always destroy the weapon system and the crew; they may continue to function. In a K-Kill, the weapon system and/or the crew is destroyed.

TYPES OF SENSING

AT fuses fall into three design categories:

- Track-width. Usually pressure-actuated, requiring contact with the wheels or tracks of a vehicle.
- Full-width. Activated by several methods—acoustics, magnetic-influence, tilt-rod, radio-frequency, infrared-sensored, command, or vibration. Tilt-rod or magnetic-influence fuses are the most common. Full-width fuses are designed to be effective over the entire target width and can cause a K-Kill from penetration and spalling metal or from secondary explosions. When a full-width fuse is activated solely by contact with the wheels or tracks of the target vehicle, it usually causes an M-Kill because most of the energy is absorbed by the wheels or tracks.
- Off-route. Designed to be placed along the side of a route likely to be taken by armored vehicles. It has numerous fuzing possibilities, including infrared, seismic, break wire, and magnetic. It produces an M-Kill or a K-Kill, depending on the location of the target at the time of mine detonation.

TYPES OF WARHEADS

AT mines can be identified by their warheads:

- Blast AT mines derive their effectiveness from the force generated by high-explosive (HE) detonation. They usually produce an M-Kill when the blast damages the track or the vehicle, but a K-Kill is also possible.
- Shaped-charge mines use a directed-energy warhead. A shaped charge is formed by detonating an explosive charge behind a cone of dense metal or other material. Upon detonation, the cone collapses and forms a metal slug and a gaseous metal jet that penetrate the target. A K-Kill is probable if the crew or ammunition compartment is hit.
- Explosive-formed penetrating (EFP) mines have an explosive charge with a metal plate in front. Upon detonation, the plate forms into an inverted disk, a slug, or a long rod. A K-Kill is probable if the crew or ammunition compartment is hit.

ANTIPERSONNEL MINES

TYPES OF KILLS

AP mines can kill or incapacitate their victims. The injuries and deaths they cause commit medical resources, degrade unit morale, and damage nonarmored vehicles. Some types of AP mines may break or damage the track on armored vehicles.

TYPES OF SENSING

AP mines can be fused in many ways, to include pressure, seismic, wire, or command detonation:

- Pressure fuses usually activate an AP mine when a load is placed on the fuse.
- Seismic fuses activate an AP mine when the sensor detects vibrations.
- Trip wires or break wires activate an AP mine when something disturbs barely visible wires.
- Command-detonated mines are activated by a soldier when he detects the enemy in the mines' blast area.

TYPES OF EFFECTS

AP mines contain five types of effects:

- Blast. Cripples the foot or leg of a soldier who steps on it; can also burst the tires of a wheeled vehicle that passes over it.
- Bounding-fragmentation. Throws a canister into the air; the canister bursts and scatters shrapnel throughout the immediate area.
- Direct-fragmentation. Propels fragments in the general direction of enemy soldiers.
- Stake-fragmentation. Bursts and scatters shrapnel in all general directions.
- Chemical. Disperses a chemical agent to whoever activates it; contaminates the surrounding area.

ANTIHANDLING DEVICES

AHDs perform the function of a mine fuse if someone attempts to tamper with the mine. They are intended to prevent moving or removing the mine, not to prevent reduction of the minefield by enemy dismounts. An AHD usually consists of an explosive charge that is connected to, placed next to, or manufactured in the mine. The device can be attached to the mine body and activated by a wire that is attached to a firing mechanism. US forces can employ AHDs on conventional AT mines only. Other countries employ AHDs on AT and AP mines.

Some mines have extra fuse wells that make it easier to install AHDs (Figure 1-4). An AHD does not have to be attached to the mine; it can be placed underneath the mine (Figure 1-5). Mines with AHDs are sometimes incorrectly called *booby-trapped* mines.

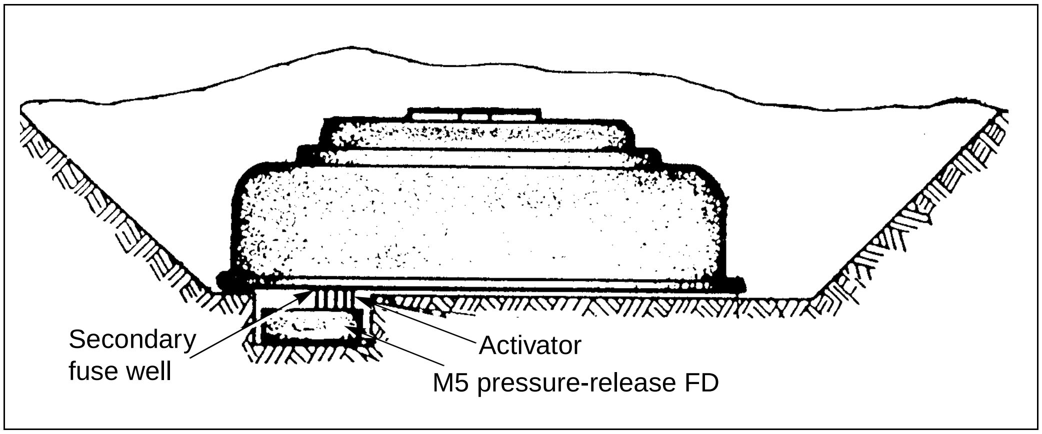


Figure 1-4. AHD incorporating a release mechanism

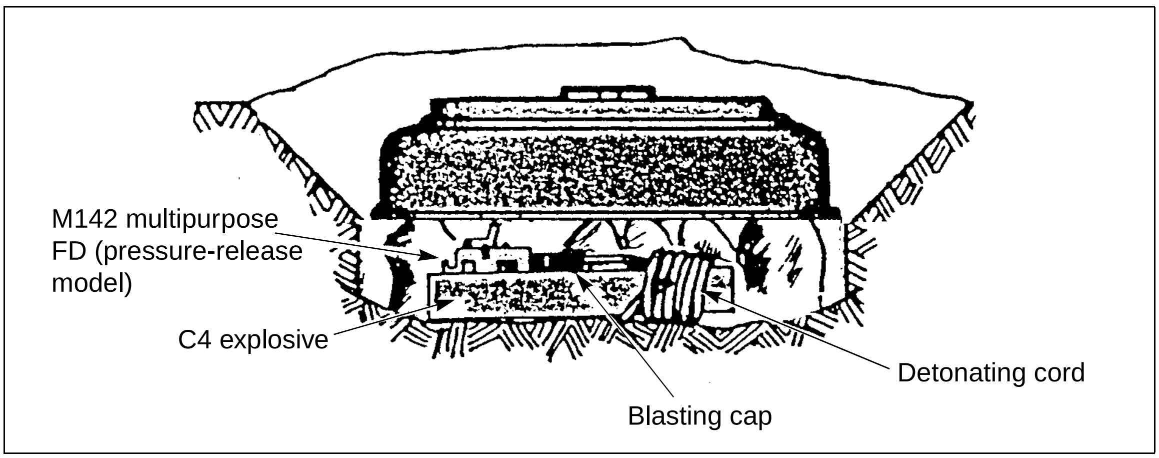
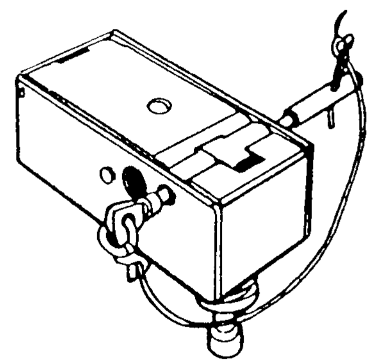


Figure 1-5. AHD not attached to the mine

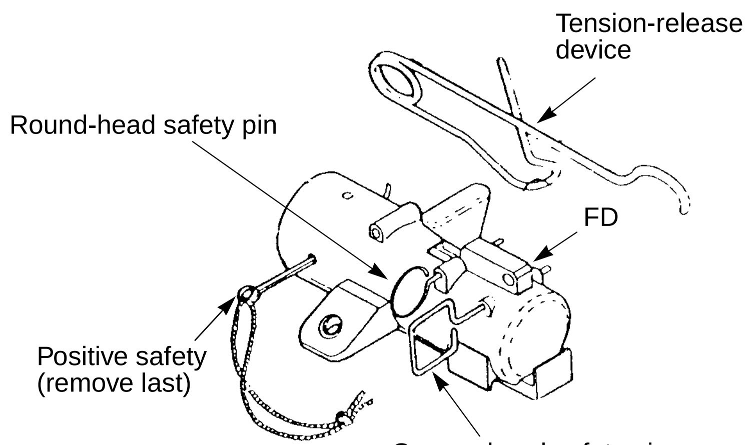
The following hand-emplaced AHDs are used by US forces (Figure 1-6, page 1-8):

- M5 pressure-release firing device (FD).
- M142 multipurpose FD.

These devices use a spring-loaded striker with a standard base, and they function in one or more modes—pressure, pressure-release, tension, and/or tension-release. When an FD is employed as an AHD on certain AT mines, it requires the use of an M1 or M2 activator. FDs and activators are described in Appendix A.



M5 Pressure-Release FD



M142 Multipurpose FD

Figure 1-6. Hand-emplaced US AHDs

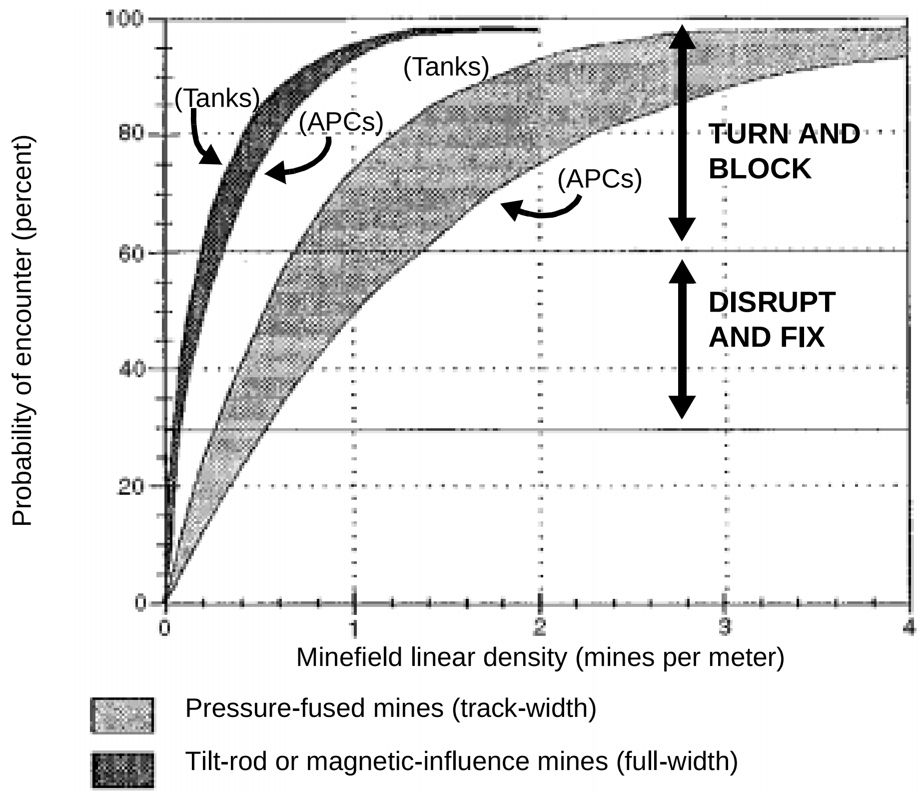


Figure 2-4. Vehicle mine encounter probability versus minefield density

Probability of Kill

The probability of kill is measured by the chance (in percent) that a vehicle will no longer be mission-capable (M-Kill or K-Kill) because of mine effects. It is a function of the combined probability that a vehicle will encounter a mine and the probability that the mine effect will produce an M-Kill or a K-Kill.

Antihandling Devices

Emplacing AHDs on mines is time-intensive. AHDs are added to a minefield to discourage manual removal and reuse of mines by the enemy and to demoralize the enemy who is attempting to reduce the minefield. AHDs do not prevent an enemy from reducing the minefield; they only discourage manual reduction methods.

Irregular Outer Edge

An IOE is a strip/row or multiple strips/rows of mines that normally extend toward the enemy from the first (enemy side) row of mines. An IOE is employed to break up the otherwise regular pattern of a minefield. It is used to confuse the enemy about the exact limits of the minefield, particularly its leading edge. An IOE adds an unknown quality to a minefield that makes the enemy's decision of whether to breach or bypass more difficult. The effect an IOE has on enemy actions may increase the overall lethality of a minefield.

DESIGN

Modifying minefield variables to achieve the desired obstacle effect is a challenge for the engineer, both technically (resourcing and designing) and tactically (supporting the maneuver scheme). Experience will provide the best basis for designing minefields. Figures 2-5 through 2-8, pages 2-10 through 2-13, provide guidelines for varying minefield depth, front, density, and composition to best achieve disrupt, fix, turn, and block effects.

These are guidelines, not fixed rules. Minefield designs must be based on a threat analysis. The designs are simply considerations or parameters to use when designing tactical minefields, regardless of the emplacement method. They apply to conventional mine-laying techniques as well as the employment of SCATMINE dispensers. These parameters give the engineer the flexibility to design and emplace tactical minefields based on mission, enemy, terrain, troops, time available, and civilian considerations (METT-TC) (particularly resources and terrain) and still achieve the required effect. These norms are also the basis for developing minefield packages and emplacement procedures outlined throughout this manual. Chapter 3 discusses the characteristics and emplacement procedures for each of the SCATMINE systems, Chapter 6 outlines procedures for row mining using conventional mines, and Chapter 7 is dedicated to the standard-pattern minefield. Each chapter describes standard disrupt, fix, turn, and block minefield packages particular to that method of emplacement or dispensing system.

Each tactical-obstacle effect has a specific resourcing factor. In short, this numeric value helps determine the amount of linear obstacle effort that is needed to achieve the desired effect. The resource factor is multiplied by the width of the AA or MC to get the total amount of linear obstacle effort required. The linear obstacle effort is then divided by the minefield front norm for the specific effect (rounded up) to yield the number of individual minefields required in the obstacle group.

Disrupt

A disrupt effect (Figure 2-5) focuses fire planning and obstacle effort to cause the enemy to break up its formation and tempo, interrupt its timetable, commit reduction assets prematurely, and piecemeal the attack. It also deceives the enemy about the location of friendly defensive positions, separates combat echelons, or separates combat forces from their logistical support. A disrupt effect should not be time-, manpower-, or resource-intensive. It should not be visible at long range but easily detected as the enemy nears it. Commanders normally use the disrupt effect forward of EAs.

Resource factor	0.5 (3 point obstacles) x AA
Group dimensions	W = 0.5 x AA
Probability of kill	50%
Minefield front	250 m
Minefield depth	100 m
AT mines	Yes (pressure/tilt)
AP mines	No **(Korea Only: optional, based on threat analysis)**
AHD	Optional, based on threat analysis
IOE	No

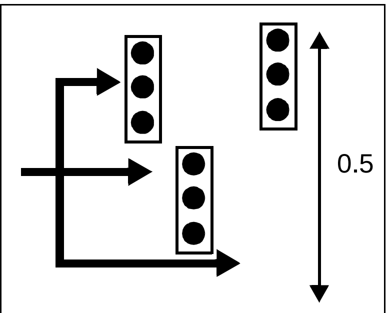


Figure 2-5. Disrupt-effect group

and Class IV/V supply-point setup during daylight hours, and plan to emplace mines during limited visibility hours as much as possible.

Table 2-2. Planning factors for the mine dump

Number of Personnel	Quantity of Mines	Required Equipment
2-man team (2 minutes per mine)	25 mines per hour	Shears, metal cutting Grease, automotive and artillery Rags Work gloves Flashlight Night-vision goggles Pliers
Squad (7 soldiers and an NCO)	100 mines per hour	
Platoon (with leadership)	300 mines per hour; 3,600 mines per day	
Company	10,800 mines per day	
NOTE: Soldiers work 50 minutes per hour, 12 hours per day.		

Table 2-3. Planning factors for work rates

Survivability	Time Required to Construct		
	With D7F Dozer	With ACE	With SEE
Hull-defilade position	1 BTH	1.5 BTH	NA
Turret-defilade position	2.5 BTH	3.5 BTH	NA
HMMWV TOW position	1.5 BTH	2 BTH	NA
Vehicle-protective position	0.75 BTH	1 BTH	NA
Dismount-crew position	NA	NA	1 SEEH
Individual-fighting position	NA	NA	0.5 SEEH
Countermobility	**With D7F Dozer**	**With ACE**	**In Man-Hours**
Antitank ditch	1 BTH/70 m	1 BTH/50 m	NA
Standardized disrupt minefield	NA	NA	1.5 PH
Standardized fix minefield	NA	NA	1.5 PH
Standardized turn minefield	NA	NA	3.5 PH
Standardized block minefield	NA	NA	5 PH
Triple-standard concertina	NA	NA	1 PH/300 m
Road crater	NA	NA	1.5 SH
Point minefield	NA	NA	1 SH
Concertina roadblock	NA	NA	1 SH
Bridge demolition (massive)	NA	NA	2 SH
Bridge demolition (steel)	NA	NA	1 SH
Mine preparation at the TF Class IV/V supply point	NA	NA	1 SH/100 mines
LEGEND: BTH (blade team hour). One blade team working for one hour. A blade team consists of two engineer blades (two dozers, two ACEs, or one ACE and one dozer). One vehicle digs (cutter) while the other spreads the spoil (striker). A dozer-ACE blade team uses the dozer BTH. SEEH (SEE hour). One SEE working for one hour. PH (platoon hour). One platoon (3 squads) working for one hour. SH (squad hour). One squad working for one hour.			

Table 2-4. Planning factors for standardized row minefields

Effect	Resource Factor	Front	Depth	Full-Width AT Mines	Track-Width AT Mines	Frag AP Mines
Disrupt	0.5	250 m	100 m	42	84	NA
Fix	1.0	250 m	120 m	63	84	NA
Turn	1.2	500 m	300 m	336	168	NA
Block	2.4	500 m	320 m	378	168	**84 (Korea Only)**

Table 2-5. Planning factors for scatterable minefields

System	Minefield Size	SD Time	Arming Time
ADAM	400 x 400 m 200 x 800 m	4 hr 48 hr	Within 1 min after ground impact
RAAM	400 x 400 m 200 x 800 m	4 hr 48 hr	2 min 45 sec
Volcano (one load = 160 canisters or 960 mines [800 AT and 160 AP])	Turn or block (1 per load): • Ground: 555 x 320 m • Air: 557 x 320 m Fix or disrupt (4 per load): • Ground: 277 x 120 m • Air: 278 x 120 m	4 hr 5 days 15 days	2 min
MOPMS	70 x 35 m	4 hr*	89 sec
*Can be recycled 3 times for a total of 13 hr			

Table 2-8. Class IV/V haul capacity

Vehicle	Concertina Wire[1]	M15 AT Mine	M19 AT Mine	M21 AT Mine	M16 AP Mine	M14 AP Mine	MOPMS Mine	Volcano Mine	MICLIC Reload[2]	Hornet
HMMWV 1,124 kg, 6 cu m	2	51	34	27	55	56	15	1	NA	1
M35 2½-ton truck 2,250 kg, 12.5 cu m	4	102	69	55	111	113	30	2	2	2
M1078 2½-ton truck 2,250 kg, 13.4 cu m	4	102	69	55	111	113	30	2	2	2
M54 5-ton truck 4,500 kg, 13.6 cu m	7	204	138	109	222	227	61	5	3	5
M1083 5-ton truck 4,500 kg, 15.6 cu m	8	204	138	109	222	227	61	5	3	5
M930 5-ton dump truck (without sideboards) 4,500 kg, 3.8 cu m	2	112	64	32	168	71	23	3	2	2
M930 5-ton dump truck (with sideboards) 4,500 kg, 8.2 cu m	4	204	138	70	222	153	51	5	3	4
M1090 5-ton dump truck 4,500 kg, 3.8 cu m	2	112	64	32	168	71	23	3	2	2
HEMTT truck 9,000 kg, 15 cu m	8	408	277	128	444	317	94	10	7	8
12-ton S&T 10,800 kg, 24.5 cu m	13	489	333	208	533	514	148	12	9	13
40-ton lowboy 36,000 kg, 49.3 cu m	27	1,466	1,035	419	1,777	1,035	308	30	27	27
M548 cargo 5,400 kg, 14.9 cu m	8	244	166	125	266	272	74	6	4	6
M1077 PLS flat rack 14,900 kg, 17.6 cu m	9	440	352	164	586	293	110	11	9	9
No of mines per box	NA	1	2	4	4	90	21	240	NA	30
Weight per box (kg)	531	22	33	41	21	20	73	833	1,195	810
Size of box (cu m)	1.8	0.04	0.05	0.12	0.03	0.06	0.16	1.6	1.8	1.8

[1]The number of concertina = bundles; 1 bundle = 40 rolls
[2]Line charge + rocket

Several considerations may drive the use of supply-point resupply. First, if there are no additional haul assets to transport obstacle material forward from the Class IV/V supply point, the supply-point method may be the only viable technique. Secondly, the minefield group may be close enough to the supply point that any other method is less efficient.

- Advantages.
  - — Minimizes unloading and loading of material.
  - — Requires minimal augmentation of haul assets.

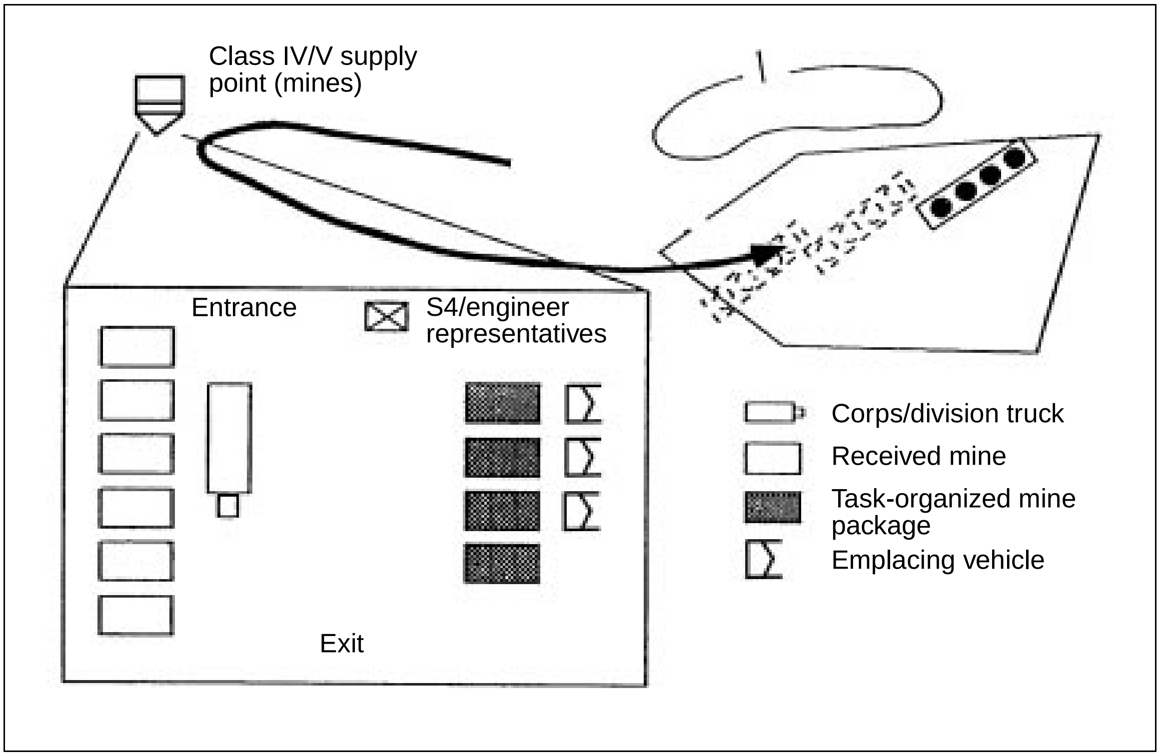


Figure 2-21. Supply-point resupply method

- Allows manpower and equipment to be massed at a single supply point.
- Streamlines C^2 of material.

- Disadvantages.
  - Requires more movement of the platoon, which may take away from emplacement time.
  - Requires that the platoon move in and out of the area where the minefields are being emplaced, increasing the risk of fratricide.
  - May disrupt the emplacement of individual obstacles when emplacing vehicles cannot carry enough material to start and complete the obstacle. This causes emplacing vehicles to stop work, reload, and pick up where they left off.
  - Requires a larger Class IV/V supply point that is capable of receiving mass quantities of obstacle material and multiple loading platoons simultaneously.

Service Station

The service-station method (Figure 2-22) centers on the activation of a mine dump forward of the Class IV/V supply point. The mines are transported to a mine dump using a combination of engineer and TF haul assets that are normally under the control of the emplacing engineer. At the mine dump, material is stockpiled and prepared by the mine-dump party. Obstacle

This chapter implements STANAG 2990.

Chapter 3

Scatterable Mines and Mine Delivery Systems

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

SCATMINE systems enable a tactical commander to emplace minefields rapidly in enemy-held territories, contaminated territories, and in most other areas where it is impossible for engineers to emplace conventional minefields. Some systems allow for rapid emplacement of minefields in friendly areas. As with all minefields and obstacles, scatterable minefields are an engineer responsibility.

Based on the tactical plan, the maneuver commander's staff engineer determines the minefield location, size, density, and emplacement and SD times. With this information and a thorough understanding of the available systems, he can then recommend the type of minefield (conventional or scatterable) to be emplaced. If a scatterable minefield is selected, he recommends the delivery system and coordinates the minefield with appropriate staff officers.

GENERAL CHARACTERISTICS

Most US SCATMINEs have similar characteristics. SCATMINEs are much smaller in size and weight than conventional mines. For example, a standard AT SCATMINE weighs approximately 1.8 kilograms and has 600 grams of explosive; an M15 conventional mine weighs 13.5 kilograms and has 10 kilograms of explosive. Arming mechanisms, arming times, and SD times of SCATMINEs differ based on the dispensing system.

ANTIPERSONNEL MINES

There are two general categories of AP SCATMINEs—wedge-shaped and cylindrical (Figure 3-1, page 3-2). Table 3-1, page 3-2, summarizes the characteristics of each AP SCATMINE.

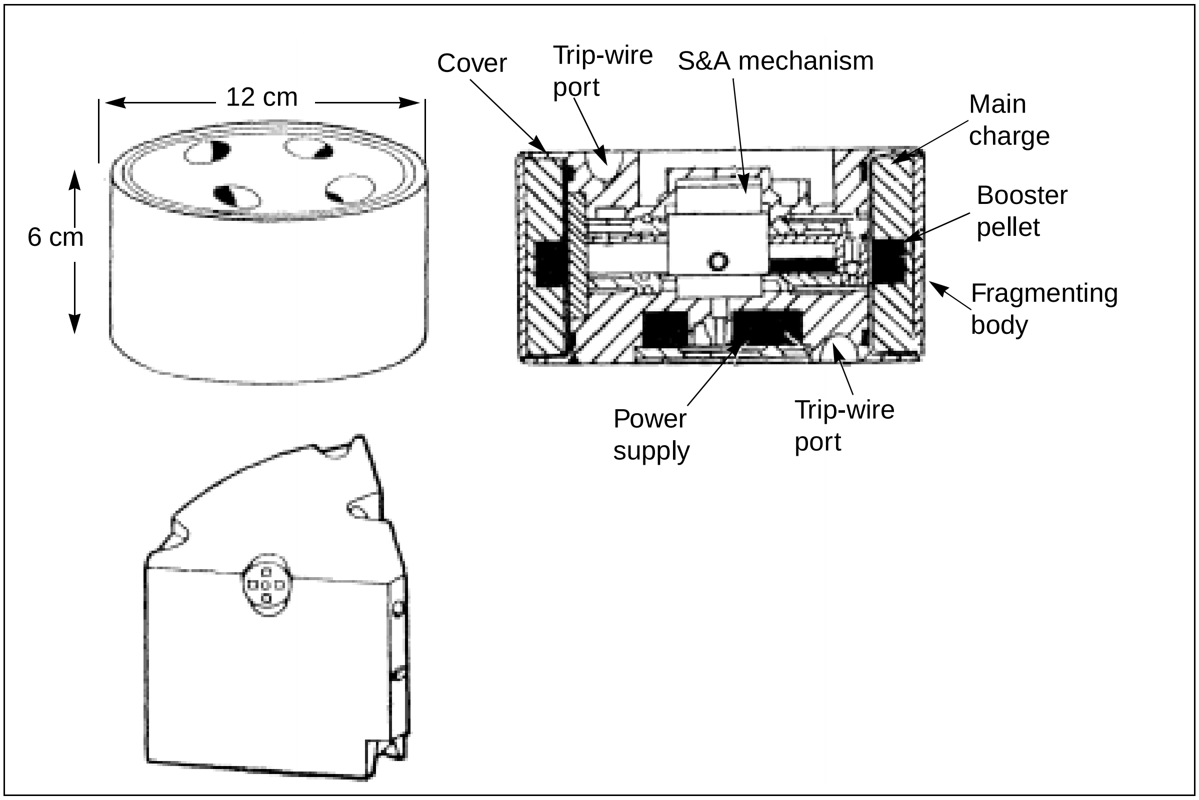


Figure 3-1. AP SCATMINEs

Table 3-1. Characteristics of AP SCATMINEs

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%	4 hr 48 hr 15 days	540 g Comp B4	1.44 kg	1 per M87 canister

The M67 and M72 AP SCATMINEs are wedge-shaped and dispensed from an ADAM projectile, which is a special 155-millimeter artillery munition. Each mine weighs 540 grams and is 7 centimeters high.

The M74, BLU 92/B, M77, and Volcano AP SCATMINEs are all cylindrical in shape. They are 6 centimeters high and 12 centimeters in diameter. Cylindrical AP SCATMINEs kill enemy soldiers through the combined effects of blast and fragmentation. Each mine contains 540 grams of composition B4 as its main charge. The charge detonates upon actuation and shatters the mine's metal casing to produce shrapnel. Shrapnel is propelled upward and outward from the mine and produces fatal casualties to a distance of 15 meters. Each mine has eight trip wires (four on the top and four on the bottom) that deploy after ground impact up to 12 meters from the mine. Trip wires are similar in appearance to very fine thread; they are olive-drab green in color and weighted at the free end. A tension of 405 grams applied to one trip wire is enough to create a break in the electrical circuit and cause the mine to detonate.

ANTITANK MINES

All AT SCATMINEs (Figure 3-2) have similar functional characteristics. They are cylindrical in shape, weigh approximately 1.8 kilograms, contain 585 grams of cyclonite (RDX) explosive as the main charge, and have a magnetically induced fuse. The characteristics of each AT SCATMINE are summarized in Table 3-2, page 3-4.

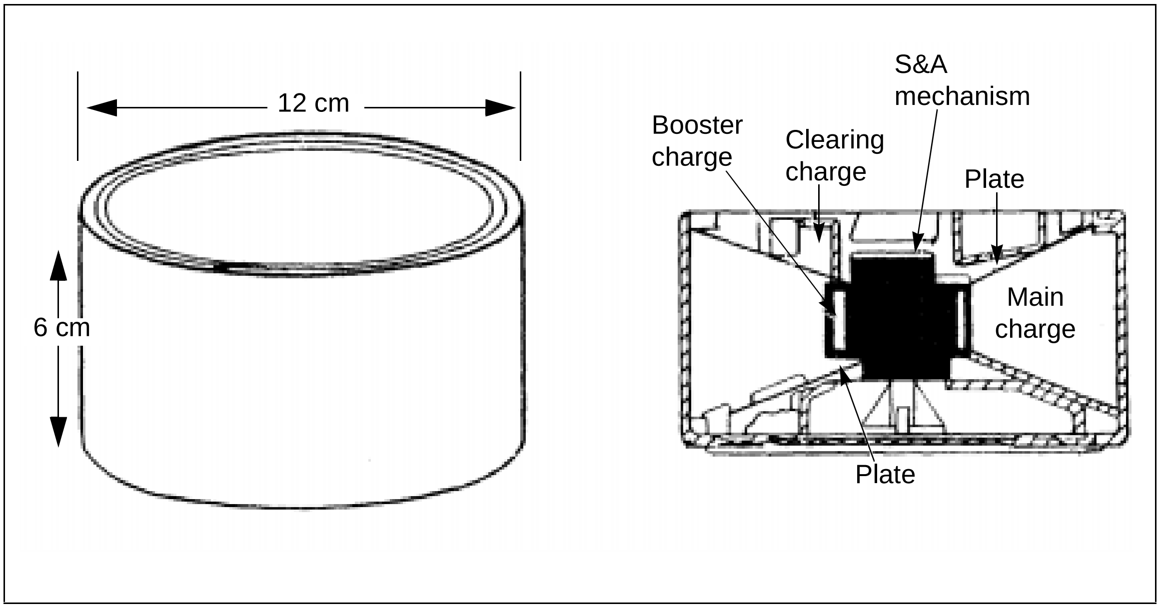


Figure 3-2. AT SCATMINE

Table 3-2. Characteristics of AT SCATMINEs

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

AT SCATMINEs are designed to produce a K-Kill instead of an M-Kill. They produce a kill by using an SFF warhead (created from an M-S plate). The warhead penetrates the vehicle's belly armor, and spalling metal from the vehicle (caused by the mine blast) kills occupants instantly. Even though the crew is killed, the drive train may be undamaged and the vehicle may continue to move. On enemy tanks with autoloaders, the detonation of rounds in the belly-mounted ammunition carousel is very likely. The mine may not achieve a kill when the track of an armored vehicle runs directly over it.

The magnetic fuse is designed to detonate as the magnetic field changes over the mine. The warhead is bidirectional, meaning that it can fire from the top or the bottom. AHDs are built into 20 percent of M70, M73, and M75 mines. Although Volcano, M76, and BLU 91/B mines do not have AHDs, they may detonate when moved, because the mine may sense a significant change from its original orientation.

Due to their small size, the reduced explosive, and the possibility of landing with an improper orientation (on their side or at an angle), AT SCATMINEs have less chance of destroying a vehicle than a conventional full-width AT mine. An armored vehicle will not always be destroyed after an encounter with an AT SCATMINE. Further, the effectiveness of SCATMINEs in water obstacles is reduced even more, because 5 centimeters of water prevents the formation of the M-S slug. Although the blast wave is accentuated by underwater placement (attacking hatches and covers), mining of banks and approaches is recommended instead.

CAPABILITIES

FASTER RESPONSE

SCATMINEs can be emplaced more rapidly than conventional mines, so they provide a commander with greater flexibility and more time to react to changes in situations. The commander can use SCATMINEs to maintain or regain the initiative by acting faster than the enemy. Using SCATMINEs also helps preserve scarce mine resources.

REMOTE PLACEMENT

All SCATMINEs are remotely emplaced. This enhances battlefield agility and allows the maneuver commander to emplace mines rapidly to best exploit enemy weaknesses. SCATMINEs can be used as situational obstacles or to attack enemy formations directly through disrupt, fix, turn, and block obstacles. Modern fusing, sensing, and AHDs allow SCATMINEs to better defeat enemy attempts to reduce the minefield.

INCREASED TACTICAL FLEXIBILITY

Upon expiration of the SD time, the minefield is cleared and the commander can move through an area that was previously denied to enemy or friendly forces. In many cases, the SD period may be set at only a few hours. This feature allows for effective counterattacks to the enemy's flank and rear areas.

EFFICIENCY

SCATMINEs can be emplaced by a variety of delivery methods. They can be deployed by fixed-wing aircraft, helicopters, artillery, manpack, or ground vehicles. They satisfy the high mobility requirements of modern warfare. Manpower, equipment, and tonnage are reduced for their emplacement.

INCREASED LETHALITY

AT SCATMINEs utilize an SFF that is created from two M-S plate charges to produce a full-width kill. In simple terms, a metal plate is formed into a high-velocity slug that punches a hole in the belly of a tank. The effect produces an M-Kill against the vehicle’s engine, track, or drive train; or it produces a K-Kill when the on-board ammunition is set off and the crew is killed or incapacitated or the vehicle’s weapon system is destroyed. AT SCATMINEs are designed to destroy any tank in the world. In order to form an SFF, the mine requires a certain standoff between the vehicle and the target. Mines must also be nearly perpendicular to the target (laying on either side). The M-S plate is actually two plates—one facing the top of the mine and one facing the bottom. This ensures that it will successfully attack the target while lying on either side.

AP SCATMINEs are actuated by a trip wire and utilize a blast-fragmentation warhead.

LIMITATIONS

EXTENSIVE COORDINATION

Because SCATMINEs are a very dynamic weapon system, great care must be taken to ensure that proper coordination is made with higher, adjacent, and subordinate units. To prevent friendly casualties, all affected units must be notified of the location and the duration of scatterable minefields. Recording and reporting procedures for SCATMINEs are discussed in detail in Chapter 8, and they were specifically designed to minimize friendly casualties.

PROLIFERATION OF TARGETS

SCATMINEs may be regarded by some commanders as easy solutions to tactical problems. Target requests must be carefully evaluated, and a priority system must be established because indiscriminate use of weapon systems will result in rapid depletion of a unit's basic load. Controlled supply rates (CSRs) will probably be a constraint in all theaters.

VISIBILITY

SCATMINEs are highly effective, especially when fires and obscurants strain the enemy's C^2. SCATMINEs lay on the surface of the ground, but they are relatively small and have natural coloring.

ACCURACY

SCATMINEs cannot be laid with the same accuracy as conventional mines. Remotely delivered SCATMINE systems are as accurate as conventional artillery-delivered or tactical aircraft-delivered munitions.

ORIENTATION

Between 5 and 15 percent of SCATMINEs will come to rest on their edges; mines with spring fingers will be in the lower percentile. If there is mud or snow more than 10 centimeters deep, the number will be in the higher percentile. When employing ADAMs or RAAMs in more than 10 centimeters of snow or mud, high-angle fire should be used and the number of mines increased. AP mines may be less effective in snow, because the deployment of trip wires is hindered. Melting of the snow may also cause the mines to change positions and activate AHDs.

LIFE CYCLE

All SCATMINEs have a similar life cycle, although specific times vary based on the SD time and the dispensing system.

For safety reasons, SCATMINEs must receive two arming signals at launch. One signal is usually physical (spin, acceleration, or unstacking), and the other is electronic. This same electronic signal activates the mine's SD time.

Mines start their safe-separation countdown (arming time) when they receive arming signals. This allows the mines to come to rest after dispensing and allows the mine dispenser to exit the area safely. Table 3-1, page 3-2, and Table 3-2, page 3-4, show arming times for individual SCATMINEs.

Mines are armed after the arming time expires. The first step in arming is a self-test to ensure proper circuitry. Approximately 0.5 percent of mines fail the self-test and self-destruct immediately.

After the self-test, mines remain active until their SD time expires or until they are encountered. Mines actually self-destruct at 80 to 100 percent of their SD time. The time period from when the mines begin to self-destruct and when they finish is called the SD window (Table 3-3). No mines should remain active after the SD time has been reached. Two to five percent of US SCATMINEs fail to self-destruct as intended. Any mines found after the SD time must be treated as unexploded ordnance (UXO). For example, mines with a 4-hour SD time will actually start self-destructing at 3 hours and 12 minutes. When the 4-hour SD time is reached, no unexploded mines should exist.

Table 3-3. SD windows

SD Time	SD Window Begins
4 hours	3 hours 12 minutes
48 hours	38 hours 24 minutes
5 days	4 days
15 days	12 days

LETHALITY AND DENSITY

LETHALITY AND TACTICAL-OBSTACLE EFFECT

Scatterable minefields are employed to reduce the enemy's ability to maneuver, mass, and reinforce against friendly forces. They increase the enemy's vulnerability to fires by producing specific obstacle effects (disrupt, fix, turn, and block) on the enemy's maneuver. To achieve this aim, individual minefields must be emplaced with varying degrees of lethality. During emplacement, lethality is varied primarily by changing the minefield density. Therefore, there is a direct correlation between the obstacle effect and the minefield density. In order to achieve the tactical-obstacle effect, use the following guidance when selecting minefield density:

- Disrupt.
  - Low density.
  - Probability of encounter: 40 to 50 percent.
  - Linear density: 0.4 to 0.5 mine per meter.
- Fix.
  - Medium density.
  - Probability of encounter: 50 to 60 percent.
  - Linear density: 0.5 to 0.6 mine per meter.
- Turn.
  - High density.
  - Probability of encounter: 75 to 85 percent.

— Linear density: 0.9 to 1.1 mines per meter.

- Block.
  - — High density.
  - — Probability of encounter: 85+ percent.
  - — Linear density: More than 1.1 mines per meter.

DENSITY

Density is normally expressed as linear or area. For conventional mines, linear density is normally used and is expressed in the average number of mines per meter of minefield front. For SCATMINE systems, area density is normally used and is expressed as the average number of mines per square meter. Since SCATMINE systems normally employ a preset combination of AT and AP mines, the area density includes both. For example, a scatterable minefield with an area density of 0.006 mine per square meter may have an AT density of 0.004 AT mine per square meter and an AP density of 0.002 AP mine per square meter. Due to the varying dimensions of scatterable minefields that can be created by the different types of employment devices, the exact density of a scatterable minefield cannot be determined. However, an estimate of the average density can be determined by using the following formulas:

- Linear density equals the number of mines divided by the minefield front.

$$\frac{number\ of\ mines}{minefield\ front} = mines\ per\ meter$$

- Area density equals the number of mines divided by the minefield area.

$$\frac{number\ of\ mines}{front \times depth} = mines\ per\ square\ meter$$

- Area density can be converted to linear density by multiplying the area density by the minefield depth. **(NOTE: Converting area density to linear density is not always accurate due to the space between minefield strips.)**

$$area\ density \times minefield\ depth = linear\ density$$

EXAMPLE: A 650- by 200-meter Gator minefield contains 564 mines (432 AT and 132 AP).

- Area density: 564 ÷ (200 x 650) = 0.004 mine per square meter.
  - — AT area density: 432 ÷ (200 x 650) = 0.003 mine per square meter.

— Hinder the ability of the enemy to reinforce the objective area.

The time and the number of rounds required to install effective ADAMs and RAAMs limit their use. Their range is limited to 17,500 or 17,740 meters, depending on which howitzer (M109 or M198, respectively) is used. Many of the deep-interdiction missions that support force-projection doctrine require a greater distance. Due to the large footprint created when the minefield is fired, many mines will scatter outside the planned minefield area. It is therefore necessary to plot the safety zone in order to prevent fratricide. The fire-support element (FSE) is responsible for plotting the safety zone, and the staff engineer should be familiar with the process and the expected results. The staff engineer ensures that the safety zone is plotted on the tactical command post (TCP)/TOC operation overlay.

Emplacement

ADAM and RAAM mining missions are requested through normal artillery-support channels. Although the actual numbers vary based on the unit and the mission, a representative basic load for an artillery battalion consists of approximately 32 ADAM and 24 RAAM (short SD time) rounds per artillery piece. **NOTE: The rounds with long SD times are normally used for preplanned targets and are issued from an ammunition supply point (ASP) on a mission-by-mission basis.**

Once the proper authorization has been received to employ the mines, requests for ADAMs and RAAMs are processed in the same way as other requests for fire support, including targets of opportunity. Allocate enough time for processing the request and completing firing procedures. This ensures that the enemy has not moved out of the target area before execution. (FM 90-7 contains more information on this process.) The use of ADAMs and RAAMs for preplanned fires requires close coordination among the Assistant Chief of Staff, G3 (Operations and Plans) (G3)/Operations and Training Officer (US Army) (S3), the staff engineer, and FSE sections. Coordination should also be made with the S2 and the S3 during the development of the decision support template (DST) to identify the proper named areas of interest (NAIs), target areas of interest (TAIs), trigger points, and decision points.

There are two critical aspects when emplacing ADAM and RAAM minefields:

- Designing the minefield to achieve the required effect.
- Ensuring the technical correctness of resourcing and delivering the minefield.

The following discussion provides general guidance for designing the minefield to achieve the desired effect and for determining the safety zone to assess the impact on maneuver. Appendix H of FM 6-20-40 serves as the primary source for technically resourcing and delivering artillery-delivered minefields.

ADAM and RAAM minefields can be emplaced to achieve disrupt, fix, turn, and block effects based on the principles outlined in Chapter 2. The engineer is responsible for deciding the required location, the density, the size, the composition, and the duration of the minefield based on the tactical-obstacle plan and the obstacle restrictions of the higher unit. The engineer provides this information to the FSE. Table 3-6 provides guidance on the minefield density and size necessary to achieve the desired obstacle effect.

Table 3-6. RAAM and ADAM minefield density and size

Obstacle Effect	RAAM		ADAM		Width (meters)	Depth (meters)
	Area[1]	Linear[2]	Area[1]	Linear[2]		
Disrupt	0.001	0.2	0.0005	0.1	200	200
Turn	0.002	0.8	0.001	0.4	400	400
Fix	0.002	0.4	0.0005	0.1	200	200
Block	0.004	1.6	0.002	0.8	400	400

[1]Area density = mines per square meter
[2]Linear density = mines per meter

The FSE determines all the technical aspects for delivering the minefield, such as the number of rounds required per aim point, the number of aim points required, the size of the safety zone, and the time required to emplace mines. There is a wide variety of factors involved in determining the number of rounds, the size of the safety zone, and the emplacement time. These factors are the range-to-target time, the battery-to-minefield angle, the high- or low-angle trajectory, and the method of firing (observer adjust or meteorological data plus velocity error [Met+VE] transfer). The FSE must tell the engineer whether the minefield mission is feasible. Feasibility is based on the number of rounds available, the scheme of indirect fires, and the availability of artillery tubes.

The engineer is primarily concerned with two technical aspects of delivery provided by the FSE—the safety zone and the emplacement time. The engineer uses the safety zone and the minefield duration to assess the impact of the minefield on the mobility requirements of the scheme of maneuver. The engineer depicts the safety zone on the obstacle overlay. He also uses the safety zone to identify requirements for minefield marking if the unit leaves or turns over the area before the SD time. The engineer and the FSE use the emplacement time to synchronize the delivery of the minefield with the tactical plan.

GATOR

The Gator (Figure 3-4) has a longer range than any other SCATMINE system. It provides a means to rapidly emplace minefields anywhere that can be reached by tactical aircraft. The Gator is produced in two versions—the United States Air Force (USAF) CBU-89/B system that contains 94 mines (72 AT and 22 AP) per dispenser and the United States Navy (USN) CBU-78/B system that contains 60 mines (45 AT and 15 AP) per dispenser.

The mines used with the Gator are the BLU-91/B AT mine and the BLU-92/B AP mine. They are similar to the mines used with the Volcano system. The mines are capable of three field-selectable SD times (4 hours, 48 hours, and 15 days). Both types of mines are encased in a plastic, square-shaped protective

The minefields would be delivered at different locations so that the group covers the entire AA and affects the entire enemy battalion.

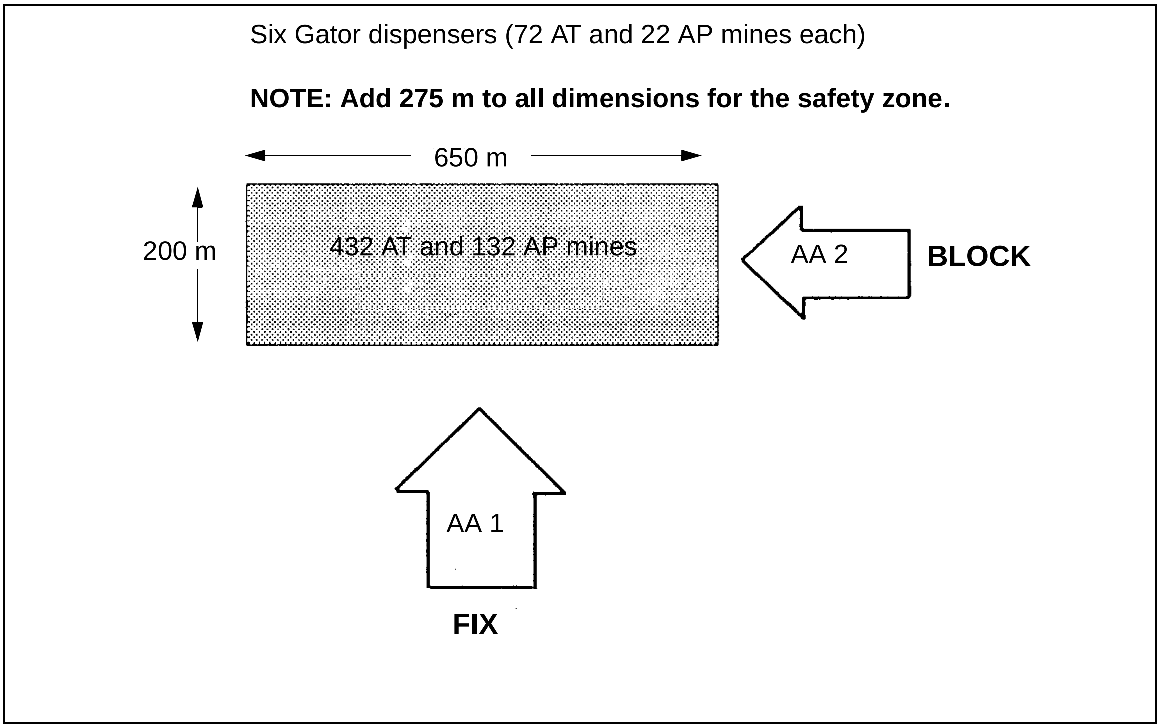


Figure 3-5. Gator minefield

VOLCANO

The Volcano multiple-delivery mine system (Figure 3-6, page 3-18) can be dispensed from the air or on the ground. It can be mounted on any 5-ton truck, an M548 tracked cargo carrier, a heavy expanded mobility tactical truck (HEMTT), a palletized load system (PLS) flat rack, or a UH-60A Blackhawk helicopter. The Volcano uses modified Gator mines and consists of four components (Figure 3-7, page 3-18)—the mine canister, the dispenser, the dispenser control unit (DCU), and the mounting hardware (aircraft also require a jettison kit). The Volcano uses M87 and M87A1 mine canisters. The M87 mine canister is prepackaged with five AT mines, one AP mine, and a propulsion device inside a tube housing. The M87A1 mine canister is prepackaged with six AT mines and a propulsion device. The mixture of mines is fixed and cannot be altered. Mines are electrically connected with a web that functions as a lateral dispersion device as the mines exit the canister. Spring fingers mounted on each mine prevent it from coming to rest on its edge. All canisters are capable of dispensing mines with 4-hour, 48-hour, and 15-day SD times. The SD times are field-selectable prior to dispensing and do not require a change or modification to the mine canister. The arming time is 2 minutes 15 seconds for AT and AP mines. The reload time (not including movement time to the reload site) for an experienced four-man crew is approximately 20 minutes.

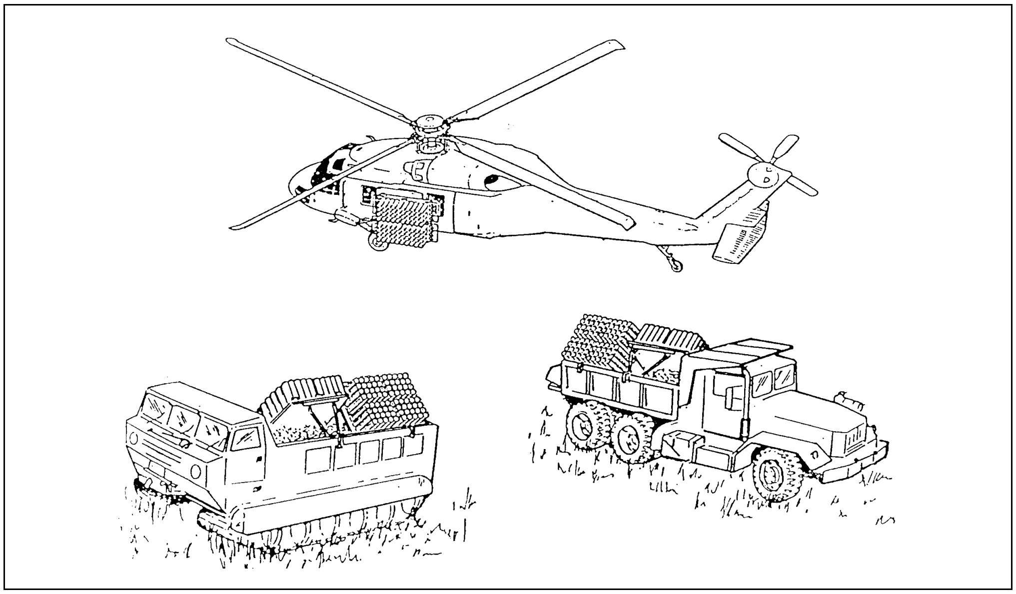


Figure 3-6. Volcano mine system

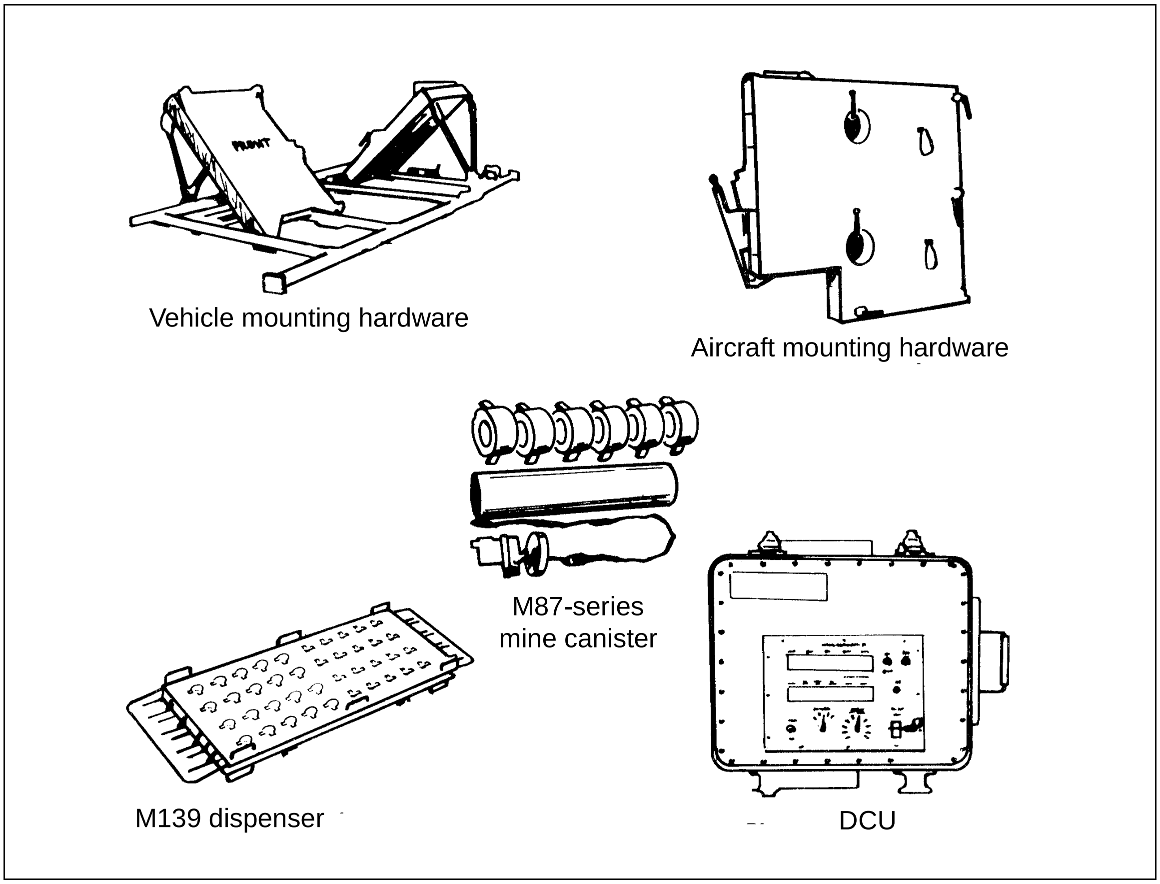


Figure 3-7. Volcano components

The dispenser consists of an electronic DCU and four launcher racks. Four racks can be mounted on a vehicle, and each rack can hold 40 M87-series mine canisters. The racks provide the structural strength and the mechanical support required for launch and provide the electrical interface between the mine canisters and the DCU. Mounting hardware secures the racks to the vehicle or the aircraft. Mounting hardware for the Blackhawk includes a jettison subassembly to propel the Volcano racks and canisters away from the aircraft in the event of an emergency.

The operator uses the DCU to control the dispensing operation electrically from within the carrier vehicle. The DCU provides controls for the arming sequence and the delivery speed and sets mine SD times. The DCU allows the operator to start and stop mine dispensing at anytime. A counter on the DCU indicates the number of remaining loaded canisters on each side of the carrier.

Mines are dispensed from their canisters by an explosive propelling charge. For ground vehicles, the mines are dispensed 25 to 60 meters from the vehicle at ground speeds of 8 to 90 kph. The average time to emplace one ground Volcano load (160 canisters) is 10 minutes.

Employment

The primary mission of the Volcano is to provide US forces with the capability to emplace large minefields rapidly under varied conditions. The Volcano can be rapidly attached to air or ground vehicles. It is used to emplace tactical minefields; reinforce existing obstacles; close lanes, gaps, and defiles; protect flanks; and deny probable enemy air-defense sites. Volcano minefields are ideal for providing flank protection of advancing forces and for operating in concert with air and ground cavalry units on flank guard or screen missions.

The air Volcano is the fastest method for emplacing large tactical minefields. When employed by combat aviation elements in support of maneuver units, close coordination between aviation and ground units assures that Volcano-dispensed mines are emplaced accurately and quickly. Although mine placement is not as precise as it is with ground systems, air Volcano minefields can be placed accurately enough to avoid the danger inherent in minefields delivered by artillery or jet aircraft. Air Volcano minefields can be emplaced in friendly and enemy territory. They should not be planned in areas of enemy observation and fire because the helicopter is extremely vulnerable while flying at the steady altitude, the speed, and the path required to emplace the minefield. The air Volcano is the best form of an obstacle reserve because a minefield can be emplaced in minutes.

The ground Volcano is designed to emplace large minefields in depth. It is normally employed by combat engineer units. These mounted dispensers are primarily used to emplace tactical minefields oriented on enemy forces in support of maneuver operations and friendly AT fires. The system is vulnerable to direct and indirect fires, so it must be protected when close to the FLOT. It is ideal for use as an obstacle reserve, employed when the enemy reaches a decision point that indicates future movement. Obstacles can then be emplaced in depth on the avenues the enemy is using, leaving other avenues open for friendly movement.

Emplacement

The principles and procedures of Volcano emplacement are significantly different for air- and ground-delivery systems. This section outlines the use of the ground Volcano system to emplace disrupt, fix, turn, and block minefields. The air Volcano system is discussed in detail in Appendix D. Both air and ground Volcano systems are capable of emplacing nonstandard minefields. However, the emplacement norms below streamline identifying resource requirements and conducting emplacement drills.

Air and ground Volcano systems emplace a minefield with an average AT linear density of 0.72 mine per meter and an AP linear density of 0.14 mine per meter. These densities may vary slightly since some mines will fail the arming sequence and self-destruct 2 to 4 minutes after dispensing. Additionally, some mines may not orient correctly, will not deliver their full mine effect, and will not produce a K-Kill. The probability of failing the arming sequence and misorienting is relatively small and does not appreciably degrade the minefield's lethality. For tracked vehicles, the AT density yields more than 80 percent probability of encounter. Volcano AT mines do not have AHDs but are highly sensitive to any movement once they are armed. Any attempt to remove the mines will likely result in detonation.

The basic site layout is extremely important, and it is the same for air and ground Volcano minefields. The limits of Volcano minefields are marked before emplacement when the situation (planned targets within the main battle area [MBA] of a defensive operation) allows it. The minefield is not premarked when the situation (offensive operations or situational obstacles) does not allow it. If the mines have not self-destructed, the minefield is marked before the unit leaves the area or turns it over to an adjacent unit. Minefield marking must include the safety zone, which is 40 meters from the start and end points and 80 meters to the left and right of the centerline. The start and end points of the strip centerline are marked based on the minefield front and the number of strips. For a ground Volcano minefield, guide markers are emplaced along the path of the centerline but are offset left to allow the host vehicle to remain on the centerline. When using a ground-delivery system, minefield marking must leave a gap along each centerline for vehicle entrance and exit. The number of guide markers used depends on the terrain and the visibility. Guide markers are not required for an air Volcano minefield because the pilot will use the start and end points of the centerline as reference points.

Figure 3-8 illustrates the emplacement pattern for standard disrupt and fix minefields using the ground or air Volcano. Disrupt and fix minefields use only one centerline to give a minefield depth of 120 meters (ground) or 140 meters (air), not including the safety zone. The strip centerline is 277 meters (ground) or 278 meters (air) long. The host vehicle moves toward the start point, achieving and maintaining the ground or air speed selected on the DCU. The operator depresses the launch switch on the DCU when the vehicle passes the start marker, and he stops dispensing mines when the vehicle passes the end marker. The operator dispenses 40 canisters (20 on each side) along the centerline. One full load of ground or air Volcano emplaces four disrupt or fix minefields. For ground emplacement, the vehicle moves out of the minefield, marks the exit, and waits a minimum of 4 minutes before approaching the minefield. This delay allows faulty mines to self-destruct.

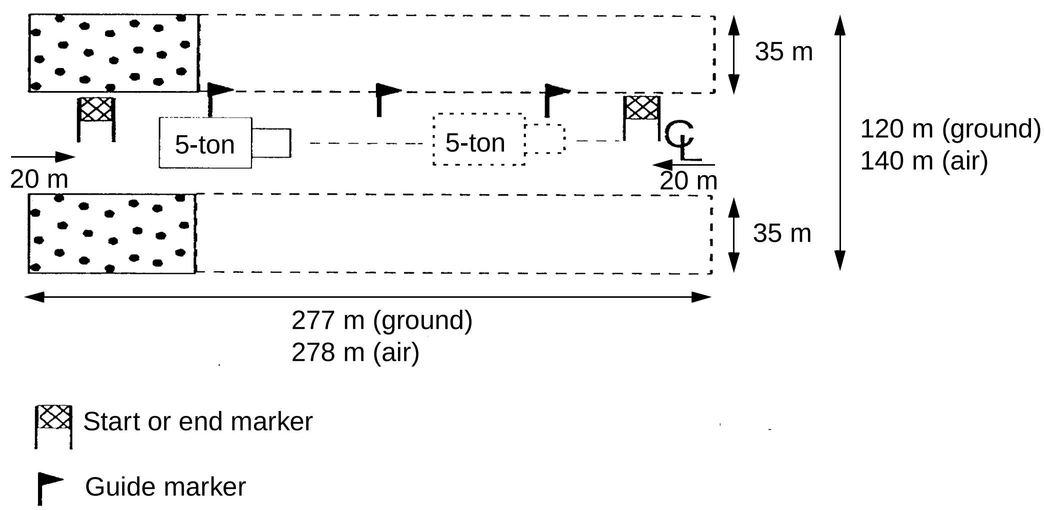


Figure 3-8. Volcano disrupt and fix minefields

Turn and block minefields (Figure 3-9, page 3-22) are emplaced using the same basic procedures as those used for disrupt and fix minefields. However, turn and block minefields use two strip centerlines along a front of 555 meters (ground) or 557 meters (air). During site layout, centerlines are separated by at least 320 meters for both ground and air delivery. This gives a total minefield depth of 440 meters (ground) or 460 meters (air). The operator dispenses 80 canisters along each centerline (40 on each side); therefore, turn and block minefields require a total Volcano load of 160 canisters. One full load of ground or air Volcano emplaces one turn or block minefield. Wherever possible, two ground Volcanoes are employed simultaneously on turn and block minefields. When only one ground delivery system is used, the crew must wait 4 minutes after dispensing the first strip before dispensing the second strip. This allows mines that fail the arming sequence to self-destruct. For air delivery, two sorties are also optimal; but demands for sorties elsewhere in the division may preclude the simultaneous employment of two Blackhawks.

Modular Pack Mine System

The MOPMS (Figure 3-10, page 3-22) is a man-portable, 162-pound, box-shaped mine dispenser that can be emplaced anytime before dispensing mines. The dispenser contains 21 mines (17 AT and 4 AP). The mines have leaf springs along their outer circumference that are designed to push the mines into proper orientation if they land on their side.

Each dispenser contains seven tubes; three mines are located in each tube. When dispensed, an explosive propelling charge at the bottom of each tube expels mines through the container roof. Mines are propelled 35 meters from the container in a 180-degree semicircle (Figure 3-11, page 3-23). The resulting density is 0.01 mine per square meter. The safety zone around one container is 55 meters to the front and sides and 20 meters to the rear.

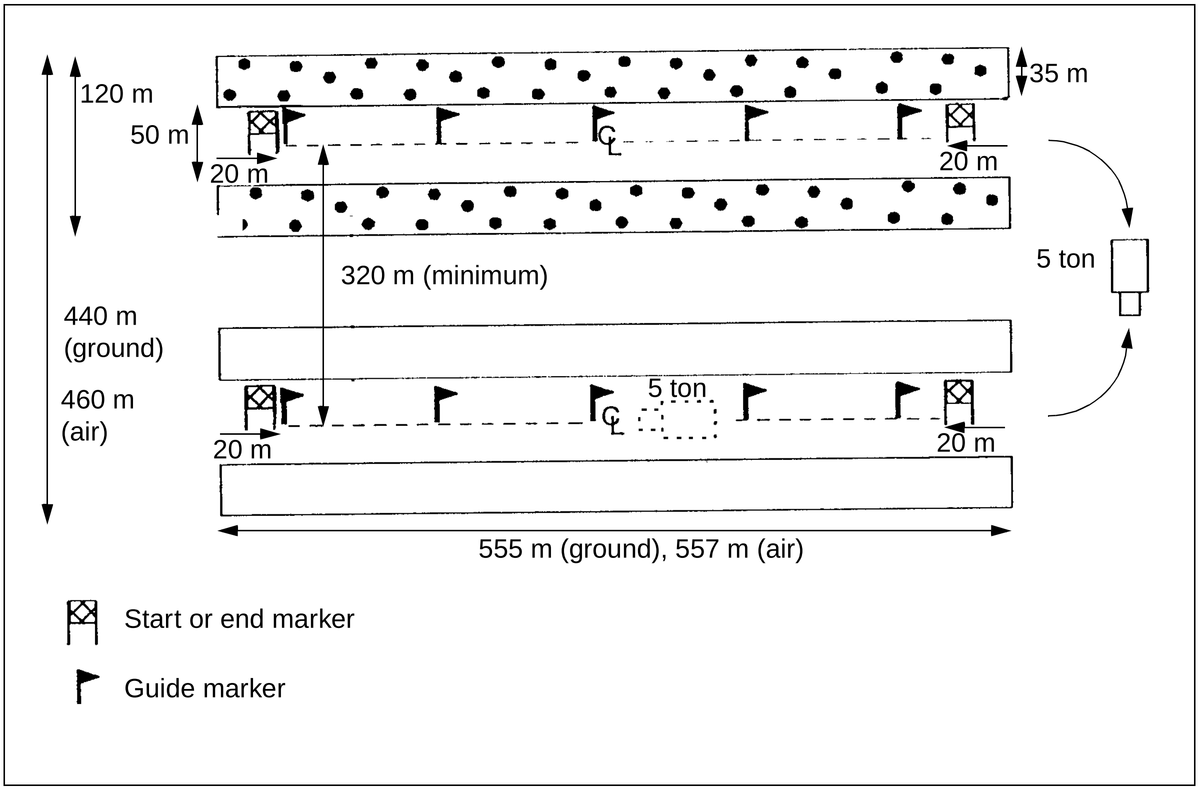


Figure 3-9. Volcano turn and block minefields

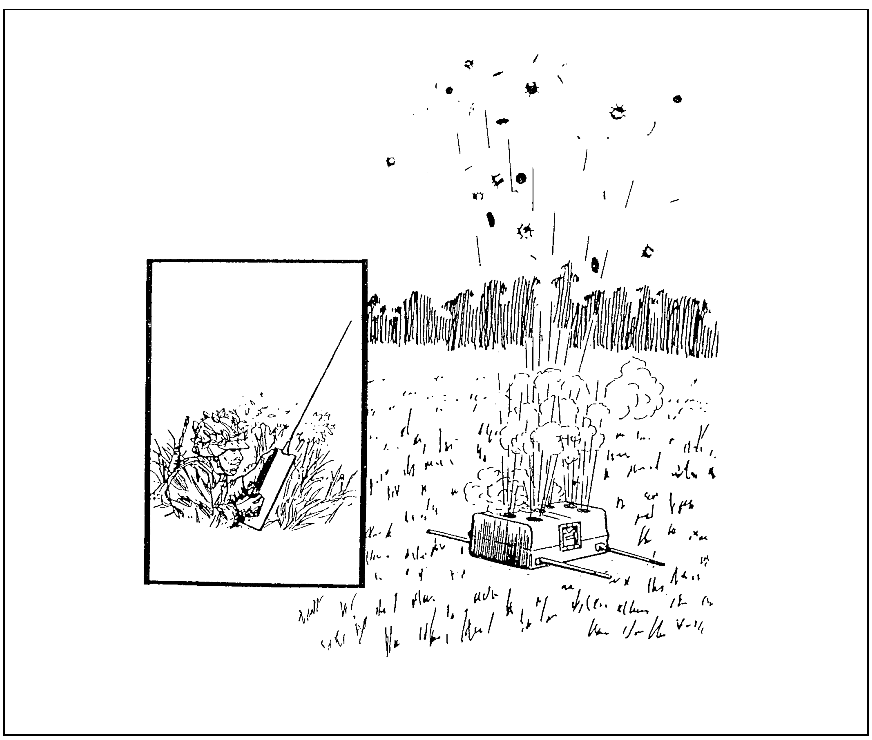


Figure 3-10. MOPMS

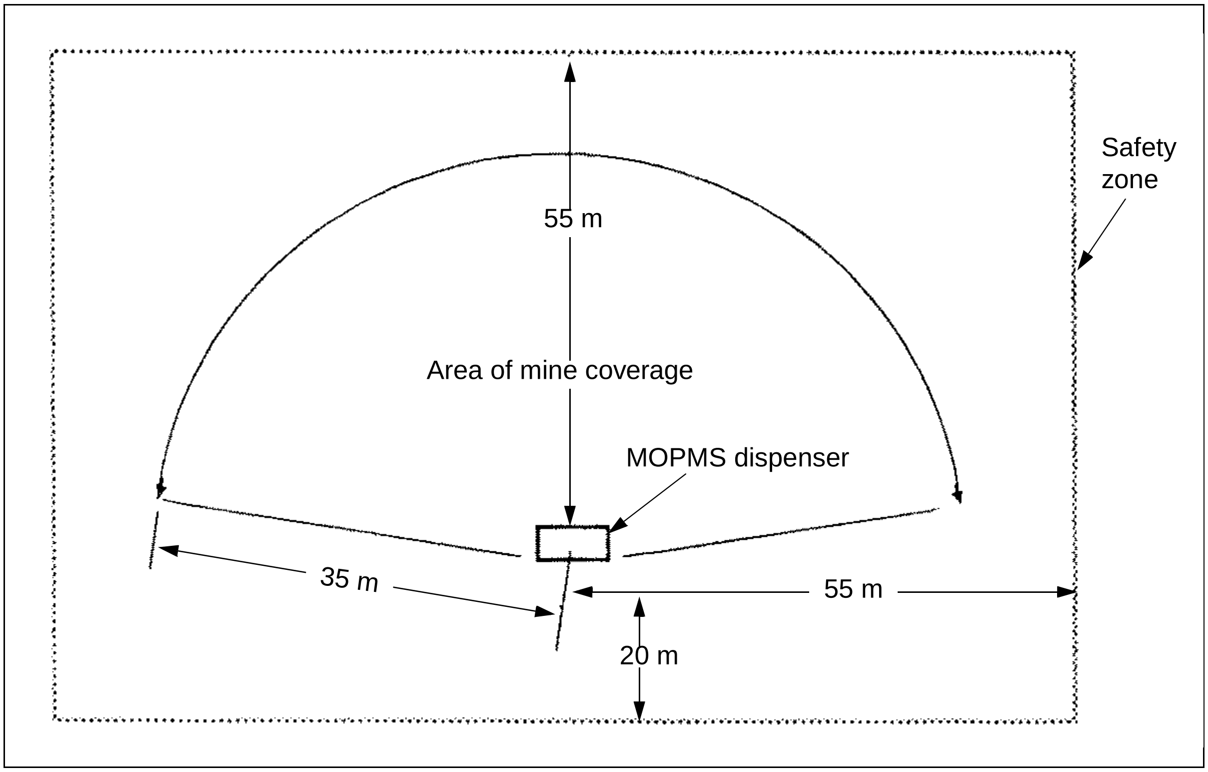


Figure 3-11. MOPMS emplacement and safety zone

Mines are dispensed on command using an M71 remote-control unit (RCU) or an electronic initiating device. 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 recycle the 4-hour SD time of the mines three times, for a total duration of approximately 13 hours. Mines with a 4-hour SD time will begin to self-destruct at 3 hours and 12 minutes. All active mines must be recycled within 3 hours of the initial launch or last recycle. This feature makes it possible to keep the minefield emplaced for longer periods if necessary. The RCU can also self-destruct mines on command, allowing a unit to counterattack or withdraw through the minefield, as necessary, rather than waiting until the SD time has expired. The RCU can control up to 15 MOPMS containers or groups of MOPMS containers from a distance of 300 to 1,000 meters via separate pulse-coded frequencies. Coded frequencies defeat threat electronic countermeasures directed against the system.

If the M71 RCU is unavailable, a direct wire link is used in conjunction with an M32, M34, or M57 blasting machine. By using the M32 10-cap blasting machine, one MOPMS dispenser can be detonated at a maximum range of 1,000 meters. The M34 50-cap blasting machine can detonate one MOPMS at a maximum range of 3,000 meters. (Due to internal resistance, the maximum range is decreased by 400 meters for each additional MOPMS connected in series.) The M57 claymore-type FD can fire only one MOPMS at a maximum range of 100 meters. When controlled by direct wire, MOPMS dispensers cannot be command-detonated, and the SD time cannot be recycled.

WARNING

The MOPMS dispenser has seven launch tubes. If all seven tubes are not visible after deployment, mines are jammed in the tube(s). In this event, clear the area and notify EOD. The dispenser is considered to be UXO; do not attempt to recover the dispenser.

Employment

The MOPMS provides a self-contained, on-call minefield emplacement capability for all forces. It can be command-detonated, reused (if mines are not dispensed), and directly emplaced to provide complete and certain coverage of small or critical targets. The ability to command-detonate mines or extend their SD time provides an added flexibility not currently available with other SCATMINE systems. With its unique characteristics, the MOPMS is ideally suited for the following minefield missions:

- Emplacing hasty protective minefields.
- Emplacing deliberate protective minefields (cases emplaced, but mines not dispensed).
- Emplacing nuisance minefields (trails, crossing sites, landing zones [LZs], drop zones [DZs], and road junctions).
- Emplacing tactical disrupt and fix minefields.
- Closing gaps and lanes in existing minefields.
- Temporarily closing counterattack routes.
- Supporting ambushes.
- Supporting military operations in built-up areas (MOBA) operations.

When the MOPMS is used to close lanes, the container is positioned and dispensed by personnel in an overwatch position from a safe standoff. The MOPMS is ideally suited for creating a small disrupt obstacle in support of engineers executing a reserved demolition target. Engineers prepare the reserved target for demolition and emplace several MOPMS units on the enemy side, just out of target range. When the last forward element passes through the target, the firing party detonates the charges. If something goes wrong or the firing party needs more time, MOPMS mines can be dispensed to disrupt the enemy before it reaches the target.

The MOPMS provides light and special forces with a versatile, compact system for emplacing nuisance minefields. It can be used in low-, mid-, and high-intensity conflicts and in a variety of environments. The MOPMS cannot be transported long distances by hand because of its weight, so its use is limited.

Emplacement

MOPMS dispensers are issued as standard Class V munitions and are drawn from an ASP on a mission-by-mission basis. RCUs are organizational issues of equipment and are assigned to engineer and combat arms units. Due to the weight of the system, it will normally be transported by vehicle, as close as possible to the emplacement site, where it can easily be hand-emplaced by four soldiers using the four foldout carrying handles.

To ensure that the minefield will be dispensed in the proper location, the container should be carefully sited by the noncommissioned officer in charge (NCOIC). Several containers can be used together to provide a greater area of coverage or a higher mine density. If mines are not dispensed immediately, containers should be camouflaged and, if possible, buried. When placed in sand or snow, brace the containers to prevent them from moving during mine dispensing. Designate a firing point that gives the operator clear observation of the area to be mined. Firing systems must be inspected according to MOPMS operating instructions. If mines are dispensed immediately, remove empty containers to avoid revealing the minefield location.

The MOPMS can be employed to emplace disrupt and fix tactical minefields. Emplacement procedures are the same as for protective minefields above. However, MOPMS containers are arranged in a specific pattern to achieve the necessary depth, front, and density. Once the minefield is marked (to include the safety zone), MOPMS containers are arranged as shown in Figure 3-12 for a disrupt minefield. The safety zone is 55 meters from the front and sides and 20 meters from the rear of the container. The disrupt minefield uses four MOPMS containers that are spaced 70 meters apart to give a minefield front of 280 meters. Other MOPMS containers are offset from the baseline by 35 meters to give the minefield a depth of 70 meters. All containers are fired using the same RCU or FD.

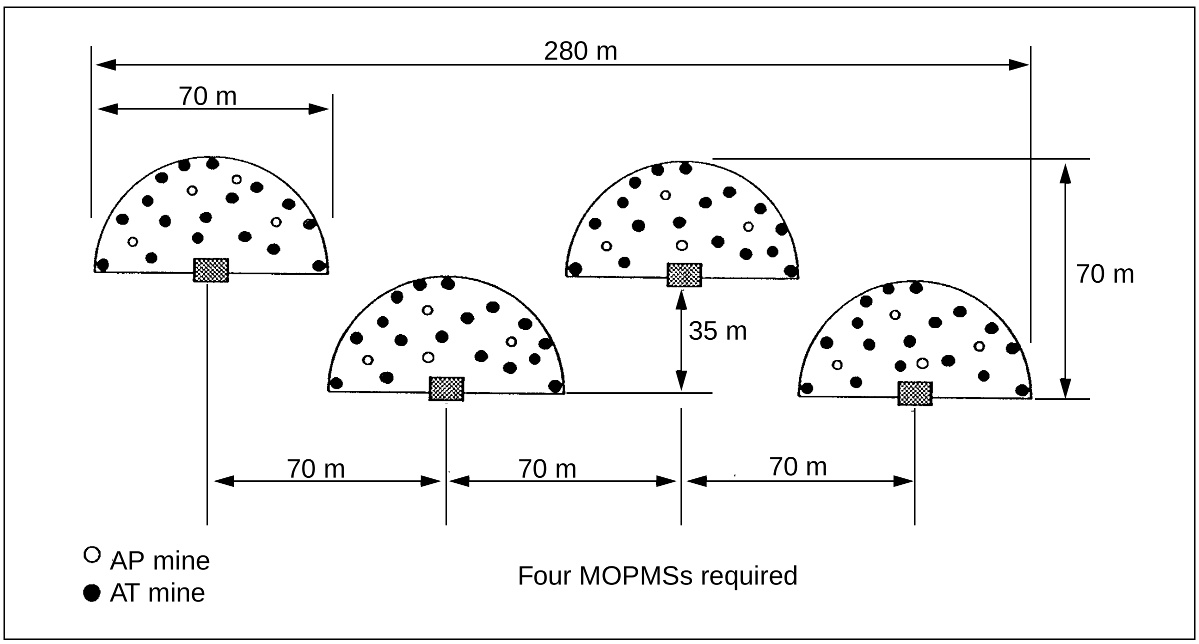


Figure 3-12. MOPMS in a disrupt minefield

Figure 3-13 illustrates the arrangement of MOPMS containers for a fix minefield. The basic layout is the same as the disrupt minefield; however, the fix minefield has one additional MOPMS that is placed 70 meters forward of the baseline to act as an IOE. This gives the same 280-meter minefield front but increases the minefield depth to 115 meters.

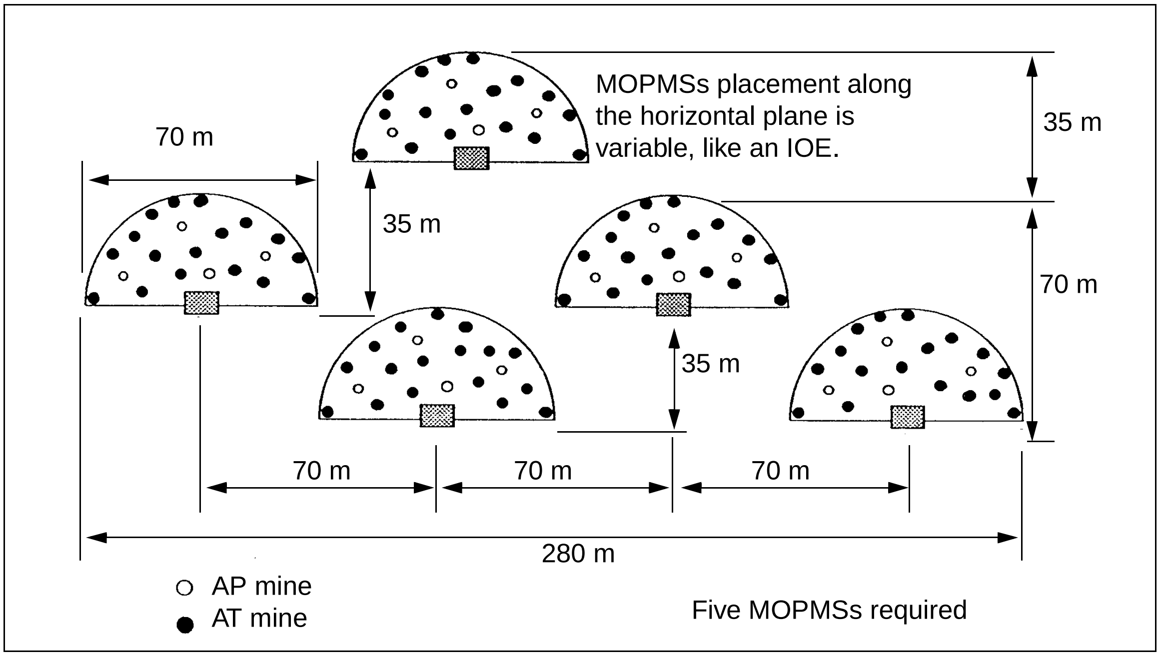


Figure 3-13. MOPMS in a fix minefield

MOPMS can be used to construct turn and block tactical minefields using the principles outlined in Chapter 2; however, turn and block minefields require more containers than are normally available to a unit.

MARKING

The maneuver unit that is responsible for the area of ground in which the minefield is emplaced is also responsible for marking the minefield. This normally requires direct coordination between elements of the maneuver command (usually the engineer) and the delivering/emplacing unit. However, it is unrealistic to expect units to mark artillery-delivered ADAM and RAAM, air-delivered Volcano, or Gator minefields. For this reason, units operating in the vicinity of these minefields must know calculated safety zones and use extreme caution. Scatterable minefields are marked to protect friendly troops as shown in Table 3-7. Ground Volcano minefields are marked according to the guidelines below.

Table 3-7. Marking scatterable minefields

Minefield Location	Marking
Enemy forward area	Unmarked
Friendly forward area	Sides and rear marked
Friendly rear area	All sides marked

SAFETY ZONES

A safety zone is an area where a stray or outlying mine has a chance of landing and laying to rest. The commander must prevent friendly forces from maneuvering into the safety zone during the minefield's life cycle. Depending on its specific location on the battlefield, the safety zone may be marked with a fence.

The safety zone around a Volcano minefield is shown in Figure 3-14.

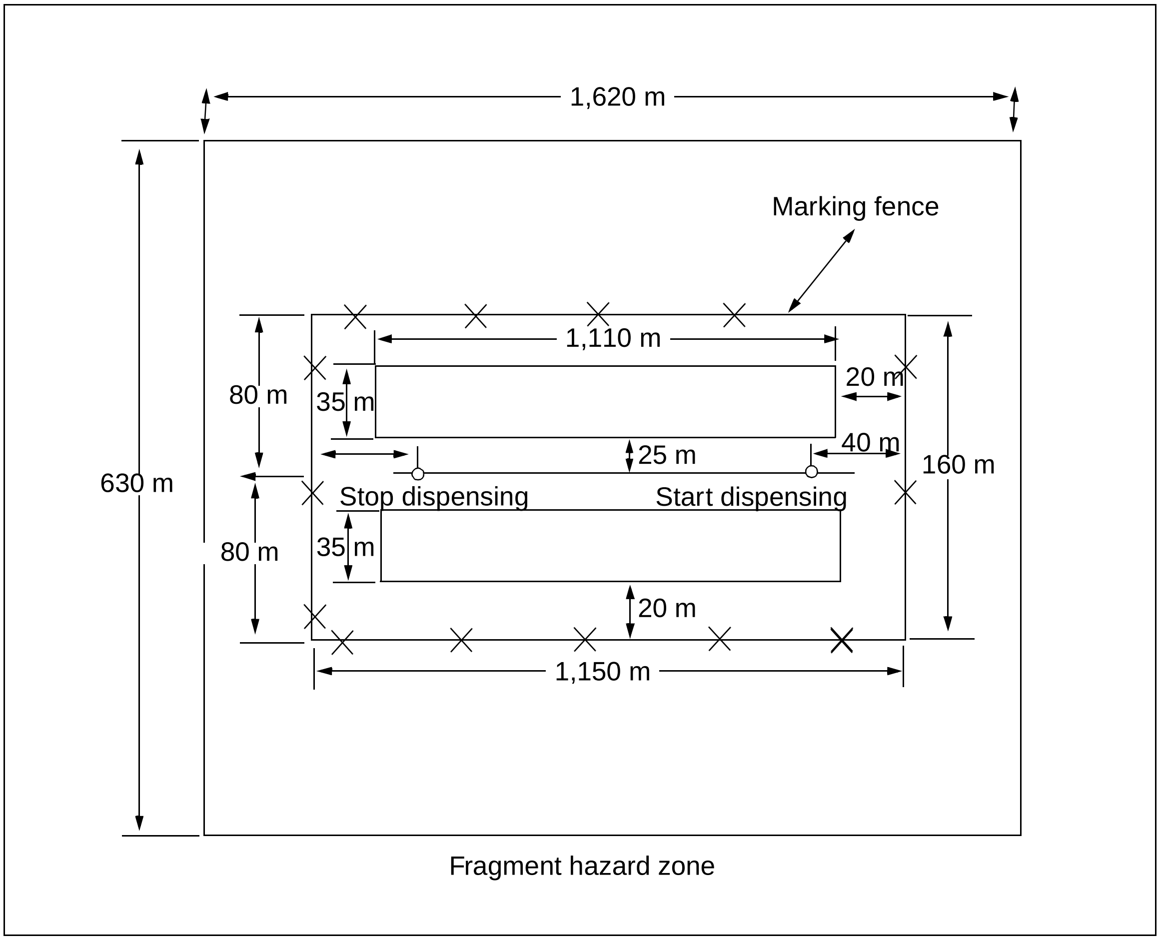


Figure 3-14. Ground Volcano minefield

FRAGMENT HAZARD ZONES

If an AT mine that is oriented on its side self-destructs, the EFP can theoretically travel 640 meters. This is the maximum fragment hazard zone; however, the chances of being struck are negligible at this distance. Tests indicate that the acceptable risk distance is 235 meters from the outer edges of the minefield's safety zone. This fragment hazard zone is also associated with the Gator and MOPMS AT mines. When the MOPMS is used for protective minefield missions, commanders must be made aware of the fragment hazard zone.

Use Table 3-8 to determine safety zones and fragment hazard zones.

Table 3-8. Safety and fragment hazard zones

System	Safety Zone	Fragment Hazard Zone
ADAM/RAAM	500 to 1,500 meters from aim point(s) (depends on delivery factors)	235 meters from the outside dimensions of the safety zone
Gator	925 x 475 meters from aim point(s)	1,395 x 945 meters from aim point(s)
Ground Volcano	1,150 x 160 meters	235 meters from start and stop points and the centerline
Air Volcano	1,315 x 200 meters	235 meters from start and stop points and the centerline
MOPMS	See page 3-28 for specific placement.	235 meters from the outside dimensions of the safety zone

FENCING

Fencing for ground Volcano minefields (Figure 3-14, page 3-27) is emplaced 80 meters beyond the centerline of the minefield and 40 meters from the start and stop points. Fencing should be no closer than 20 meters from the nearest mine.

Air Volcano minefields are not normally marked by fencing. However, if air Volcano minefields are emplaced in friendly areas, they are marked with fencing to protect friendly personnel. Fencing is installed before delivering an air Volcano, and it is located 100 meters from the centerline of the minefield and 100 meters from the start and end points. Appendix D contains detailed information pertaining to air Volcano minefields.

Chapter 4

Special-Purpose Munitions

Special-purpose munitions are hand-emplaced and used to create an expedient obstacle, enhance existing ones, and attack specific types of targets. The commander can employ these munitions to support his scheme of maneuver, to mass firepower, and to disrupt or destroy enemy forces in depth. Special considerations must be made in the planning process to effectively employ special-purpose munitions.

M18A1 CLAYMORE

The M18A1 claymore munition (Figure 4-2) is a fragmentation munition that contains 700 steel balls and 682 grams of composition C4 explosive. It weighs 1.6 kilograms and can be detonated by command **(Korea Only: or trip wire)**. It is activated by electric or nonelectric blasting caps that are inserted into the detonator well. The claymore projects a fan-shaped pattern of steel balls in a 60-degree horizontal arc, at a maximum height of 2 meters, and covers a casualty radius of 100 meters. The forward danger radius for friendly forces is 250 meters. The backblast area is unsafe in unprotected areas 16 meters to the rear and sides of the munition. Friendly personnel within 100 meters to the rear and sides of the munition should be in a covered position to be safe from secondary missiles. If the M18A1 is employed in a minefield for 72 hours or more, the minefield must be fenced on all sides.

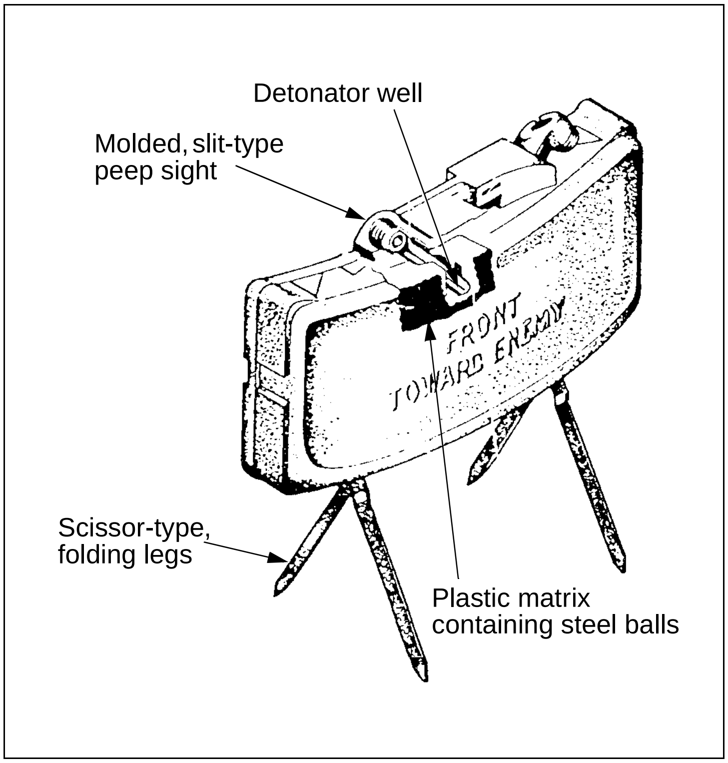


Figure 4-2. M18A1 claymore

When employing the M18A1 claymore with other munitions or mines, separate the munitions by the following minimum distances:

- 50 meters in front of or behind other M18A1s.
- 3 meters between M18A1s that are placed side by side.
- 10 meters from AT or fragmentation AP munitions.
- 2 meters from blast AP munitions.

SELECTABLE LIGHTWEIGHT ATTACK MUNITION

The selectable lightweight attack munition (SLAM) (Figure 4-3) is a multipurpose munition with an antitamper feature. The SLAM is compact and weighs only 1 kilogram, so it is easily portable. The SLAM is intended for use against APCs, parked aircraft, wheeled or tracked vehicles, stationary targets (such as electrical transformers), small fuel-storage tanks (less than 10,000-gallon), and ammunition storage facilities. The EFP warhead can penetrate 40 millimeters of homogeneous steel.

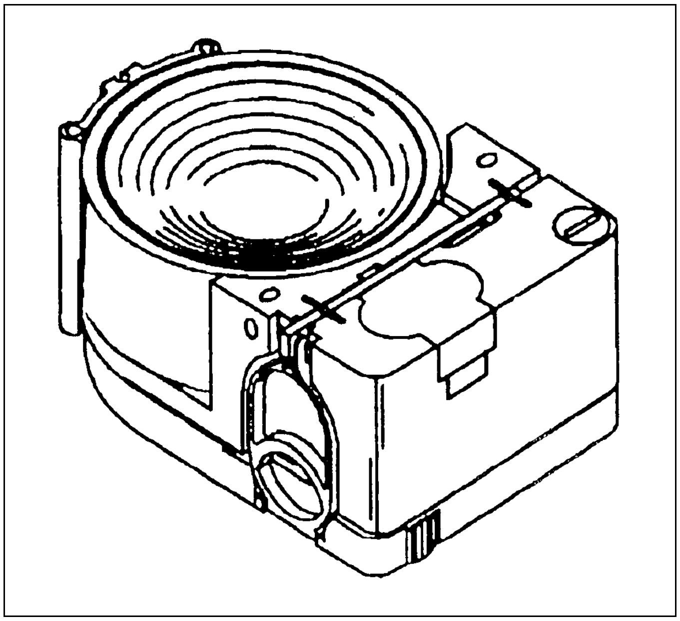


Figure 4-3. SLAM

The SLAM has two models—one is self-neutralizing (M2) and the other is self-destructing (M4):

- The M2 is solid green and has no labels, brands, or other distinguishing marks. This device is used by SOF and is not available to other units.
- The M4 is green with a black warhead (EFP) face. This device is normally used by units designated as light, airborne, air assault, crisis response, and rapid deployment.

See Appendix B for a description of major SLAM components.

OPERATING MODES

The SLAM has four possible employment methods—bottom attack, side attack, timed demolition, and command detonation.

Bottom Attack

The SLAM has a built-in magnetic sensor, so it can be used as a magnetic-influenced munition against trucks and light armored vehicles (Figure 4-4, page 4-4). It can be concealed along trails and roads where target vehicles operate and can be camouflaged with dry leaves, grass, and so forth without affecting EFP performance. Mud, gravel, water, and other debris that fill the EFP cup have minimal impact on EFP formation and effectiveness as long as the debris does not extend beyond the depth of the EFP cup. The magnetic sensor is designed to trigger detonation when it senses a vehicle's overpass. For the EFP to form properly, it needs a minimum of 13 centimeters from the point of emplacement to the target. The bottom-attack mode is active when the selector switch is set to *4, 10, or 24 HOURS* and the passive infrared sensor (PIRS) cover is in place. The SLAM will self-destruct (M4) or self-neutralize (M2) if the selected time expires before the SLAM is detonated by a vehicle.

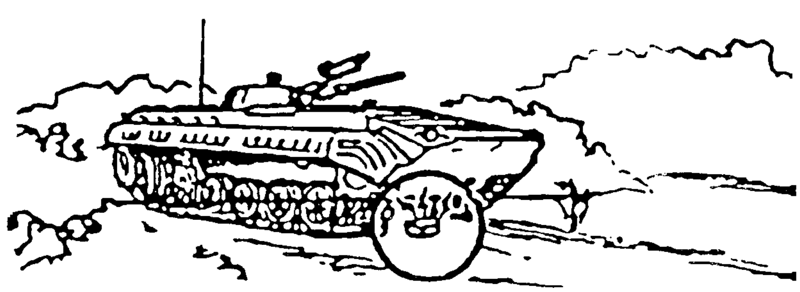


Figure 4-4. SLAM in bottom-attack mode

Side Attack

The SLAM is equipped with a PIRS that was specifically developed for the side-attack mode (Figure 4-5). The PIRS detects trucks and light armored vehicles by sensing the change in background temperature when vehicles cross in front of the PIRS port. The PIRS is directional and aligned with the EFP when the device is aimed. The side-attack mode is active when the SLAM selector switch is set to *4, 10, or 24 HOURS* and the PIRS cover is removed to expose the PIRS. The SLAM will self-destruct (M4) or self-neutralize (M2) if the selected time expires before it is detonated by a vehicle.

Timed Demolition

The SLAM's built-in timer will trigger detonation at the end of a selected time (Figure 4-6). The timed-demolition mode is active when the SLAM selector switch is set to *15, 30, 45, or 60 MINUTES*. In this mode, the magnetic sensor and the PIRS are inoperable, and the SLAM will detonate after the selected time has expired.

Command Detonation

This mode provides manual warhead initiation using standard military blasting caps and a priming adapter (Figure 4-7). The command-detonation capability bypasses the SLAM's fuse and safing and arming (S&A) assembly.

affect future Hornet's two-way communications capability with the Centurion remote control device.

See Appendix B for a description of Hornet components.

EMPLOYMENT CONSIDERATIONS

The Hornet's active battery pack is inserted during prearming and has an estimated life of 4 hours. The active battery pack powers the munition from the time it is inserted until the end of the safe-separation time, when the built-in reserve battery is activated. To prevent munitions from becoming duds, do not prearm them too early. Allow adequate time for travelling to the obstacle site, emplacing mines, throwing arming switches, and expiration of safe-separation times.

Once the Hornet is armed and the self-test is performed, the munition will remain active until its SD time expires or until it is encountered. The SD time (4 hours, 48 hours, 5 days, 15 days, or 30 days) is determined by the mission and the commander's intent. The munition will self-detonate after the SD time has expired.

Hornet munitions have an employed life of 60 days in the prearmed mode (remote arming) and 30 days in the armed mode. If the temperature exceeds 100ºF, the employed life drops to 15 days in the prearmed mode and 30 days in the armed mode.

EMPLOYMENT ROLES

Combat engineers or maneuver forces under engineer supervision emplace Hornets in close operations; SOF or rangers emplace Hornets in deep operations. Hornets will be employed throughout the entire depth of the battle space to support Army operations.

Close Operations

In close operations, the Hornet can be—

- Used to fix the enemy and weaken it along its AA.
- Emplaced as an offensive-support weapon system because of its quick emplacement time and wide attack area.
- Employed rapidly along exposed flanks during a maneuver as a situational obstacle to disrupt the enemy's counterattacks.

- Used as a stand-alone tactical obstacle or as a reinforcement to conventional obstacles.
- Used to disrupt and delay the enemy, allowing long-range weapons to engage more effectively.

Deep Operations

In deep operations, the Hornet can be—

- Emplaced along key routes in gauntlet obstacles to disrupt and delay threat second-echelon forces, resupply operations, and key lines of communication (LOC).
- Used at C^2 and logistics sites to disrupt enemy operations.

Rear Operations

In rear operations, the Hornet can be emplaced (unarmed) along key routes in preparation for possible retrograde operations.

Early-Entry Operations

In early-entry operations, the Hornet can be—

- Used as an additional antiarmor weapon to supplement light forces.
- Used along high speed AAs in gauntlet obstacles to buy time and space.

TACTICAL EMPLACEMENT

There are four basic emplacement scenarios for the Hornet.

Conventional Minefield Reinforcement

The Hornet can be used to reinforce a conventional turn, block, or fix minefield (Figure 4-9).

Platoon engineers emplace the conventional minefield first, and then they traverse the safe lane that is perpendicular to the minefield. The Hornets are employed in two staggered rows, spaced 100 meters apart, 50 to 100 meters from the front edge (on the enemy side) of the conventional minefield. It is also recommended that a row of Hornets be placed 50 meters behind the minefield to reduce the enemy's breaching capability. (This row will be emplaced after the safe lane is closed.) The emplacing vehicles work toward the safe lane.

Two squads employ Hornets in two rows of ten each. One or more soldiers provide security. Under the supervision of a noncommissioned officer (NCO), four soldiers in each squad vehicle start prearming the Hornets, if necessary. They—

- Rotate the handle.
- Remove the cover.
- Insert the active battery pack and verify functionality via a solid status light.
- Reinstall the active battery-pack cover.

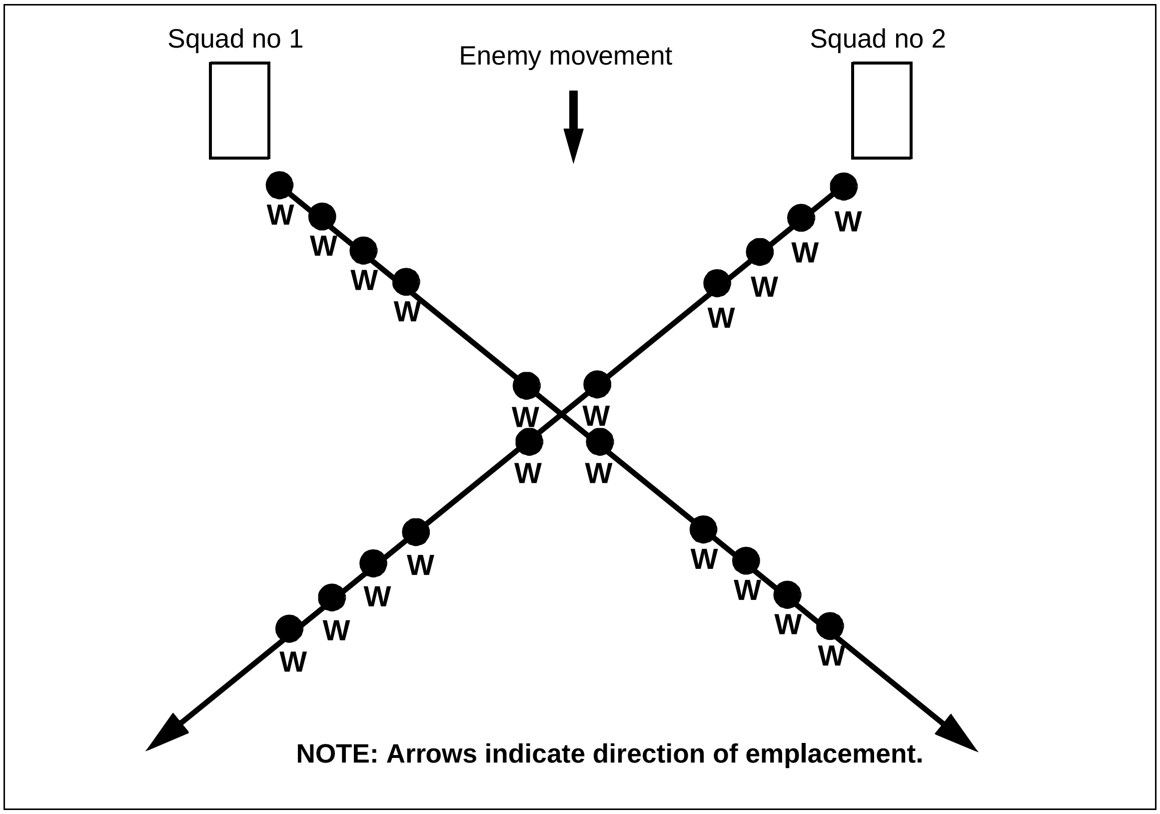


Figure 4-11. Hornet area-disruption obstacle

Area-disruption obstacles are normally armed by remote, but they can be manually armed under the following conditions:

- METT-TC requires rapid emplacement and arming.
- Terrain reconnaissance determines that there are no major impediments (rough terrain, vegetation) to maneuver.
- Emplacement is done during daylight hours (mission-oriented protective posture [MOPP] level 0 only).

Hornets are prearmed the same as above. Two squads lay the Hornets in unison, starting with the two emplacement sites closest to the enemy. Each squad drives in a straight line, crossing paths at the middle of the X, and emplaces ten Hornets.

A soldier in the back of each emplacing vehicle throws the arming switch and sets the Hornet down or drops it off (base down) the back of the vehicle. After all the Hornet clusters are emplaced, squad vehicles quickly travel to the 475-meter safe standoff distance (no further than 2 kilometers) to prepare for remote arming. Hornets can be remotely armed 36 minutes after the arming switch is thrown on the last Hornet emplaced. If manual arming is used, Hornets automatically arm at the end of their safe-separation time (5 to 6 minutes after the arming switch is thrown).

Gauntlet Obstacle

Hornet gauntlet obstacles (Figure 4-12) are emplaced by an engineer platoon and are very effective in constricted terrain along the enemy's AA and at choke points. A Hornet gauntlet typically consists of 40 to 50 Hornets employed in a series of clusters (Figure 4-13). Each cluster contains 3 to 6 Hornets. The Hornets in each cluster are emplaced at 50-meter intervals, perpendicular to the road centerline, on alternating sides of the road/AA, and 25 to 50 meters (depending on the terrain and the vegetation) off the side of the road/AA. The distance between clusters varies from 750 to 2,000 meters so that the advancing threat force is kept guessing about when they will encounter the next cluster.

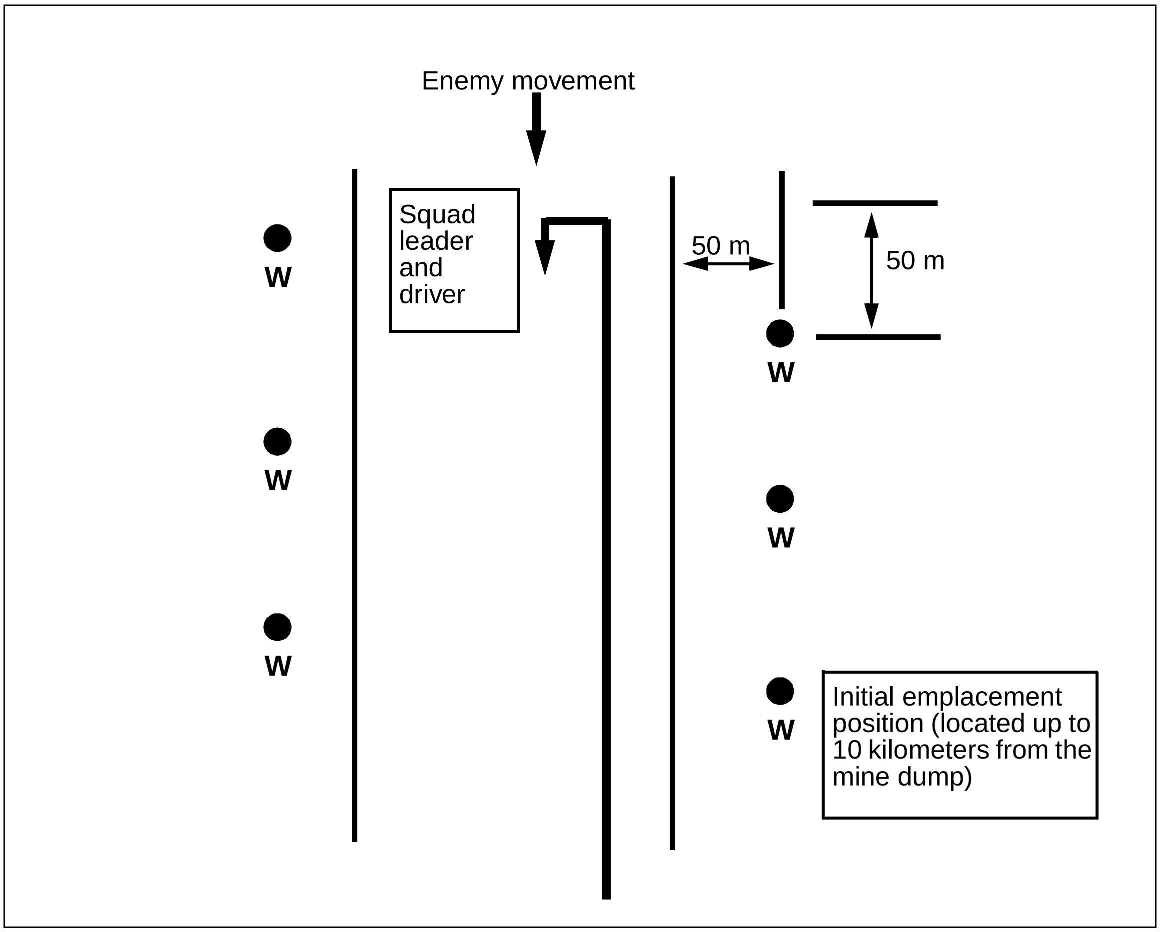


Figure 4-12. Hornet gauntlet obstacle (one cluster)

Before laying any Hornets, the munitions are prearmed as above. Soldiers also set the target switch to *HVY* for clusters closest to the enemy, so that the Hornets will only engage heavy tracked vehicles. The intent is to make threat forces commit to a route they perceive to be clear.

Hornets are emplaced beginning on the friendly side of the cluster. The first engineer squad emplaces Hornet munitions beginning with the cluster closest to the enemy. The emplacement vehicle drives even with the first Hornet

Camouflage and Concealment

The best camouflage and concealment for the Hornet is tall grass and brush. The Hornet can be partially buried if the terrain or the vegetation does not provide effective natural camouflage and concealment. Placing the Hornet in a hole degrades its performance, so it should only be done when Hornets cannot be covered by fires or protected from tampering by dismounted enemy. The following conditions must be met:

- The depth of the hole must not exceed 4 inches, because the acoustic sensors must be above ground level.
- The hole must not restrict the Hornet's ability to rotate and tilt its body and to fire the sublet. To meet this requirement, the hole must be at least 36 inches wide and flat enough to support the munition. Although the Hornet should be placed on a flat surface if possible, it can operate on slopes up to 15 degrees.

Munitions placed at ground level should be no closer to obstructions than the distances shown in Table 4-1.

Table 4-1. Hornet minimum emplacement distances

Maximum Obstruction Height	Minimum Employment Distance from Obstruction
1 m	3 m
2.4 m	5 m
6.5 m	15 m
25 m	25 m

When the Hornet is emplaced and concealed, remove all indicators of excess soil and camouflage material before performing the arming sequence.

RECORDING AND MARKING

When the Hornet munition field is completed, the OIC will identify an NCO to be the recorder. The NCO will collect data from the NCOICs of the emplacing squads and complete DA Form 1355 as outlined in Chapter 8. The OIC will ensure that the DA Form 1355 is completed timely and accurately.

Marking the Hornet munition field will be completed as prescribed in Chapter 2. The fence will be no closer than 150 meters from the nearest Hornet munition. Marking must be completed before emplacing the munitions.

ANTIPERSONNEL MINES

The M14 and M16 AP mines are used by US forces on the Korean peninsula. They are also used by many other countries. The M16 AP mine is likely to be seen in a modified form. These mines are shown in Figure 5-2, and their characteristics are listed in Table 5-2.

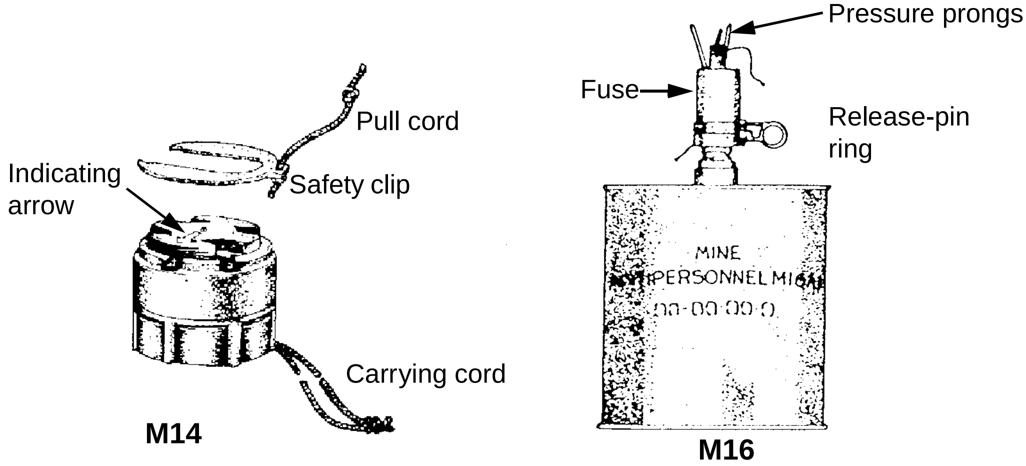


Figure 5-2. AP mines

Table 5-2. 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

M14

The M14 AP mine is a low-metallic blast mine consisting of a main charge (28.4 grams of tetryl) and a plastic fuse with a steel firing pin. It is cylindrical in shape (56 millimeters in diameter and 40 millimeters high) and weighs 99.4 grams. The pressure plate has an indented, yellow arrow that points to the *A* or *S* position on top of the fuse body. A force of 11.5 to 13.5 kilograms depresses the pressure plate and causes the Belleville spring to drive the firing pin into the detonator. The M14 is not designed to kill, but to incapacitate. The M14 AP mine has been modified by gluing a metal washer to the bottom of the mine. The modification was directed to improve the detectability of the mine. Unmodified mines are not authorized for use by US forces.

M16

The M16 AP mine is a bounding fragmentation mine that consists of a mine fuse (M605), trinitrotoluene (TNT) explosive, a propelling charge, and a projectile that are contained in a sheet-steel case. The mine is 103 millimeters in diameter, 199 millimeters high (including the fuse), and weighs 3.5 kilograms. The principal difference between the M16, M16A1, and M16A2 versions are in the construction of the detonators and boosters. The casualty radius is 27 meters for the M16 and M16A1 and 30 meters for the M16A2. A pressure of 3.6 to 9 kilograms applied on one or more of the three prongs of the M605 fuse or a pull of 1.4 to 4.5 kilograms on the trip wire will activate the mine.

EMPLACING MINES

The method used to lay and conceal each type of mine depends on the method of mine operations, the type of ground in which the mine is to be laid, and the type of ground cover available for camouflage.

Standard-pattern mine laying is laborious and time-consuming, but it is more effective and flexible than row mine laying and allows better mine concealment. Standard-pattern mine laying is well suited for protective minefields, and it can be used in terrain where the nature of the ground makes row mine laying impractical.

To achieve the maximum effect, mines must be laid where they cannot be seen and where a vehicle or a person exerts enough pressure to detonate them. The following rules should be applied to achieve the maximum effects of mines:

MINES WITH PRONGS

Korea Only: If the mine is activated by its prongs, it should be buried flush with the ground so that only the tips of the mechanism are exposed (Figure 5-3). A mine buried in this manner is held firmly upright. The target exerts a direct, downward pressure rather than a sideways thrust. The mine is protected from damage and is difficult to see. If it is buried more deeply, it becomes unreliable because the layer of spoil may prevent the mine mechanism from operating.

If the mine is activated by a trip wire, it should be buried so that the trip wire is at least 2 to 3 centimeters above the ground (Figure 5-4).

MINES WITH PRESSURE PLATES

Mines with pressure plates will function when completely buried as long as the cushion of earth above them is not too thick. AT mines are normally buried with the top of the mine approximately 5 centimeters below ground level.

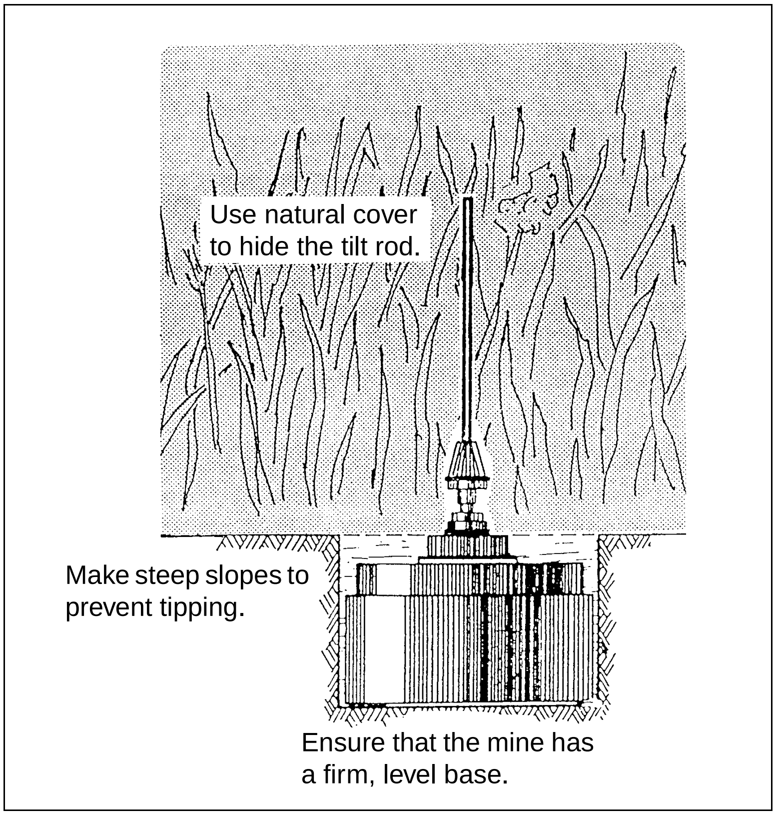


Figure 5-6. Buried mine with tilt rod

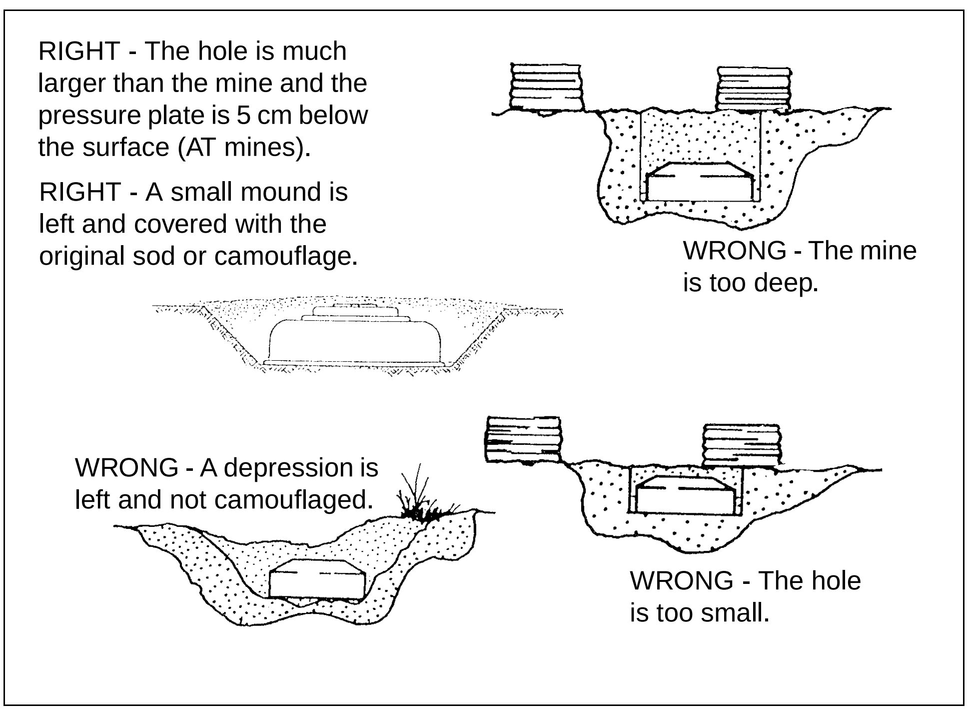


Figure 5-7. Buried and concealed mines

they are surface-laid, they may be physically damaged when pressure is exerted by a tracked vehicle. Buried mines also have some resistance to countermeasures, but surface-laid mines have none. Consideration must also be given to sympathetic detonation of AT mines (Table 5-3). US conventional mines do not have integral AHDs, so allow extra time to lay mines with AHDs.

Table 5-3. Sympathetic detonation chart

Type	M16	M15	M19
Surface-laid	NA	4.0 m	4.0 m
Buried flush	1.5 m	2.4 m	5.5 m
Buried 5 cm	NA	1.5 m	4.8 m

The difficulty of burying mines in very rocky ground and the necessity for surface laying will have a bearing on which mines are suitable. For example, small, blast-type AP mines are hard to detect and easy to camouflage. They are much easier to camouflage than larger fragmentation mines. The type of AT mine used will make little difference, because the mine's size will always make camouflage very difficult.

MANEUVER ASSISTANCE

During large mine-laying operations, engineers seldom have sufficient manpower to carry out all minefield tasks. Other combat arms units must often provide work parties. Engineers must be capable of organizing, controlling, and supervising combined arms work parties. They must also instruct them in new equipment and techniques. Work parties may be integrated with engineers or given certain tasks that are within their capabilities.

When laying a standard-pattern minefield, consider supplementing work parties with other combat arms soldiers to perform the following:

- Executing Class IV/V supply point or mine dump missions. Soldiers uncrate and prepare mines and remove empty boxes and residue.
- Laying. Soldiers position mines within strips and dig holes.
- Marking. Soldiers construct the perimeter fence and emplace mine signs.

Unpacking, preparing, and loading mines are the most time-consuming tasks when laying a row minefield; and they are ideal tasks for other combat arms soldiers.

Basic information pertaining to the minefield is normally determined by the engineer company commander or the staff engineer. It is provided to the OIC or NCOIC of the emplacing unit during the mission briefing. In this example, the following guidance is given to the emplacing unit:

Desired density	AT 1	APF 4	APB 8
IOE representative cluster	AT 1	APF 2	APB 2
Front	200 meters		
Depth	300 meters		
Percentage of AHDs	10%		
Type of mines	AT M15	APF M16A2	APB M14
Type of truck/trailer	5-ton dump (with sideboards)		
Lanes/gaps/traffic tapes	1 lane, 1 traffic tape (foot troops)		
Trip-wire safety tapes	3		

The rest of this work sheet is completed by using the above information.

The regular strip has a cluster density of one cluster every 3 meters. The IOE has a cluster density of one-third that of a regular strip, or one cluster every 9 meters. Therefore, to obtain the number of clusters in the IOE, the length of the strip is divided by 9. Decimals are rounded up to the next higher whole number.

PART 1. NUMBER OF MINES

Step 1.

IOE live clusters $200 \div 9 = 23$ (rounded up)

The representative cluster composition for the IOE clusters is established and provided by the commander based on METT-TC factors. The number of clusters in the IOE is multiplied by the cluster composition to determine the number of mines, by type, in the entire IOE.

Step 2.

	AT	APF	APB
IOE representative cluster ×	1	2	2
Number of IOE clusters =	23	23	23
Number of mines in IOE	23	46	46

The minefield front multiplied by the desired density determines the number of mines in the minefield.

NOTE: The desired density pertains only to the regular strips and does not take into account the number of mines in the IOE which were calculated in Step 2.

Figure 6-2. Step-by-step procedures for completing the minefield requirements computation work sheet

Step 3.

Desired density ×	1	4	8
Minefield front =	200	200	200
Mines in regular strips	200	800	1,600

The number of mines required for the IOE (Step 2) is added to the number of mines in the regular strips (Step 3).

Step 4. Subtotal of mines

(Step 2 + 3)	223	846	1,646

Ten percent is added to the total number of mines required to allow for damaged items and irregularities in terrain and strip length. This is accomplished by multiplying the total number of mines (Step 4) by 1.1. Decimals are rounded up to the next higher whole number.

Step 5.

10% excess factor =	1.1	1.1	1.1
Total number of mines to order	246	931	1,811

These figures represent the total number of mines, by type, required for the entire minefield. When ordering by the case rather than by individual mines, the total should be divided by the number of mines per case and rounded up to the next whole case. (See Table 2-8, page 2-45.)

PART 2. NUMBER OF REGULAR STRIPS

Step 1.

Add desired density	AT 1	+ APF 4	+ APB 8 = 13

Each regular mine strip has a cluster every 3 meters; therefore, its density is one-third cluster per meter of front. A total density of 13 mines per meter of front in the previous example would equal 3 × 13 or 39 mines per 3 meters of front. Clusters may contain a maximum of five mines, so the resulting figure must be divided by 5. In short, to determine the minimum number of regular strips required, the total density must be multiplied by three-fifths (3 meters between clusters and five mines per cluster). For ease of calculation, three-fifths is converted to the decimal 0.6. Decimals are rounded up to the next highest whole number.

Step 2.

0.6 × Step 1	0.6 × 13 = 8 (rounded up)

The calculations to determine the minimum number of regular strips previously described are not suitable when the ratio of AT to AP mines is greater than 1:4. For example, if the desired density is 1-1-1, the total density is 3. The minimum number of strips would be 3 × 3/5 = 1.8, rounded up to 2 strips. However, because of the restriction on the number of AT mines per cluster, it is impossible to obtain a density of 1 AT mine per meter of front with only 2 strips. A minimum of 3 regular strips is required. The alternative means of determining the number of regular strips is founded by multiplying the AT desired density by 3.

Figure 6-2. Step-by-step procedures for completing the minefield requirements computation work sheet (continued)

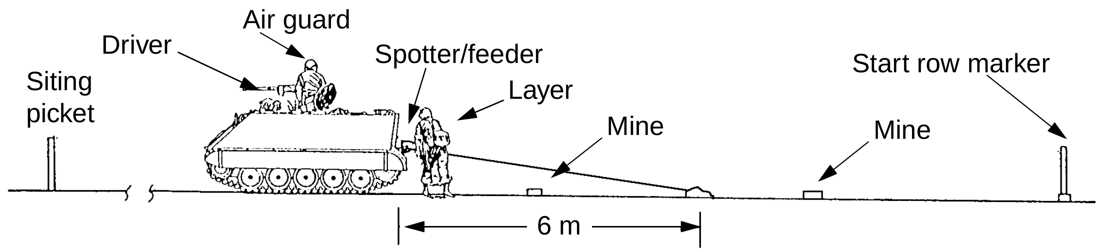


Figure 6-8. Measuring distances between mines with sandbags

- — Soldier 4 walks behind the vehicle and arms mines.
- — After the mine row is armed and camouflaged, Soldier 4 buries pins, clips, and shipping plugs 30 centimeters to the rear of the start row marker.
- — The sapper team repeats the above steps until the end of the row is reached.

- Digging team, if needed. (The NCOIC selects the mine to be buried by each soldier and supervises the operation.)
  - — Follows the laying party along the friendly side of the row.
  - — Digs in mines but leaves them exposed until arming is complete.
  - **— Korea Only: Arms AP mines in a cluster before arming AT mines.**

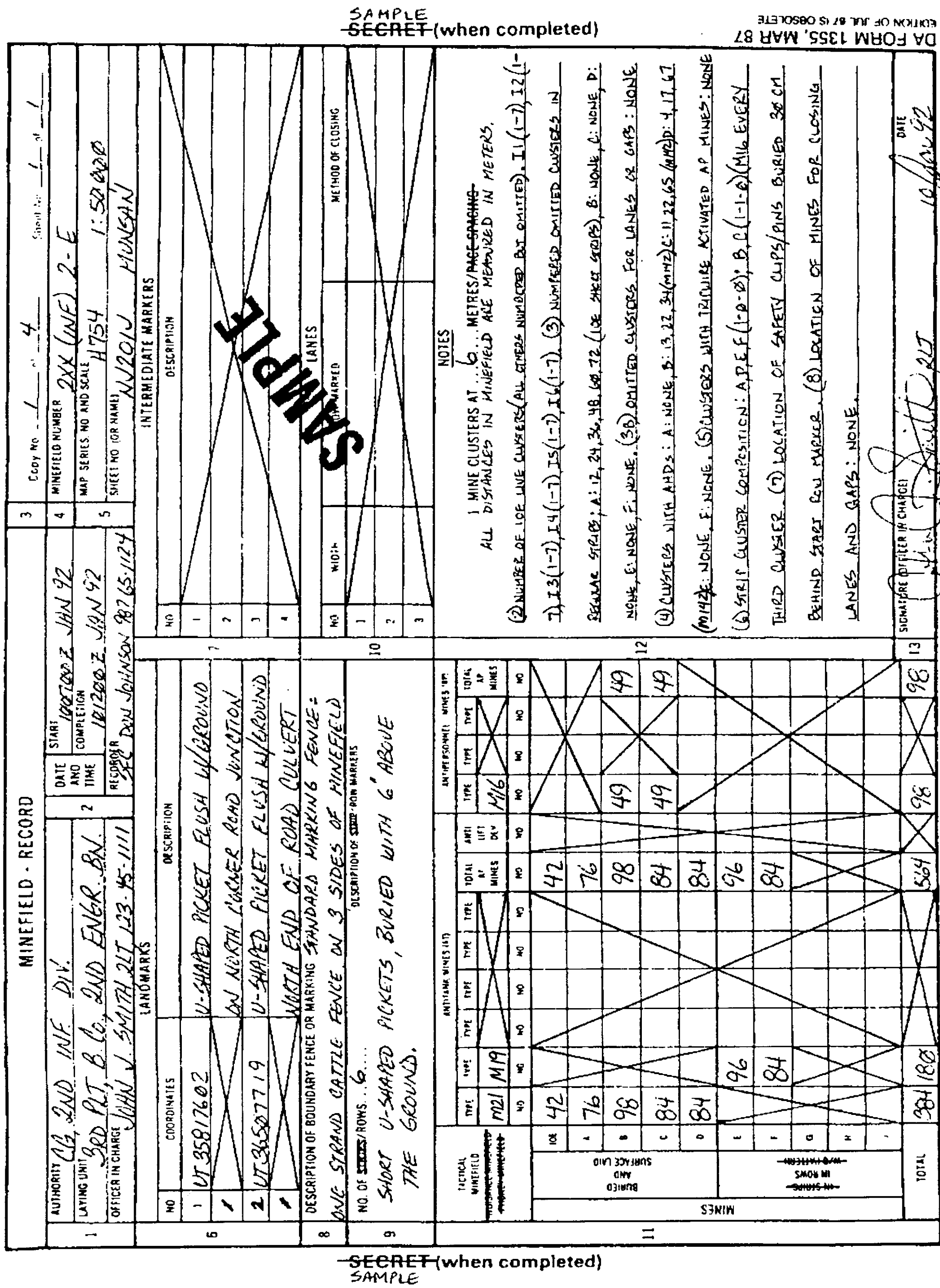
MARKING, RECORDING, AND REPORTING ROW MINEFIELDS

Marking procedures for row minefields are the same as those for other minefields (see Chapter 2).

Row minefields are recorded on DA Form 1355 (Figures 6-9a and 6-9b, pages 6-26 and 6-27). Reporting procedures for intent, initiation, status, and completion reports are detailed in Chapter 8.

STANDARDIZED TACTICAL ROW MINEFIELDS

The specific composition of a tactical row minefield depends on METT-TC factors and available resources. To aid in standardization of platoon techniques, four compositions have been developed to match desired obstacle effects. Using standardized minefields facilitates planning the obstacle type, size, and logistical requirements. It is imperative that the design and the effect of these minefields are well understood. They are an integral part of combined arms obstacle doctrine and form the cornerstone of engineer obstacle operations.



SAMPLE
~~SECRET~~ (when completed)

MINEFIELD - RECORD

1. AUTHORITY: CG, 2ND INF. DIV.
   LAYING UNIT: 3RD PLT, B Co., 2ND ENGR. BN.
   OFFICER IN CHARGE: JOHN J. SMITH 2LT 123-45-1111
2. DATE AND TIME — START: 100700 Z JAN 92; COMPLETION: 101200 Z JAN 92; RECORDER: SFC DON JOHNSON 987-65-1124
3. Copy No 1 of 4 — Sheet No 1 of 1
4. MINEFIELD NUMBER: 2XX (INF) 2-E
5. MAP SERIES NO AND SCALE: H754 1:50000; SHEET NO (OR NAME): NJ201J MUNSAN

6. LANDMARKS

NO	COORDINATES	DESCRIPTION
1	UT 35817602	U-SHAPED PICKET FLUSH W/GROUND
1		ON NORTH CORNER ROAD JUNCTION
2	UT 36507719	U-SHAPED PICKET FLUSH W/GROUND
2		NORTH END OF ROAD CULVERT

7. INTERMEDIATE MARKERS

NO	DESCRIPTION
1	
2	
3	
4	

8. DESCRIPTION OF BOUNDARY FENCE OR MARKING: STANDARD MARKING FENCE = ONE STRAND CATTLE FENCE ON 3 SIDES OF MINEFIELD

9. NO. OF ~~STRIPS~~/ROWS . . 6 . . . .
   DESCRIPTION OF ~~STRIP~~ ROW MARKERS: SHORT U-SHAPED PICKETS, BURIED WITH 6" ABOVE THE GROUND.

10. LANES

NO	WIDTH	UNMARKED	METHOD OF CLOSING
1			
2			
3			

SAMPLE

11. MINES

TACTICAL MINEFIELD ~~NUISANCE MINEFIELD~~ ~~PHONEY MINEFIELD~~		AT TYPE M21 NO	AT TYPE M19 NO	AT TYPE NO	AT TYPE NO	AT TYPE NO	AT TYPE NO	TOTAL AT MINES NO	ANTI LIFT DEV NO	AP TYPE M16 NO	AP TYPE NO	AP TYPE NO	TOTAL AP MINES NO
BURIED AND SURFACE LAID	IOE	42						42					
	A	76						76					
	B	98						98		49			49
	C	84						84		49			49
	D	84						84					
~~IN STRIPS~~ IN ROWS ~~W/O PATTERN~~	E		96					96					
	F		84					84					
	G												
	H												
	J												
TOTAL		384	180					564		98			98

12. NOTES

(1) MINE CLUSTERS AT . . . 6 . . . METRES/~~PACE SPACING~~
ALL DISTANCES IN MINEFIELD ARE MEASURED IN METERS.
(2) NUMBER OF IOE LIVE CLUSTERS (ALL OTHERS NUMBERED BUT OMITTED). I1(1-7), I2(1-7), I3(1-7), I4(1-7), I5(1-7), I6(1-7). (3) NUMBERED OMITTED CLUSTERS IN REGULAR STRIPS; A: 12, 24, 36, 48, 60, 72 (IOE SHORT STRIPS), B: NONE, C: NONE, D: NONE, E: NONE, F: NONE. (3B) OMITTED CLUSTERS FOR LANES OR GAPS: NONE. (4) CLUSTERS WITH AHDs: A: NONE, B: 13, 22, 34 (M142) C: 11, 22, 65 (M142) D: 4, 17, 67 (M142) E: NONE, F: NONE. (5) CLUSTERS WITH TRIPWIRE ACTIVATED AP MINES: NONE (6) STRIP CLUSTER COMPOSITION: A, D, E, F (1-0-0); B, C (1-1-0) (M16 EVERY THIRD CLUSTER. (7) LOCATION OF SAFETY CLIPS/PINS BURIED 30 CM BEHIND START ROW MARKER. (8) LOCATION OF MINES FOR CLOSING LANES AND GAPS: NONE.

13. SIGNATURE (OFFICER IN CHARGE): John J. Smith, 2LT — DATE: 10 Jan 92

DA FORM 1355, MAR 87 — EDITION OF JUL 67 IS OBSOLETE

~~SECRET~~ (when completed)
SAMPLE

Figure 6-9a. Sample DA Form 1355 for a row minefield (front) visualized, complete recording and emplace the mines, but do not arm them. This procedure simplifies recording and makes retrieval quicker and safer.

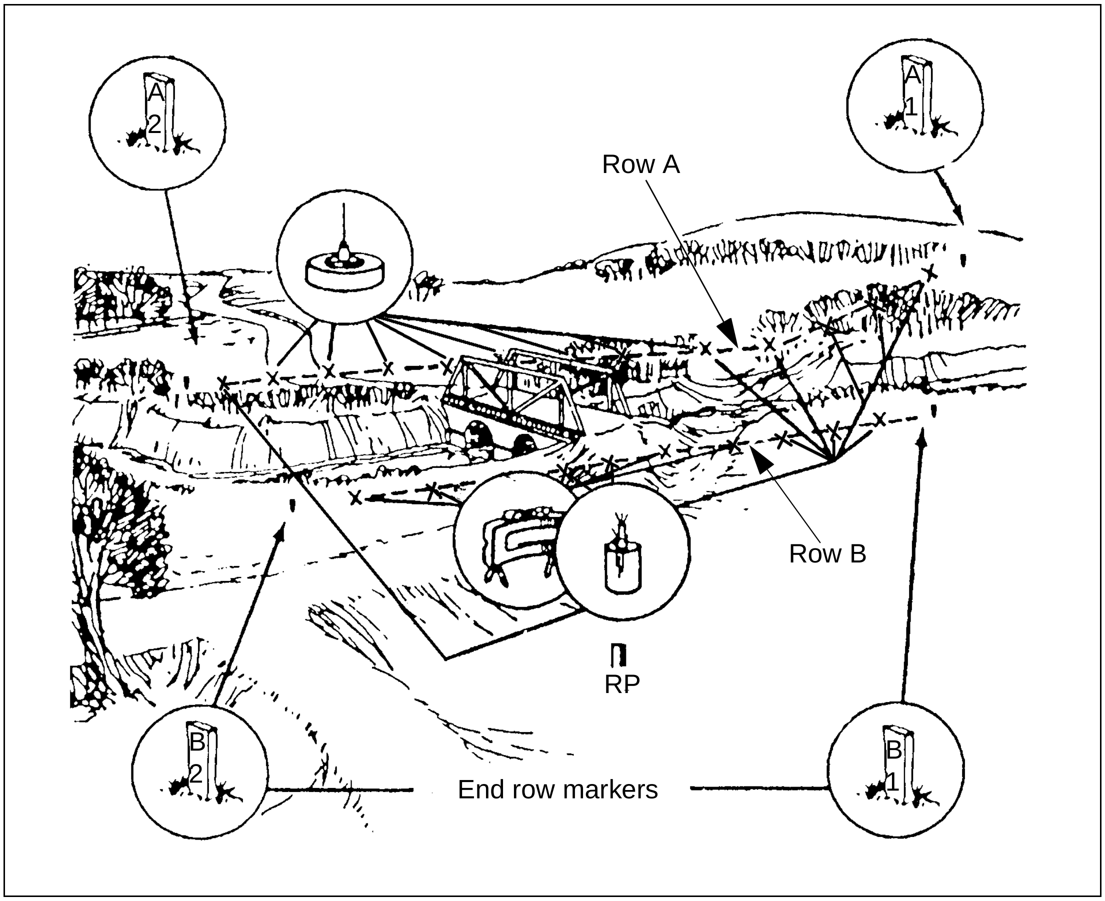


Figure 6-13. Site layout

Mine Rows

The row closest to the enemy is designated as Row A; succeeding rows are designated B, C, D, and so on. The ends of rows are shown by two end row markers. They are labeled with the letter of the row and the number 1 for the right end of the row or the number 2 for the left end of the row. The rows are numbered from right to left, facing the enemy. The marker should be an easily identifiable object, such as a wooden stake with a nail or a steel picket so that it can be found with an AN/PSS-12 mine detector.

Laying Procedures

From the RP, the leader measures the magnetic azimuth, in degrees, to a selected point on the right side (facing the enemy) of the tentative minefield. He paces off the distance and records it in meters. This point (B1) marks the beginning of the second row. The leader places a marker at B1 and records the azimuth and the distance on DA Form 1355-1-R.

From B1, the leader measures the azimuth and distance to a second point on the right side of the minefield (facing the enemy). He places a marker at this point (A1), and records the information.

The leader measures the distance and the azimuth from A1 to the location of the first mine in that row. The distance (or spacing) from the end row marker to the first mine is the mine spacing for that row. After the leader records the location, the mine is emplaced, but it is not armed.

The distance and azimuth are measured from the first mine to the second mine, and so on, until all the mines are emplaced and the locations are recorded. This procedure is repeated for the second row. As each mine is recorded, it is assigned a number to identify it in the minefield record.

When the last mine location is recorded for a row, the distance and the azimuth are measured from that point to another arbitrary point, A2 or B2. A marker is placed here in the same manner as A1 and B1. Next, the distance and azimuth from the RP to B2 and from B2 to A2 are measured and recorded.

When all the mines have been placed and recorded, the leader measures the distance and the azimuth between the RP and a permanent landmark that can be found on the map. He records the information on DA Form 1355-1-R. The landmark is used to assist others in locating the minefield if it is transferred or unexpectedly abandoned.

Mines can be armed after recording is complete. Mines nearest the enemy are armed first, allowing soldiers to safely work their way back to the unit position. Pins and clips are buried 30 centimeters behind row markers, the RP, or any easily identifiable, accessible location. Record the location of the pins and clips in the remarks section of DA Form 1355-1-R. The leader then reports the completion of the minefield to higher headquarters.

If the minefield is transferred to another unit, the transferring unit leader briefs the gaining unit leader. The gaining unit leader signs and dates the mines-transferred block on the DA Form 1355-1-R. The form is destroyed when the minefield is removed. If the minefield is abandoned unexpectedly, the DA Form 1355-1-R is forwarded to higher headquarters.

Mine Removal

When removing mines from a hasty protective row minefield, the leader first determines the best method to use:

- If the minefield has been under constant observation from the time it was laid and has not been tampered with, the squad leader directs the personnel who laid the mines to pick up the same mines. He uses DA Form 1355-1-R preceded by a mine detector to determine the types of mines to be removed and where they are located.
- If the minefield has not been under constant observation, may have been tampered with, or the personnel who laid the mines are not available or do not remember the location of the mines, the squad leader uses DA Form 1355-1-R and a clearance team as outlined in Chapter 11 to locate and remove mines.

The leader retrieves safety devices, shipping plugs, and other items that accompanied the emplaced mines. Using the azimuths and distances provided on the DA Form 1355-1-R, the removal team starts at the RP and moves to B1. They then move from B1 to the mine and remove the mine. If B1 is destroyed, the team moves from the RP to B2. The team then shoots a back azimuth (subtract 180 degrees) from the recorded azimuth from B2 to the first mine and removes the mine. Personnel continue this process until all the mines have been removed. The stakes at Al, B1, A2, and B2 are necessary because it is safer to find a stake than to find an armed mine.

The removal team observes basic safety precautions by maintaining 30 meters between personnel, not running, and moving only in cleared areas. The team starts with the row closest to the defender and works toward the enemy. Personnel—

- Check the sides and bottoms of the mines for AHDs, and disarm or mark the mines as they are found.
- Replace all pins, clips, and other safety devices before the mines are removed from the ground.
- Turn arming dials to *SAFE* or *UNARMED;* or if mines have screw-type fuses, remove the fuses and take them away from the mines.
- Lift the mines from the holes after they have been rendered safe.
  - — If a mine was put in place and kept in sight by the individual who removes it, he lifts it directly from the hole after rendering it safe.
  - — If a mine has not been kept in sight, the individual attaches a 60-meter rope or wire to the mine, takes cover, and pulls the mine from the hole.
- As each mine is removed, place a tick mark beside it on the DA Form 1355-1-R.
- Assemble all the mines in one location for accountability.

NOTE: AHDs are not used in hasty protective row minefields. However, as a safety precaution, consider all mines to be equipped with AHDs until proven otherwise.

The leader confirms the removal of the mines and accounts for the number of mines, by type, as recorded on the DA Form 1355-1-R. The leader may find it necessary to confirm an exploded mine to account for all the mines.

To confirm a mine explosion that was not witnessed, identify the crater or traces of burnt soil made by the detonated mine and place a tick mark beside the mine number on the DA Form 1355-1-R. Ensure that the crater found in the vicinity of the mine was caused by a land mine and not by artillery. A mine crater is normally circular, and it shows traces of burnt soil. The impact and the soil dispersion of artillery is normally elongated.

The squad leader confirms that each mine is disarmed and safe. The removal team cleans and repacks serviceable mines for future use and destroys the others; they repack serviceable mines in their original containers and store them according to the unit SOP and local regulations. The removal team removes and stores the row markers. The leader submits a report to his higher headquarters stating that the minefield has been removed and that the area is clear.

Fuse types are not mixed. **(Korea Only: AP mines are left in their crates, and the crate lids are removed.)**

When the siting party completes the centerline staking, it installs lane tapes and traffic tapes, respectively. Lane tapes are used by tactical vehicles and patrols. Traffic tapes are used by laying personnel to assist in camouflage and to reduce the amount of traffic on strip centerlines. Traffic tapes are laid perpendicular to the minefield trace at 100-meter intervals.

MINE EMPLACEMENT

The laying party must know the cluster composition of the strip, the location of any omitted cluster, and future lane locations. When the centerline tape for a regular strip has been installed, the NCOIC designates all but two members of the laying party to emplace mines in the ground. The remaining two soldiers, usually the most experienced, are designated as fusers and are responsible for arming mines. Layers carry the maximum load of mines to be used as base mines in the clusters. Fusers carry the fuses and the detonators.

The NCOIC moves to the right or left (depending on the laying direction) beginning-of-strip marker of the strip and organizes the layers into one column to his rear, directly on the centerline. He measures 6 meters along the centerline for the first cluster and, pointing perpendicular from the centerline and in the direction of the enemy, indicates the placement of the base mine. The first layer on the enemy side places a mine on the ground, 3 meters from the centerline.

The NCO measures 3 more meters and indicates the placement of the second base mine on the opposite (friendly) side of the strip. The first layer on that side places a base mine on the ground. As the initial load of mines is laid, each layer returns to the nearest mine dump for another load. Fusers follow behind layers and insert mine fuses, but they do not arm the mines. This procedure is followed until the end-of-strip marker on the far side of the minefield is reached.

Korea Only: The NCO tells layers the number and type of mines to be placed next to the base mine in each cluster. As AP mines are being placed, the NCO proceeds along the strip and ensures that the proper number of AP mines is placed in each cluster. The NCO places a spool of trip wire next to the mines that are to be activated by trip wire.

When all the mines are positioned in clusters, one layer is assigned to dig the holes for all the mines in a cluster. He places the spoil from the holes in sandbags and leaves the sandbags beside the base mine in each cluster. The layer checks the positioning of the mines in the holes, removes the mines from the holes, and places the mines beside the holes. **(Korea Only: The layers anchor trip wires with nails or stakes and wrap the loose ends of trip wires around the fuses.)**

When digging has progressed at least 25 meters from the first mine laid, the arming procedure begins. Fusers arm all the mines in a cluster, beginning with the mine farthest from the centerline and work backward. They place all the mines in the holes **(Korea Only: attach trip wires)** and arm and camouflage the mines. They place filled sandbags on the centerline of the strip, opposite the base mine. Fusers keep their back toward the centerline. Other personnel must remain at least 25 meters from the fusers (Figure 7-8).

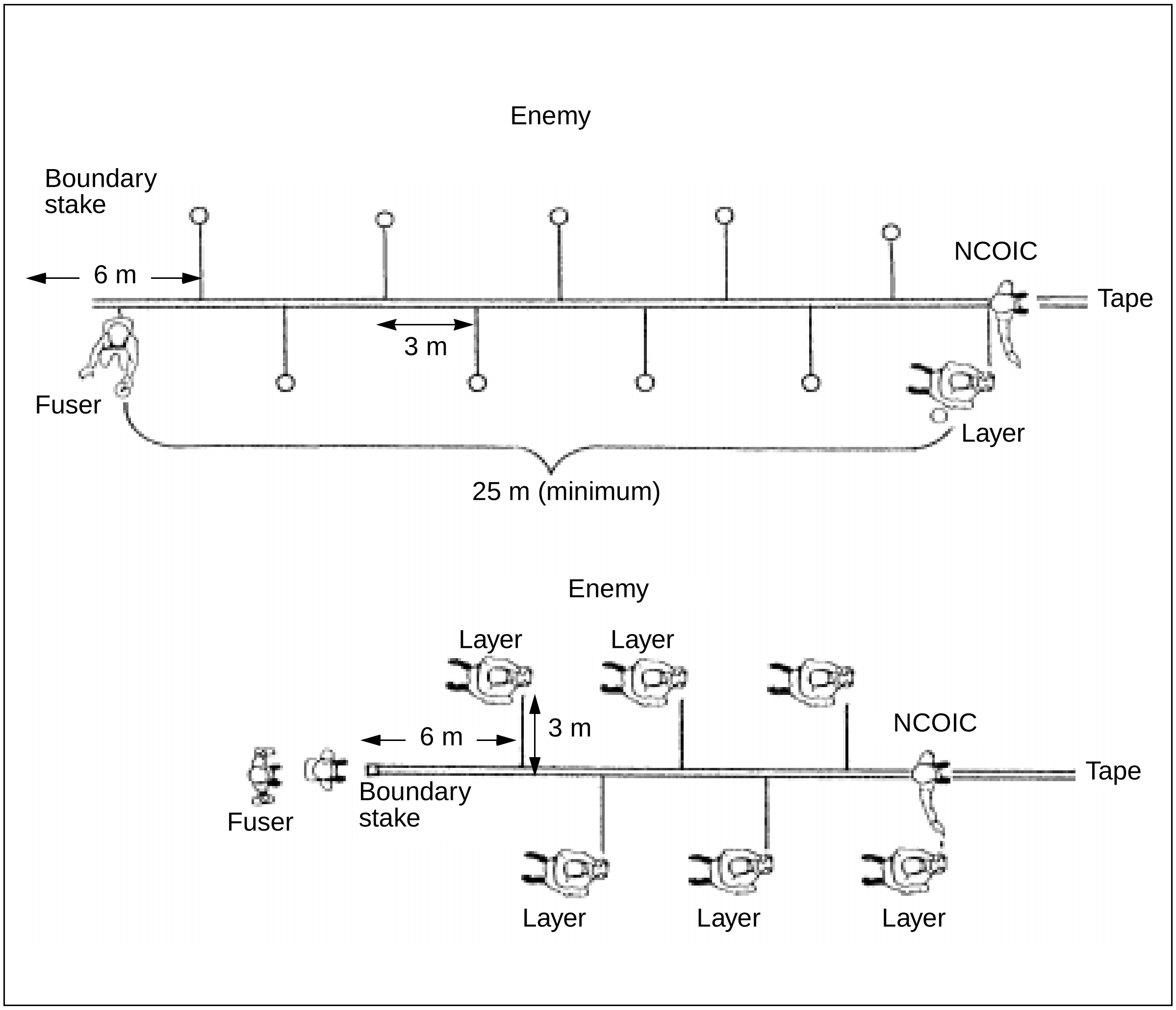
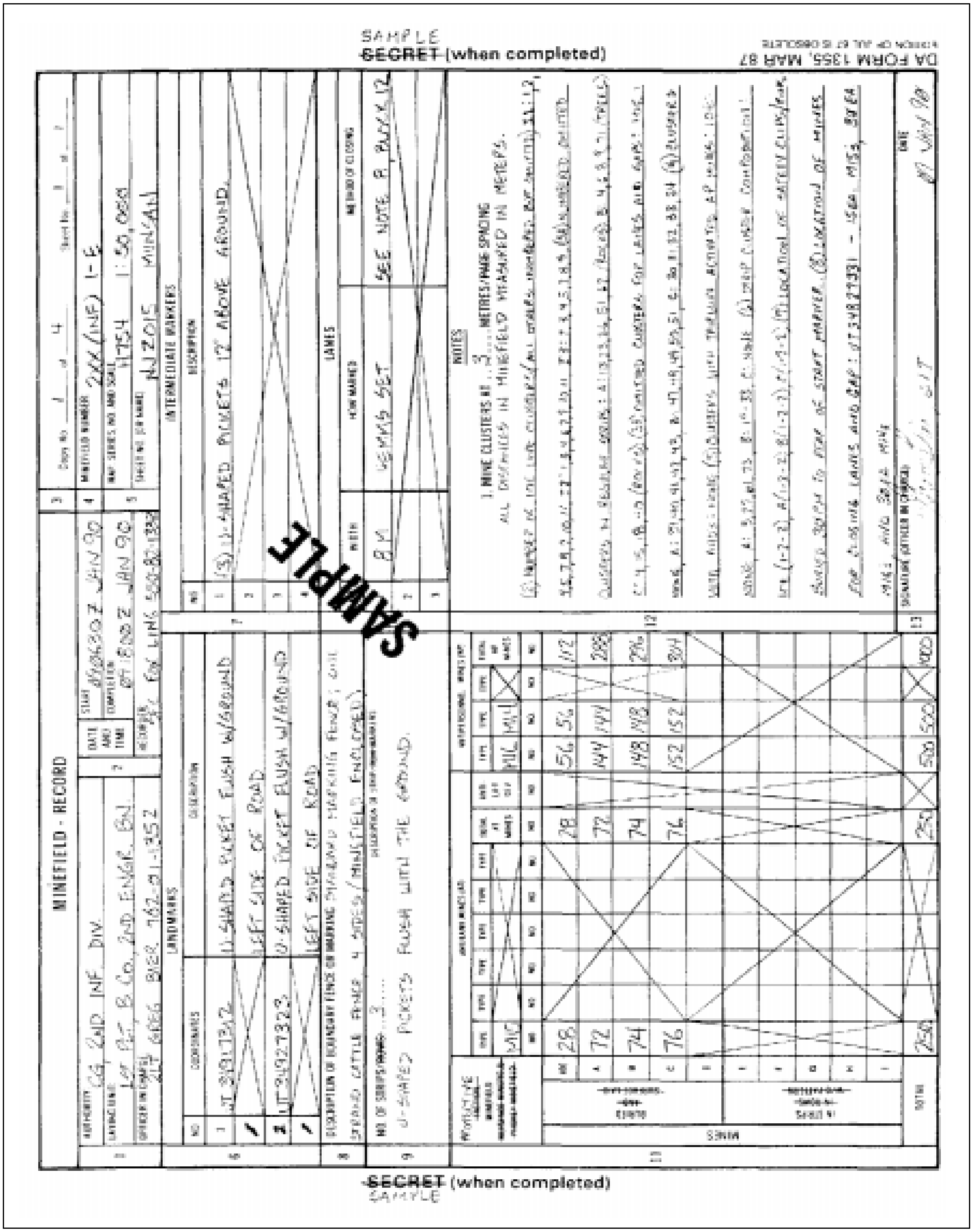


Figure 7-8. Laying and fusing mines

Mines located in lanes are not initially buried. They are placed aside to prevent confusion when counting clusters. The mines can be buried after the lane is closed. Upon completing the arming operation, fusers give the safety clips to the NCO, who verifies that all the mines have been armed and camouflaged. The NCO checks the strip and ensures that sandbags, tape, and debris have been picked up. The NCO gives the safety clips to the PSG, who buries them 30 centimeters to the rear of the beginning-of-strip marker.

All mines and other explosive items are recorded upon issue. They are summarized on a mines tally sheet (see Table 7-2). If more than one mine



SAMPLE
SECRET (when completed)

MINEFIELD - RECORD

1 AUTHORITY: CG, 2ND INF. DIV.
LAYING UNIT: 1st PLT, B Co, 2ND ENGR. BN.
OFFICER IN CHARGE: 2LT GREG BIER 762-91-1352

2 DATE AND TIME — START: 090630Z JAN 90; COMPLETION: 091800Z JAN 90; RECORDER: SFC FOR LING 500-82-1338

3 Copy No 1 of 4 — Sheet No 1 of 1

4 MINEFIELD NUMBER: 2XX (INF) 1-E

5 MAP SERIES NO. AND SCALE: V754 1:50,000 — SHEET NO. (OR NAME): NJ2015 MUNSAN

6 LANDMARKS

NO	COORDINATES	DESCRIPTION
1	JT 34917312	U-SHAPED PICKET FLUSH W/GROUND
/		LEFT SIDE OF ROAD
2	JT 34927323	U-SHAPED PICKET FLUSH W/GROUND
/		LEFT SIDE OF ROAD

7 INTERMEDIATE MARKERS

NO	DESCRIPTION
1	(3) U-SHAPED PICKETS 12" ABOVE GROUND.
2	
3	
4	

8 DESCRIPTION OF BOUNDARY FENCE OR MARKING: STANDARD MARKING FENCE; ONE STRAND CATTLE FENCE 4 SIDES/MINEFIELD ENCLOSED.

9 NO. OF STRIPS/ROWS: 3 — DESCRIPTION OF STRIP/ROW MARKERS: U-SHAPED PICKETS FLUSH WITH THE GROUND.

LANES

NO	WIDTH	HOW MARKED	METHOD OF CLOSING
1	8M	VEMMS SET	SEE NOTE 8, BLOCK 12
2			
3			

SAMPLE

12 NOTES
1. MINE CLUSTERS AT 3 METRES/PACE SPACING
ALL DISTANCES IN MINEFIELD MEASURED IN METERS.

13 SIGNATURE (OFFICER IN CHARGE): 2LT — DATE: 09 JAN 90

DA FORM 1355, MAR 87

SECRET (when completed)
SAMPLE

Figure 8-2a. Sample DA Form 1355 (front side) for a standard-pattern minefield/munition field

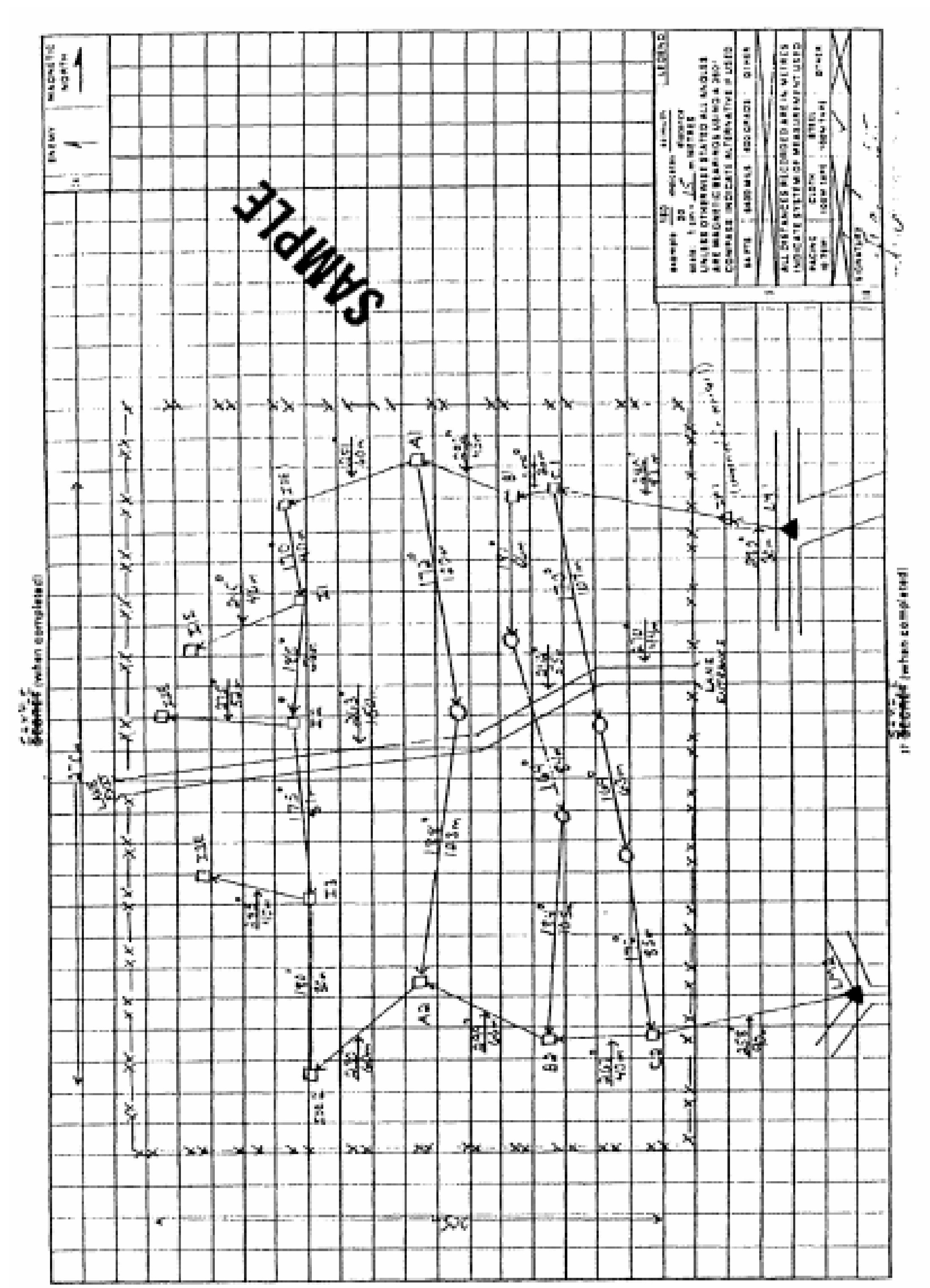


Figure 8-2b. Sample DA Form 1355 (inside) for a standard-pattern minefield/munition field

Table 8-2. Abbreviations for obstacle types

B—Bridge Demolition		**W—Wire Obstacle**	
BA	Abutment	WA	Double apron
BS	Span	WB	Booby-trapped
BC	Abutment and span	WF	Tanglefoot
M—Minefield/Munition Field		WG	General-purpose, barbed tape
MD	Disrupt	WN	Nonstandard
MT	Turn	WR	Road block
MF	Fix	WT	Triple standard
MB	Block	**R—Road Crater**	
MN	Nonstandard	RH	Hasty
MP	Protective	RD	Deliberate
MQ	Nuisance	RM	Mined
MS	Standard pattern	**M—Miscellaneous**	
S—Scatterable Minefield/Munition Field		AD	AT ditch
SA	ADAM	AR	Rubble by CEV gun
SB	Gator	AB	Rubble by blade
SR	RAAM	AT	Abatis
SF	ADAM and RAAM	AE	Rubble by explosives
SM	MOPMS	AM	Movable MOBA obstacle (car, bus)
SV	Volcano	AN	Expedient nonstandard
H—Hand-Emplaced Munitions		AL	Log crib, log obstacle
HH	Hornet	AP	Post obstacle (hedgehog, tetrahedron)
HS	SLAM	AH	Log hurdle

Block 5. Enter the map data as stated on the map(s) used.

5	MAP. SERIES, NO. AND SCALE	H754 1: 50 000
	SHEET NO (OR NAME)	NJ 2015 MUNSAN

Block 6. Enter the grid coordinates and a description of at least two landmarks. If the landmarks are roads, trails, or routes, enter their name or number. This makes identification easier when removing the minefield/munition field. When recording minefields/munition fields, GPSs can only be used to determine the coordinates for minefield/munition field landmarks and RPs.

WARNING

Do not use GPSs to chart or record minefield/munition field perimeter coordinates or to determine safe routes through or around existing minefields/munition fields.

6	LANDMARKS		
	NO	COORDINATES	DESCRIPTION
	1	UT 34917312	U-SHAPED PICKET FLUSH WITH GROUND
	2		NEXT TO ROAD
	2	UT 34927323	U-SHAPED PICKET FLUSH WITH GROUND
	4		NEXT TO ROAD

Block 7. Enter the description of intermediate markers, if applicable. When a landmark is more than 200 meters from the minefield/munition field, or a strip or row reference stake cannot be seen from the landmark, an intermediate marker must be used. If possible, the intermediate marker is at least 75 meters from the strip or row reference stake.

7	INTERMEDIATE MARKERS	
	NO	DESCRIPTION
	1	3 U-SHAPED PICKETS 12" ABOVE GROUND
	2	
	3	
	4	

Block 8. Enter the word STANDARD when a standard marking fence is used. Describe the boundary marking if a standard marking fence is not used. (Use two sides and the rear for a tactical minefield/munition field; use four sides for a protective minefield/munition field.)

8	DESCRIPTION OF BOUNDARY FENCE OR MARKING STANDARD 4 SIDES MINEFIELD FULLY ENCLOSED

Block 9. Enter the number of strips or rows laid. (Do not include the IOE.) Describe the strip or row markers. Cross out words that do not apply.

9	NO. OF STRIPS/~~ROWS~~: ..3.....	DESCRIPTION OF STRIP/~~ROW~~ MARKERS
	U-SHAPED PICKETS FLUSH WITH GROUND	

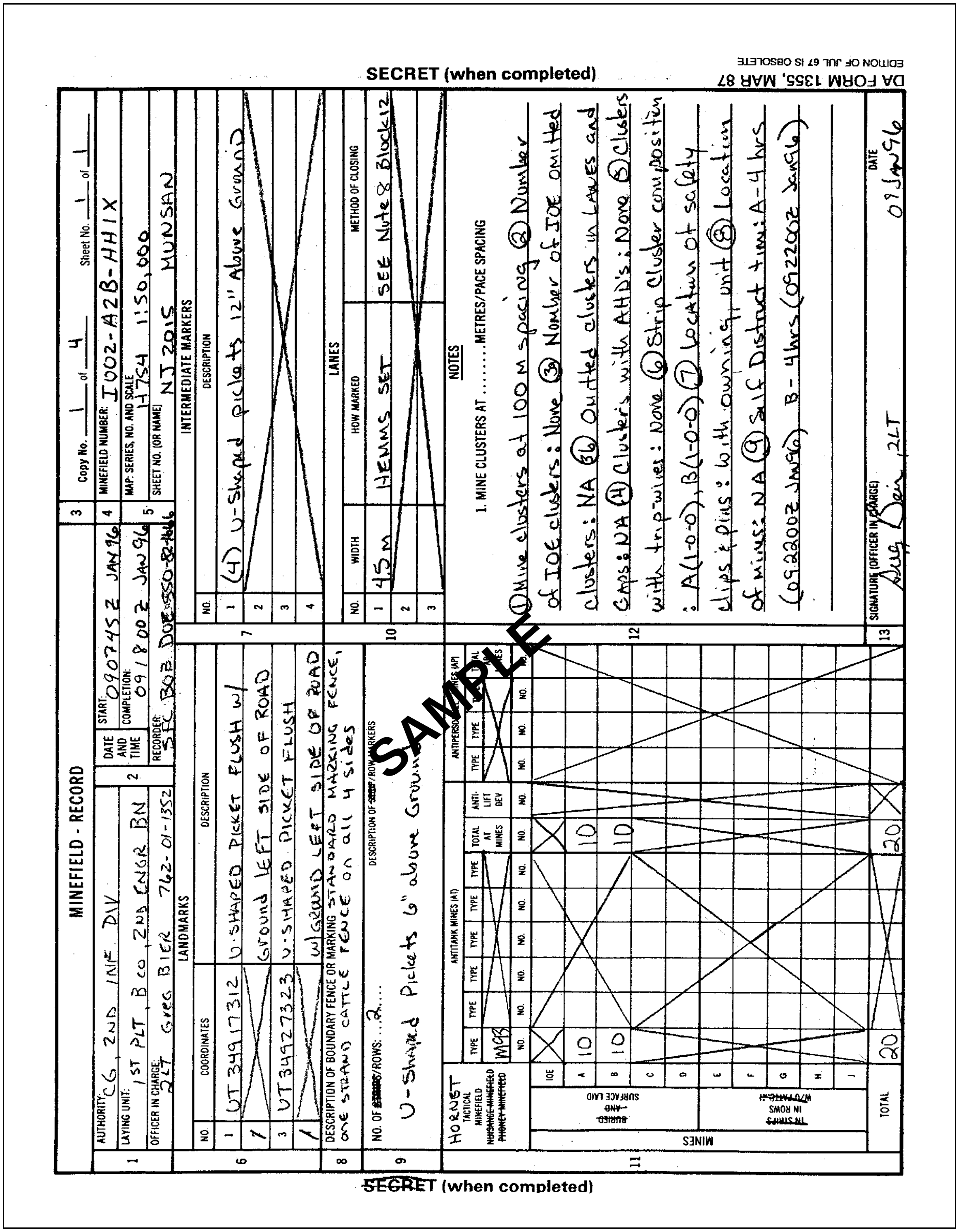
Block 10. Enter the width, the marking, and the provisions for each lane. When appropriate, give the types of mines and the number of each type of mine for closing. (The location of these mines is described in Block 12.)

10	LANES			
	NO	WIDTH	HOW MARKED	METHOD OF CLOSING
	1	8m	HEMMS SET	15×M15, 30×M16, 30×M14
	2			
	3			

Block 11. Enter the type of minefield/munition field by crossing out the lines that are not needed. Indicate the method of laying by crossing out incorrect descriptions. Enter the types of mines and the number of each type of mine. Also enter the number of AHDs installed in the IOE and in each row. Letter the strips or rows sequentially, starting with the first one laid. Enter totals.

11			ANTITANK MINES (AT)								ANTIPERSONNEL MINES (AP)			
	Protective ~~TACTICAL~~ MINEFIELD ~~NUISANCE MINEFIELD~~ ~~PHONEY MINEFIELD~~		TYPE M15	TYPE	TYPE	TYPE	TYPE	TYPE	TOTAL AT MINES	ANTI-LIFT DEV	TYPE M16	TYPE M14	TYPE	TOTAL AP MINES
			NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	MINES	BURIED ~~AND SURFACE LAID~~ IOE	28						28		56	56		112
		A	72						72		144	144		288
		B	74						74		148	148		296
		C	76						76		152	152		304
		D												
		IN STRIPS ~~IN ROWS~~ ~~W/O PATTERN~~ E												
		F												
		G												
		H												
		J												
	TOTAL		250						250		500	500		1000

If the type of munition field is Hornet, enter “Hornet” above the word “tactical” and line out “nuisance minefield” and “phoney minefield.” (See Figures 8-3a and 8-3b, pages 8-12 and 8-13.)



SECRET (when completed)

MINEFIELD - RECORD

1. AUTHORITY: CG, 2ND INF DIV
LAYING UNIT: 1ST PLT, B CO, 2ND ENGR BN
OFFICER IN CHARGE: 2LT Greg BIER 762-01-1352

2. DATE AND TIME — START: 090745Z JAN96; COMPLETION: 091800Z JAN96; RECORDER: SFC BOB DOE 550-82-1666

3. Copy No. 1 of 4 — Sheet No. 1 of 1

4. MINEFIELD NUMBER: I002-A2B-HH1X

5. MAP: SERIES, NO. AND SCALE: H754 1:50,000
SHEET NO. (OR NAME): NJ 2015 MUNSAN

6. LANDMARKS

NO.	COORDINATES	DESCRIPTION
1	UT 34917312	U-SHAPED PICKET FLUSH w/
1		Ground LEFT SIDE OF ROAD
3	UT 34927323	U-SHAPED PICKET FLUSH
1		w/GROUND LEFT SIDE OF ROAD

7. INTERMEDIATE MARKERS

NO.	DESCRIPTION
1	(4) U-Shaped pickets 12" Above Ground
2	
3	
4	

8. DESCRIPTION OF BOUNDARY FENCE OR MARKING: STANDARD MARKING FENCE, ONE STRAND CATTLE FENCE on all 4 sides

9. NO. OF ~~STRIPS~~/ROWS: 2 — DESCRIPTION OF ~~STRIP~~/ROW MARKERS: U-Shaped Pickets 6" above Ground

10. LANES

NO.	WIDTH	HOW MARKED	METHOD OF CLOSING
1	45 m	HEMMS SET	SEE Note 8 Block 12
2			
3			

11. HORNET TACTICAL MINEFIELD ~~NUISANCE MINEFIELD~~ ~~PHONEY MINEFIELD~~

MINES		ANTITANK MINES (AT) TYPE M93	TYPE	TYPE	TYPE	TYPE	TYPE	TOTAL AT MINES	ANTI-LIFT DEV	ANTIPERSONNEL MINES (AP) TYPE	TYPE	TYPE	TOTAL AP MINES
		NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.
~~BURIED AND~~ SURFACE LAID	IOE												
	A	10						10					
	B	10						10					
	C												
	D												
~~IN STRIPS~~ IN ROWS ~~W/O PATTERN~~	E												
	F												
	G												
	H												
	J												
TOTAL		20						20					

12. NOTES

1. MINE CLUSTERS AT ....METRES/PACE SPACING

① Mine clusters at 100 M spacing ② Number of IOE clusters: None ③ Number of IOE omitted clusters: NA ③b Omitted clusters in LANES and GAPS: NA ④ Clusters with AHD's: None ⑤ Clusters with trip-wires: None ⑥ Strip Cluster composition: A(1-0-0), B(1-0-0) ⑦ Location of safety clips & pins: with owning unit ⑧ Location of mines: NA ⑨ Self Destruct time: A-4 hrs (092200Z JAN96) B-4hrs (092200Z Jan96)

13. SIGNATURE (OFFICER IN CHARGE): Greg Bier, 2LT — DATE: 09 Jan 96

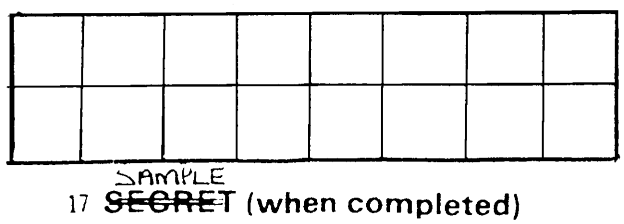
DA FORM 1355, MAR 87 — EDITION OF JUL 67 IS OBSOLETE

SAMPLE

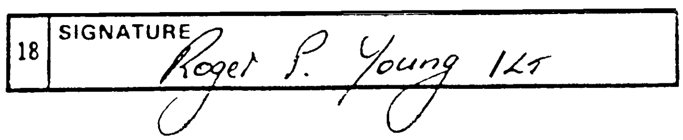
~~SECRET~~ (when completed)

Figure 8-3a. Sample DA Form 1355 (front side) for a Hornet minefield/munition field

Block 17. Enter the security classification of the form. If the form was used for training, enter the word SAMPLE.



Block 18. The emplacing unit OIC signs the signature block.



HASTY PROTECTIVE ROW MINEFIELD RECORD

Hasty protective row minefields/munition fields are recorded on DA Form 1355-1-R (Figure 8-4, page 8-18). A blank DA Form 1355-1-R is provided at the back of this publication; it can be locally reproduced on 8½- by 11-inch paper.

Use the following formula to determine the scale used on DA Form 1355-1-R:

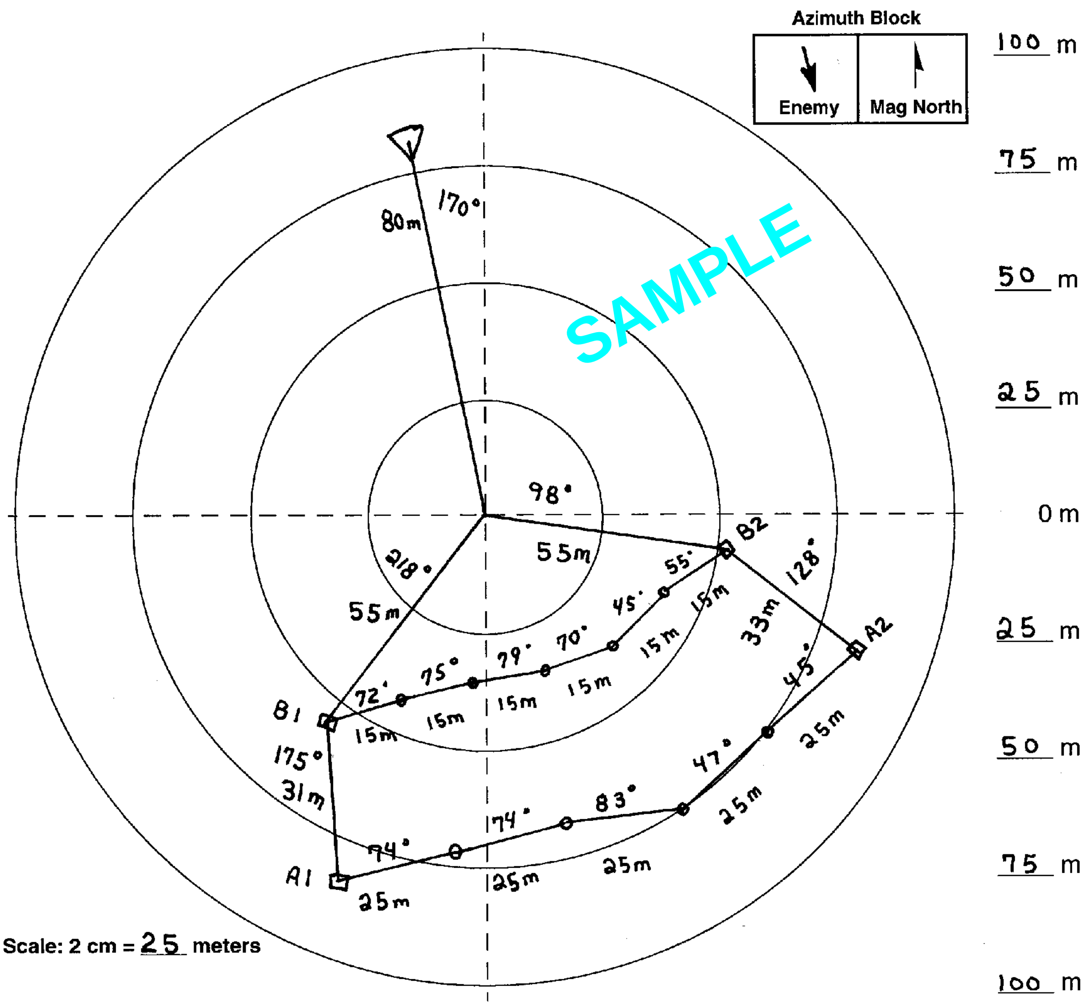
Distance from RP to the farthest point in the minefield + 10 meters ÷ 4 = scale

Example: 90 meters + 10 meters = 100 meters ÷ 4 = 25 meters

The number 4 is a constant and represents the four concentric rings on DA Form 1355-1-R. Ten is added as a safety margin to ensure that the minefield/munition field sketch is entirely contained within the largest ring. The distance between rings is 2 centimeters; therefore, the scale used in this example is 2 centimeters = 25 meters.

HASTY PROTECTIVE ROW MINEFIELD RECORD

For use of this form, see FM 20-32; the proponent agency is TRADOC.



Scale: 2 cm = 25 meters

Tabular Block

Row	Type	Actuation	Mine Number
A	M-15	Pressure	1, 4
A	M-21	Tilt-Rod	2, 3
B	M-15	Pressure	1, 3, 5
B	M-15	Tilt-Rod	2, 4

Remarks Points: A1, A2, B1, B2 are marked with orange tent pegs flush to the ground.

Identification Block

Unit 2nd PLT. C. Co. 317TH Eng. BN.	
Reference Point Tree stump right side of the road w/white eng. tape at NA 14503505	
Remarks Landmark: Center of road junction at NA 13403409	
Map and Sheet No. Talbot #5568	
Name of OIC 2nd LT. Roy Bean 123-45-7611	
Signature Roy Bean	Time and Date 1400z/1JUL01
Mines Removed	
Mines Transferred	

Figure 8-4. Sample DA Form 1355-1-R

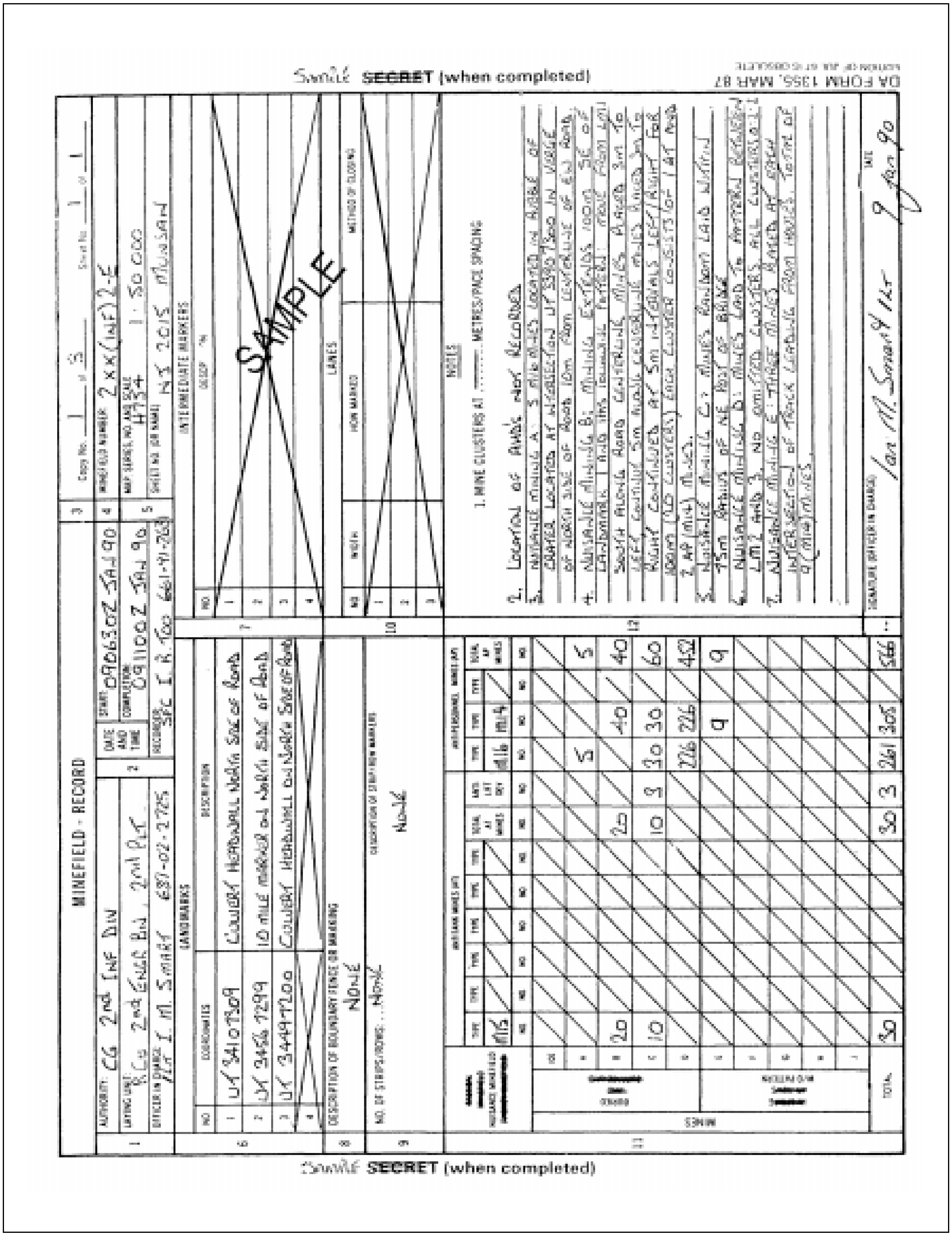


Figure 8-6a. Sample DA Form 1355 (front side) for a nuisance minefield/munition field

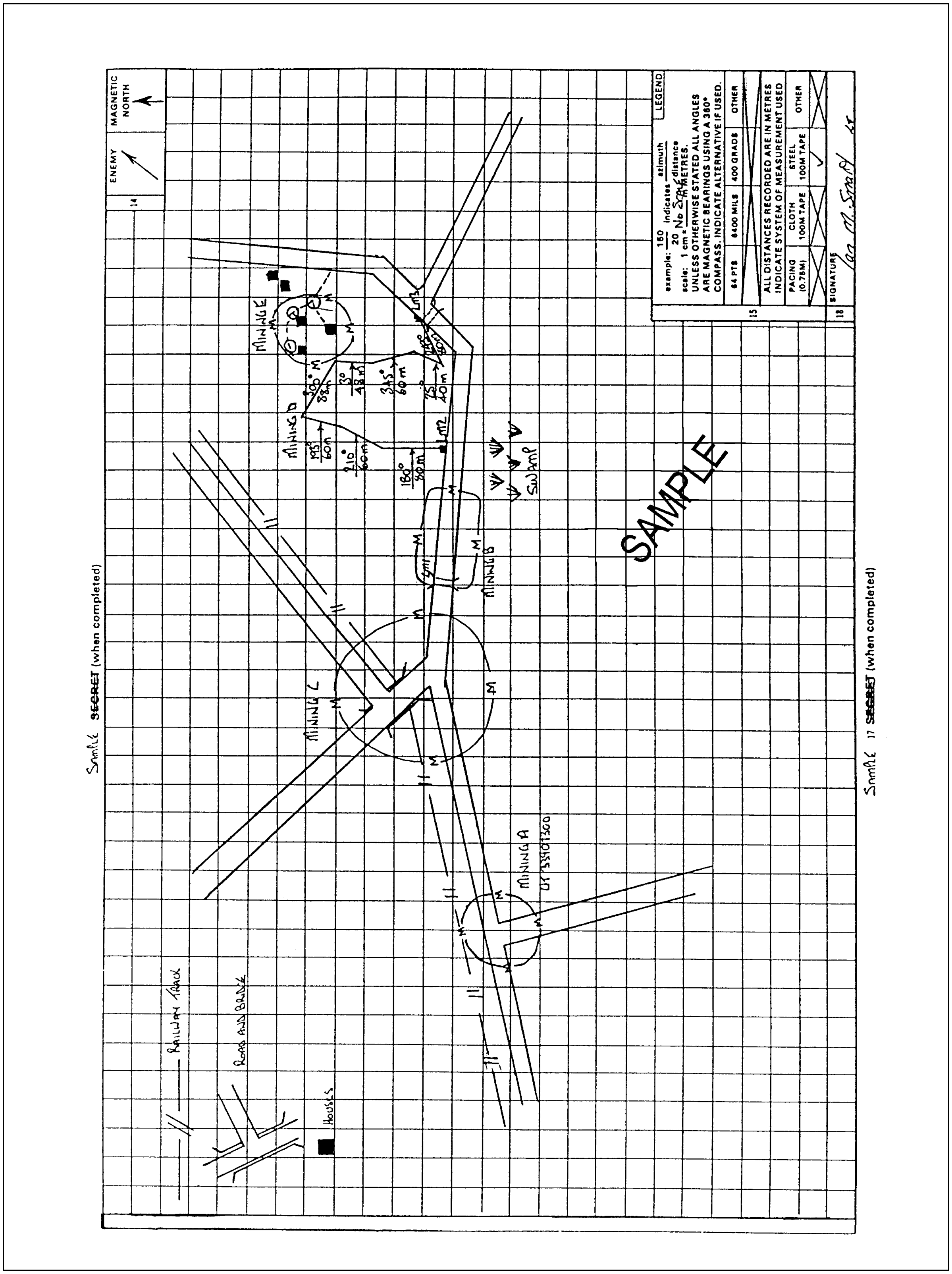


Figure 8-6b. Sample DA Form 1355 (inside) for a nuisance minefield/munition field

To facilitate reporting and recording of scatterable minefields/munition fields, a simple, uniform procedure is used. This procedure combines the report and the record into one document (Figure 8-7) that is applicable for all delivery systems.

Line No	Information Required	Data
1	Approving authority	Enter the approving authority, such as CDR 3AD.
2	Target/obstacle number	If the minefield/munition field is part of an obstacle plan, enter the obstacle number, such as 2XXX0157. This number represents II Corps, target number 157. If the minefield/munition field is not a part of an obstacle plan or does not have a number, then leave this line blank or enter NA.
3	Type of emplacing system	Enter the type system that emplaced the minefield/munition field, such as artillery or Volcano.
4	Type of mines	Enter AP for antipersonnel mines and AT for antitank mines. If both types of mines are used, enter AP/AT.
5	Life cycle	Enter the DTG the minefield/munition field was emplaced and the DTG the last mine SDs.
6-14	Aim point/corner points of minefield/munition field	If the system used to emplace the minefield/munition field uses a single aim point to deliver the mines, enter that aim point, such as MB 10102935. If the system has distinct corner points (Volcano), enter those corner points, such as MB 17954790, MB 18604860, MB 18504890, and MB 18054895.
15	Size of safety zone from aim point	If an aim point is given in Line 6, enter the size of the safety zone from that aim point. **Example:** Artillery emplaces a minefield/ munition field from aim point MB 10102935, and the safety zone is 1,000 x 1,000 m. Enter 500 m so that personnel plotting or receiving the information can plot the coordinates and go 500 m in each direction from the aim point to plot the safety zone.
16	Unit emplacing mines/ report number	Enter the unit emplacing mines and the report number, such as BCO 23 ENGR BN 4. Reports should be numbered consecutively. This would be the fourth minefield/munition field that B Company has emplaced.
17	Person completing report	Enter the person's name completing the report, such as SFC Jones.
18	DTG of report	Enter the DTG of the report, such as 160735ZOCT90.
19	Remarks	Include any other items the reporting unit may feel are important.

Figure 8-7. Scatterable minefield/munition field report and record work sheet

In addition to the scatterable minefield/munition field report and record, the SCATMINWARN (a sample is shown in Figure 8-8, page 8-24) notifies effected units that SCATMINEs will be emplaced. These two reports are the only reports used with scatterable mines.

A completed scatterable minefield/munition field report and record for an ADAM/RAAM artillery mission is shown in Figure 8-9, page 8-24. Note that on line 6, only one grid coordinate is given. It is the aim point used when the mission was fired. Also note that the 500-meter distance from the aim point (line 15) designates a safety zone that is 1,000 by 1,000 meters.

Line	Message
Alpha	Emplacing system
Bravo	AT (Yes or No)
Charlie	AP (Yes or No)
Delta	4 aim or corner points
Echo	Grid coordinates of aim points/corner points and size of the safety zone
Foxtrot	DTG of the life cycle

Figure 8-8. Sample SCATMINWARN

Line No	Information Required	Data
1	Approving authority	CDR 3AD
2	Target/obstacle number	2XXX0157
3	Type of emplacing system	Artillery
4	Type of mines	AT/AP
5	Life cycle	0816102-082020OCT90
6	Aim point/corner points of minefield/munition field	MB 10102935
7		
8		
9		
10		
11		
12		
13		
14		
15	Size safety zone from aim point	500 m
16	Unit emplacing mines/report number	2/48FA/2
17	Person completing report	SFC Hollins
18	DTG of report	061645ZOCT90
19	Remarks	NA

Figure 8-9. Scatterable minefield/munition field report and record for an ADAM/RAAM artillery mission

The SCATMINWARN provides affected units with the necessary warning to plan and execute their operations. The information is kept to a minimum to ensure rapid dissemination. The report may be sent orally, digitally, or hard copy. It is sent before or immediately after the mines have been emplaced. A completed SCATMINWARN for an artillery mission is shown in Figure 8-10.

Line	Message
Alpha	Artillery
Bravo	Yes
Charlie	Yes
Delta	One
Echo	MB 10102935 500 m
Foxtrot	081610Z-081920ZOCT90

Figure 8-10. Sample SCATMINWARN for an artillery mission

MINEFIELD/MUNITION FIELD OVERLAY SYMBOLS

The symbols contained in Figure 8-11, pages 8-26 through 8-30, are extracted from FM 101-5-1 and are provided for posting mine data on maps and overlays.

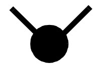
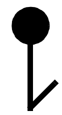
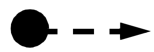
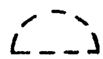
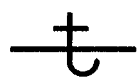
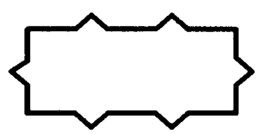
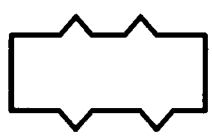
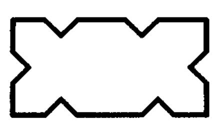
Description	Symbol
Minefield/Munition Fields	
Korea Only: AP mine	
AT mine	
AT mine with AHD	
Directional mine (arrow points in direction of main effect)	
Mine cluster	
Mine, type unspecified	
Trip wire	
Control Measures	
Zone	
Belt	
Restrictions	

Figure 8-11. Minefield/munition field overlay symbols

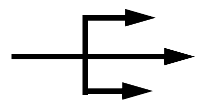
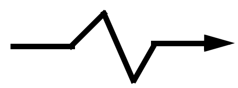
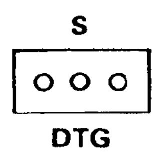
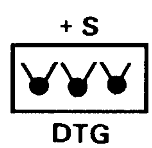
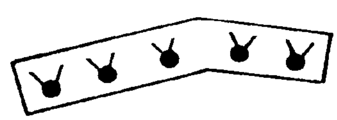
Description	Symbol
Block effect	
Turn effect	
Disrupt effect	
Fix effect	
Conventional	
A planned minefield/munition field consisting of unspecified mines	
A completed minefield/munition field consisting of unspecified mines	
Scatterable minefield/munition field (DTGs used for SD times)	
Conventional AP minefield/ munition field reinforced with SCATMINEs	
Tactical AP row minefield/ munition field (outline drawn to scale)	

Figure 8-11. Minefield/munition field overlay symbols (continued)

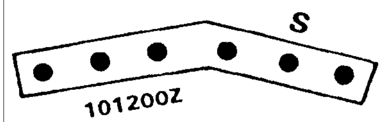
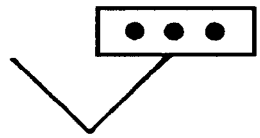
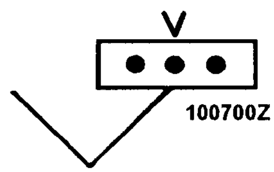
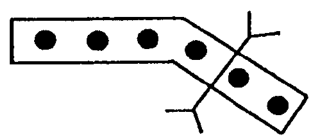
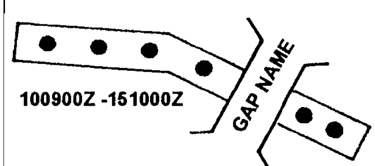
Description	Symbol
Tactical minefield/munition field of scatterable AT mines, effective until 101200Z	
Completed AT minefield/munition field (drawn away from the location and connected by a vector)	
Executed Volcano minefield/munition field (DTG used for SD time)	
Lane in conventionally laid AT minefield/munition field	
Gap in conventionally laid AT minefield/munition field (DTG opened to DTG closed)	

Figure 8-11. Minefield/munition field overlay symbols (continued)

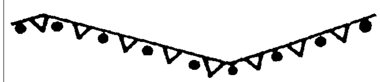
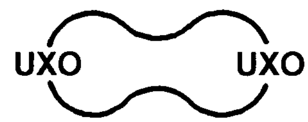
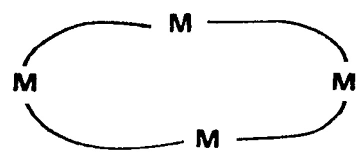
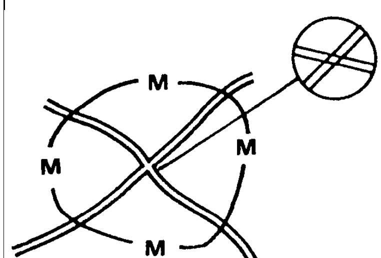
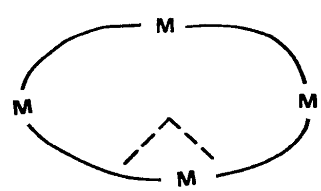
Description	Symbol
AT ditch reinforced with AT mines	
UXO	
UXO area	
Nuisance	
Nuisance minefield/munition field	
Demolished crossroads with nuisance mines	
Phony	
Phony minefield/munition field	

Figure 8-11. Minefield/munition field overlay symbols (continued)

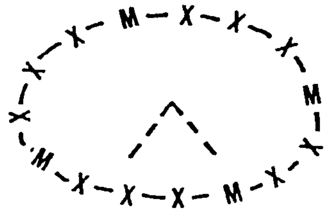
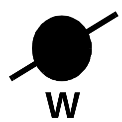
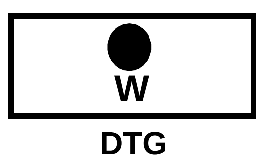
Description	Symbol
Phony minefield/munition field, fenced	
Hornet Symbology	
Planned	
Unarmed	
Armed	
Expended	
Armed munition field (DTG used for SD time)	

Figure 8-11. Minefield/munition field overlay symbols (continued)

PART TWO

Counteroperations

This part of the manual provides overall guidance for conducting counteroperations by US forces. The types of breaching and clearing operations conducted, the tasks performed, and the equipment required are described in detail. Responsibilities and planning considerations are outlined for each operation.

Chapter 9

Countermine Operations

Countermine operations are undertaken to breach or clear a minefield. All the tasks fall under breaching or clearing operations and include detecting, reporting, reducing, proofing, and marking.

DEFINITIONS

OBSTACLE

The term *obstacle* is used often in this chapter because the same breaching and clearing operations are used for minefields and other obstacles. For the purpose of this manual, breaching and clearing tactics, techniques, and procedures (TTP) focus solely on minefields.

REDUCTION

Reduction is the act or actions taken against an obstacle that diminishes its original effect. For example, creating a lane in a minefield would yield a reduction of the minefield obstacle.

BREACHING

Breaching is the employment of TTP to project combat power to the far side of an obstacle. It is a synchronized combined arms operation that is under the control of the maneuver commander.

AREA CLEARANCE

Area clearance is the total elimination or neutralization of an obstacle or portions of an obstacle. Clearing operations are not conducted under fire. They are usually performed by follow-on engineer forces after a breaching operation or anytime in a friendly AO where an obstacle is a hazard or hinders movement.

ROUTE CLEARANCE

Route clearance is the removal of mines along preexisting roads and trails.

MINE NEUTRALIZATION

Mine neutralization occurs when a mine is rendered incapable of firing on passage of a target. The mine may still be dangerous to handle.

PROOFING

Proofing is done by passing a mine roller or other mine-resistant vehicle through a lane as the lead vehicle. It verifies that a lane is free of mines.

DEMINING

Demining is the complete removal of all mines and UXO within a geopolitical boundary after hostilities cease.

BREACHING OPERATIONS

Breaching is a synchronized combined arms operation that is under the control of the maneuver commander. FM 3-34.2 provides combined arms commanders and staffs with doctrine TTP that are needed to successfully overcome obstacles. Breaching operations make maneuver possible in the face of enemy obstacle efforts. Since obstacles may be encountered anywhere, maneuver forces integrate breaching operations into all movement plans.

When possible, enemy minefields are bypassed to maintain the momentum and conserve critical countermobility assets. However, when making the decision to bypass rather than breach, consider the likelihood of friendly units being channelized into kill zones. Bypassing is done by maneuvering around a minefield or, if aviation assets are available, moving over the minefield. When maneuvering around an obstacle, attempt to locate a portion of the force in overwatch positions to cover the bypass of the main element. Even when the decision is made to conduct a breach, scouts should continue to reconnoiter for bypass routes.

The first step in understanding breaching operations is to know the obstacle breaching theory. Knowing the theory behind breaching operations equips the engineer and the maneuver commander with fundamentals that are needed to integrate breach into the tactical planning, preparation, and execution of an operation.

Successful breaching operations are characterized by the application of the following tenets of breaching:

INTELLIGENCE

In any operation where enemy obstacles interfere with friendly maneuver, obstacle intelligence (OBSTINTEL) becomes a priority intelligence requirement (PIR). Finding enemy obstacles or seeing enemy obstacle activity validates and refines the S2's picture of the battlefield. OBSTINTEL helps determine enemy intentions, plans, and strength. The force engineer is the unit's expert on enemy countermobility, and he assists the S2 in templating enemy obstacles and analyzing OBSTINTEL.

When collecting OBSTINTEL, reconnaissance is a combined arms activity that includes engineers. An engineer squad moves with scouts or the patrol and conducts dismounted reconnaissance of templated or discovered obstacles. Additional information on reconnaissance can be found in FM 5-170. Reconnaissance teams gather the following OBSTINTEL information from the reconnaissance:

- Minefield location. Plot the perimeter location on a large-scale map and refer to recognizable landmarks.

Marking is emplaced across the front, on both sides, between lanes, and to the left and right of the crossing site as far out as practical.

Engineers may also help remove damaged vehicles from minefield lanes. Recovery vehicles should be available near lanes for this purpose.

AREA CLEARANCE

Clearing operations are done when engineers receive a mission to clear an area of mines or to clear a specific minefield in a friendly AO. The minefield was reported and may already be marked on all sides. The worst case would be if the minefield was reported but not marked and its limits were unknown. The engineer unit receiving the mission bases plans on available information and prepares equipment based on the estimate. Detailed techniques and procedures for area and route clearance operations are outlined in Chapter 11.

Actions at the minefield begin with a thorough reconnaissance to identify the minefield limits and the types of mines. This is a time-consuming process that is hazardous to shortcut. Identified limits are marked with an expedient system of single-strand barbwire or concertina. In this situation, since all mines must be destroyed, the unit takes a systematic approach to clearing mines. The procedure depends on the types of mines and whether the mines are buried or surface-laid.

If mines are magnetic- or seismic-fused, mechanical assets are used. Pressure mines can be destroyed by using hand-emplaced explosives. When a manual procedure is used, eliminate trip wires on AP mines with grapnel hooks before moving forward to detect mines.

Using the manual procedure, engineers visually detect mines or detect them with mine detectors and probes. They also mark mines for destruction by explosives. Chapter 11 contains information on minesweeping procedures.

After the mines are destroyed, engineers proof used lanes and routes to ensure that all the mines were eliminated. This is done by using a mine roller or another blast-resistant device. Proofing is discussed further in Chapter 10.

DEMINING

Demining is the complete removal of all mines and UXO to safeguard the civilian population within a geopolitical boundary after hostilities cease. It is an extremely manpower- and time-intensive operation and is sometimes contracted. Although not a formal Army mission or function, SOFs may provide special expertise in training demining organizations, acting as advisors, and taking the lead in providing clearance equipment or techniques that can be useful in demining operations. Demining TTP are outlined in TC 31-34.

Chapter 10

Minefield Reduction

Reduction is the physical creation of a lane through a minefield. It is a fundamental of breaching operations as discussed in Chapter 9 and in FM 3-34.2. A number of tasks (detecting, reporting, reducing, proofing, and marking) directly support or are included in minefield reduction.

DETECTING

Detection is the actual confirmation and location of mines. It may be accomplished through reconnaissance, or it may be unintentional (such as a vehicle running into a mine). Mine detection is used in conjunction with intelligence-gathering operations, minefield bypass reconnaissance, and breaching and clearing operations. There are four types of detection methods—visual, physical (probing), electronic, and mechanical.

VISUAL

Visual detection is part of all combat operations. Personnel visually inspect the terrain for the following minefield indicators:

- Trip wires.
- Signs of road repair (such as new fill or paving, road patches, ditching, culvert work).
- Signs placed on trees, posts, or stakes. Threat forces mark their minefields to protect their own forces.
- Dead animals.
- Damaged vehicles.
- Disturbances in previous tire tracks or tracks that stop unexplainably.
- Wires leading away from the side of the road. They may be firing wires that are partially buried.
- 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. They 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 FDs. These devices may be on the surface or partially buried.

- Patterns of objects that could be used as a sighting line. The enemy can use mines that are fired by command, so road shoulders and areas close to the objects should be searched.

PHYSICAL

Physical detection (probing) is very time-consuming and is used primarily for clearing operations, self-extraction, and covert breaching operations. Detection of mines by visual or electronic methods should be confirmed by probing. Use the following procedures and techniques when probing for mines:

- Roll up your sleeves and remove your jewelry to increase sensitivity. Wear a Kevlar helmet, with the chin strap buckled, and a protective fragmentation vest.
- Stay close to the ground and move in a prone position to reduce the effects of an accidental blast. When moving into a prone position—
  - — Squat down without touching your knees to the ground.
  - — Scan forward up to 2 meters and to the sides up to 3 meters for mine indicators.
  - — Probe the area around your feet and as far forward as possible.
  - — Kneel on the ground after the area is found to be clear, and continue probing forward until you are in a prone position.
- Use sight and touch to detect trip wires, fuses, and pressure prongs.
- Use a slender, nonmetallic object as a probe.
- Probe every 5 centimeters across a 1-meter front.
- Gently push the probe into the ground at an angle that is less than 45 degrees.

DANGER
Use extreme caution when probing. If the probe is pushed straight down, its tip may detonate a pressure fuse.

- Apply just enough pressure on the probe to sink it slowly into the ground.
- If the probe encounters resistance and does not go into the ground freely, carefully pick the soil away with the tip of the probe and remove the loose dirt by hand. Care must be taken to prevent functioning the mine.
- When you touch a solid object, stop probing and use two fingers from each hand to carefully remove the surrounding soil and identify the object.
- If the object is a mine, remove enough soil to show the mine type and mark its location. Do not attempt to remove or disarm the mine. Use explosives to destroy detected mines in place, or use a grappling hook and rope to cause mines to self-detonate. Do not use metal grappling hooks on magnetic-fused mines.

Probing is extremely stressful and tedious. The senior leader must set a limit to the time a prober can actually probe in the minefield. To determine a reasonable time, the leader must consider METT-TC factors, weather conditions, the threat level, the unit's stress level, and the prober's fatigue level and state of mind. As a rule, 20 to 30 minutes is the maximum amount of time that an individual can probe effectively.

ELECTRONIC

Electronic detection is effective for locating mines, but this method is time-consuming and exposes personnel to enemy fire. In addition, the suspected mines must be confirmed by probing.

AN/PSS-12 Mine Detector

The AN/PSS-12 mine detector (Figure 10-1) can only detect metal, but most mines have metal components in their design. The detector can locate and identify plastic or wooden mines by a slight metallic signature. Employment and operation procedures for the AN/PSS-12 are discussed in Appendix F, and technical data is available in TM 5-6665-298-10. The detector is hand-held and identifies suspected mines by an audio signal in the headphones.

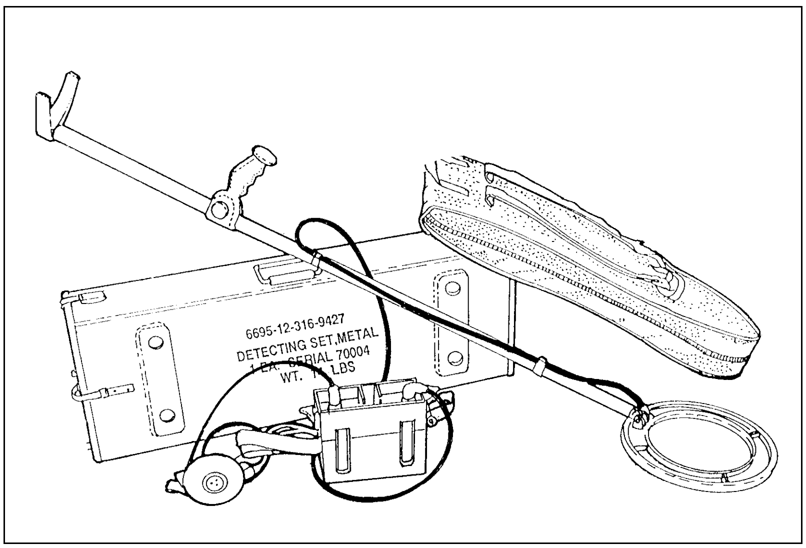


Figure 10-1. AN/PSS-12 mine detector

As in probing, consideration must be taken for the maximum amount time an individual can operate the detector. The leader considers METT-TC factors, weather conditions, the threat level, the unit's stress level, and the individual's fatigue level and state of mind. As a rule, 20 to 30 minutes is the maximum amount of time an individual can use the detector effectively.

Airborne Standoff Minefield Detection System

The Airborne Standoff Minefield Detection System (ASTAMIDS) (Figure 10-2, page 10-4) provides US forces with the capability to detect minefields rapidly. Environmental conditions must be favorable for aircraft and ASTAMIDS operations. ASTAMIDS can be mounted on a UH-60 Blackhawk helicopter, an unmanned aerial vehicle (UAV), or a fixed-wing aircraft. The system detects and classifies thermal and other anomalies as suspected minefields along routes or in areas of interest. ASTAMIDS can be used to protect advancing forces and can operate in concert with air and ground units in reconnaissance missions.

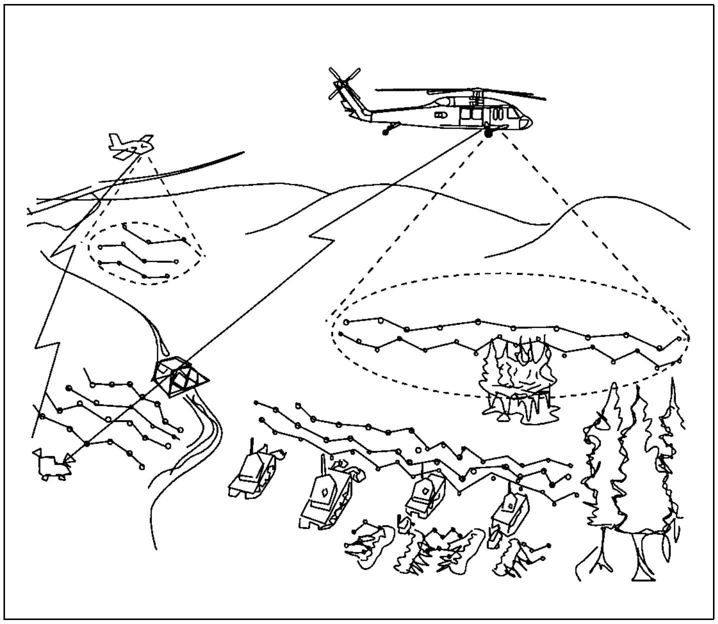


Figure 10-2. ASTAMIDS

System Components

ASTAMIDS hardware and software components consist of a sensor with associated electronics and the minefield-detection algorithm and processor (MIDAP). Surrogate equipment includes an air-data package (GPS, radar altimeter, inertial measurement unit [IMU]), a power supply, a work station(s), a digital data recorder, mounting racks, and a modified floor for the specific aircraft.

Operators view the data displayed on the monitors, communicate with the aircrew, and perform other functions (such as changing data tapes and producing reports). The aircrew must maintain an altitude of 300 feet and an airspeed of approximately 70 knots for the system to detect mines accurately within the sensor's ground swath (approximately 215 feet wide). The system has a 2-hour operational capability, based on standard flight time for the mission profile.

Employment Concept

ASTAMIDS is a fast method for detecting tactical minefields. When it is employed by aviation elements in support of maneuver units, close coordination between aviation and ground units assures that minefield detection is reported accurately and quickly. ASTAMIDS is not as precise as ground detection systems, but it is accurate enough to help mitigate the dangers inherent with minefields. It can be used in both friendly and enemy territories. The use of a Blackhawk ASTAMIDS in areas of threat observation

The neutralization of mines by blast depends on the peak pressure and the impulse. For the MICLIC, the impulse is at a maximum of 3 meters from the line charge (on both sides) and decreases the closer it gets toward the line charge, to a minimum of 1 meter from the line charge. This decrease on impulse causes a *skip zone* (Figure 10-8). This does not mean that neutralization is equal to zero percent; it means that it is not equal to 100 percent. Mines that are buried deeper than 10 centimeters and located 1 to 2 meters from the line charge have a high probability of not being neutralized.

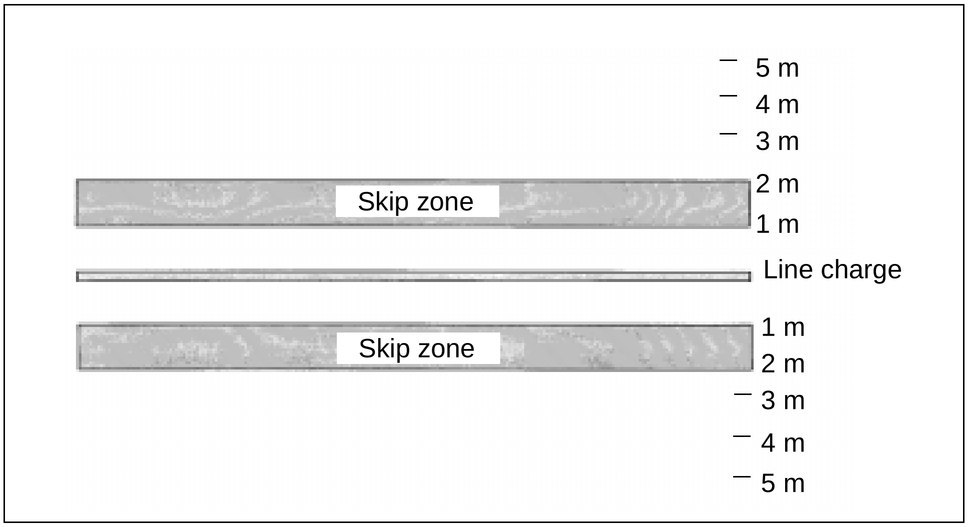


Figure 10-8. Skip zone

Antipersonnel Obstacle Breaching System

The Antipersonnel Obstacle Breaching System (APOBS) (Figure 10-10) is a man-portable device that is capable of quickly creating a footpath through AP mines and wire entanglements. The APOBS is normally employed by combat engineers, infantry soldiers, or dismounted armored cavalry personnel. The APOBS provides a lightweight, self-contained, two-man, portable line charge that is rocket-propelled over AP obstacles from a standoff position away from the edge of the obstacle.

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 the rocket-motor launch mechanism, containing a 25-

of the attack, from initial reduction of the obstacle to the passage of larger follow-on forces, as well as the return traffic necessary to sustain the force. Additional guidelines are discussed in FM 3-34.2.

Marking breach lanes and bypasses is critical to obstacle reduction. Effective lane marking allows the commander to project forces through the obstacle quickly, with combat power and C^2. It gives the assaulting force confidence in the safety of the lane and helps prevent unnecessary minefield casualties.

There are two critical components of the lane-marking system:

- Lane-marking pattern (location of markers indicating the entrance, the lane, and the exit).
- Marking device (type of hardware emplaced to mark the entrance, the lane, and the exit).

The lane-marking system outlined in this section centers around standardized marking patterns rather than the marking device. Standardizing the marking pattern is critical to offensive operations. A common lane pattern—

- Enables cross attachments and adjacent units to recognize breach lanes easily with minimal knowledge of a particular unit's tactical SOP.
- Gives all forces a standardized set of visual cues that are needed to pass through a lane safely while maintaining their momentum.
- Facilitates quick conversion to the lane-marking requirements of STANAGs 2889 and 2036 (discussed later in this chapter).

The standard lane-marking hardware is decided by unit commanders. This gives units greater flexibility and allows them to adopt marking devices that are tailor-made for their type of unit and operational focus (such as an armored or light force, a mounted or dismounted attack, limited visibility, thermal capability). However, regardless of the type of device used, it must support the standard lane-marking pattern outlined in the following paragraphs. Therefore, commanders should consider these guidelines and examples before developing or adopting their own marking system.

LANE-MARKING TERMS

The definitions in the following paragraphs provide a common basis for discussing lane marking.

Entrance Markers

Entrance markers indicate the start of a reduced lane through an obstacle. They signify the friendly-side limit of the obstacle and the point at which movement is restricted by the lane width and path. Entrance markers are placed to the left and the right of the entrance point and spaced the width of the reduced lane. They must be visually different from handrail markers to help the force distinguish this critical point in the lane.

Handrail Markers

Handrail markers define the lane path through the obstacle and indicate the limits of the lane width. As a minimum, mounted and dismounted lanes will have a left handrail marker. Mounted and dismounted forces moving through the lane should keep the left handrail marker immediately to their left. As the operation progresses, lane marking may be upgraded to include left and right handrail markers.

Exit Markers

Exit markers indicate the far side of the reduced lane through an obstacle. Like entrance markers, exit markers must be distinguishably different from handrail markers; however, the exit may be marked the same as the entrance. Exit markers are placed to the left and the right of the exit point and spaced the width of the reduced lane. This visual reference is critical when only the left handrail is marked. The combination of entrance markers, left handrail markers, and exit markers provide the driver and the tank commander with visual cues so that they can safely pass through a reduced lane.

Entrance Funnel Markers

Entrance funnel markers augment entrance marking. The V formed by a funnel marker forces the platoon into a column and helps drivers and tank commanders make last-minute adjustments before entering a lane.

Final-Approach Markers

Final-approach markers are highly visible, robust markers that augment the visual signature of entrance funnel markers. They are critical when initial assault forces must maneuver to the breaching site. Normally, the initial assault force can observe the breaching area but cannot clearly distinguish entrance funnel markers. Final-approach markers provide the assault force commander with a highly visible RP toward which to maneuver his formation. They also signal company team commanders to begin changing from combat column to column formation, with platoons in combat column.

Far Recognition Markers

Far recognition markers are highly visible markers that are located between the final-approach marker and the friendly unit. They are primarily used when passing forces are denied direct observation of the final-approach marker due to distance, visibility, or terrain. When possible, far recognition markers should be different from the final-approach marker. Far recognition markers indicate the point at which forces begin changing their formation to posture for the passage. A single far recognition marker may serve up to two initial breach lanes. Once lanes are upgraded to two-way traffic, far recognition markers are required for each two-way lane. When a far recognition marker serves more than one lane, a guide or a traffic-control post (TCP) is collocated with the far recognition marker that is nearest to the breach.

Guides and Traffic-Control Posts

A TCP or a guide consists of a two-man team with communications means. The team assists the commander in controlling the movement of forces. When possible, military police (MP) should man TCPs. However, the commander may initially use other personnel as guides to man critical far recognition markers until the MP establish full TCPs. TCPs and guides provide the commander with a man on the ground who controls traffic flow to the appropriate lanes. When there are multiple lanes branching off a single far recognition marker, the TCP can assist in breaking parts of the formation off into various lanes. The TCP can also help modify the traffic flow when lanes have been closed for maintenance, for lane expansion, or by enemy SCATMINEs. The guide or TCP must give the assault force commander the azimuth and distance to the final-approach marker, identify the device used for the final-approach marker, and provide the level of the lane-marking pattern. For light forces, guides may physically escort passing units from the far recognition marker to the lane entrance.

LEVELS OF LANE MARKING AND PATTERNS

The three standard levels of marking for breach lanes and bypasses are initial, intermediate, and full.

Each lane-marking level provides an increase in lane signature and capability. Lane requirements change as a breaching operation matures from an initial breach to the forward passage of large combat forces.

Initial lane-marking requirements are driven by the nature of the fight through the obstacle. Marking must be rapid, providing only the bare minimum signature needed to pass small units who make up the initial assault force. This contrasts with the lane requirements of later phases of an offense where larger units are passed to subsequent objectives. Here, the lane signature must be more extensive and more visible, because it must guide larger forces over a greater distance to the lane's entrance without interruption. Two-way traffic becomes a priority for the simultaneous forward passage of combat units as well as the return traffic (such as ambulances and empty supply vehicles) that is necessary to sustain the force. Lane-marking limits must be absolutely clear to the most inexperienced driver or crewman. A fully developed lane must support two-way traffic and be completely marked.

Bypasses are not marked the same as lanes. They are marked with directional panels indicating the direction of the bypass. The limits of the mine threat must be marked to prevent friendly forces from entering the minefield. Marking the direction of the bypass and the minefield limits will enable the maneuvering element to bypass the minefield without having to unnecessarily defile through a marked lane. Further information on bypass marking can be found in FM 3-34.2.

Commanders must be aware of how the needs of the force change with the operation so that they can anticipate lane-marking and lane-capability requirements. Integrating the levels of lane marking into the overall breaching plan ensures that the unit's needs are satisfied. Forces necessary to mark, maintain, and upgrade lanes must be allocated and tasked with the mission. The phases of the scheme of maneuver and the service-support plan are the basis for analyzing lane requirements. The following paragraphs describe lane-marking patterns in detail and provide guidelines on when the commander should upgrade lane marking and lane capability.

Initial Lane Marking

Initial lane marking (Figure 10-22, page 10-28) is emplaced by the breach force immediately after the lane is reduced and proofed. It provides a signal to the assault force commander that the lane is ready for traffic. Initial lane marking is kept to a minimum, centering on markings needed to pass immediate assault forces through the lane to seize the initial foothold on the objective. Normally, the assault force can observe the breach and does not need the more visual signature of a mature lane marking. The initial lane-marking pattern has the following markers:

- Entrance.
- Exit.
- Left handrail.
- Entrance funnel.
- Final-approach.

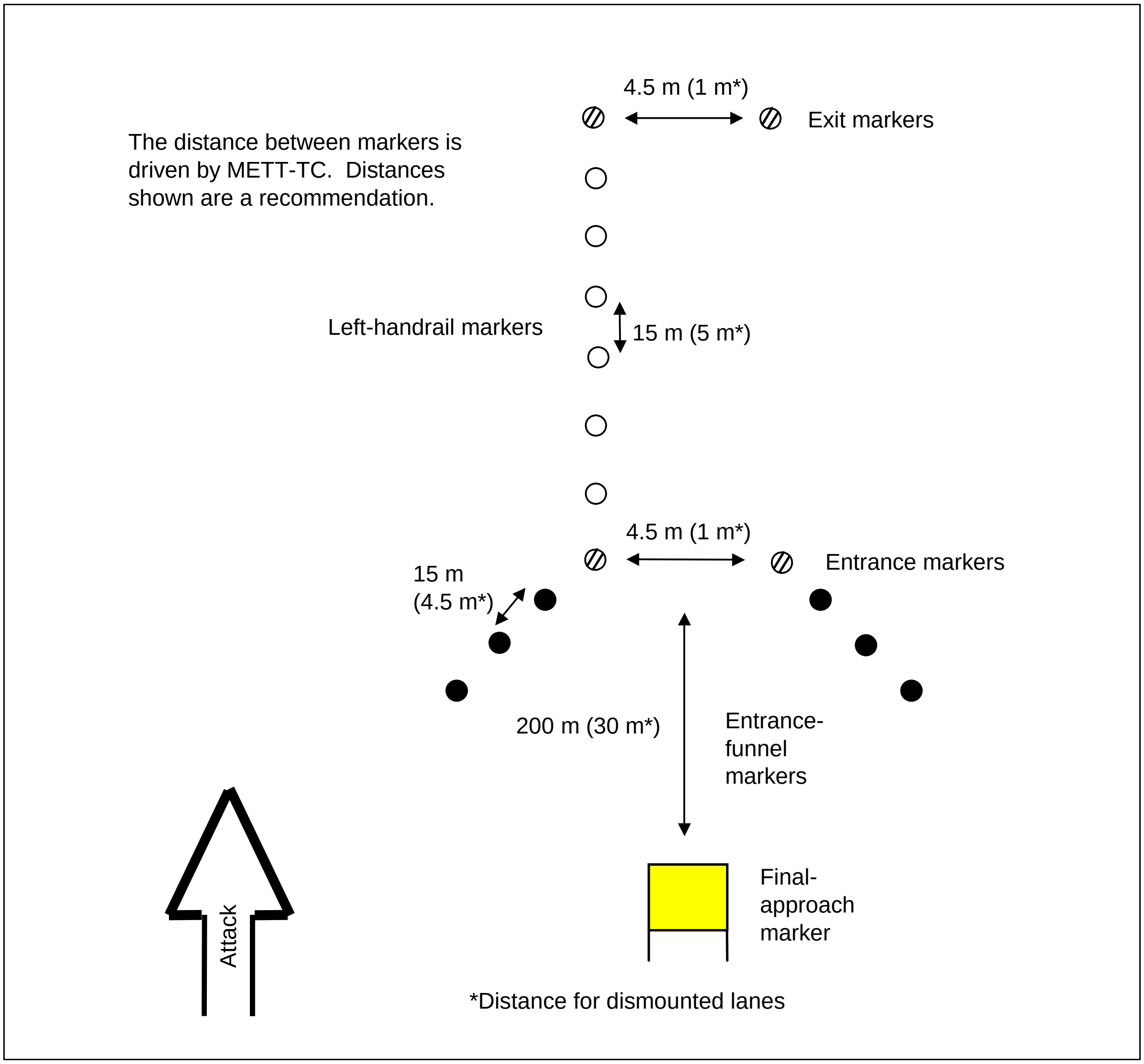


Figure 10-21. Initial lane marking

The entrance, left handrail, and exit markers are the first markers emplaced by the breach force because they define the location and the limits of the reduced lane.

- Entrance markers are placed to the left and the right of the reduced lane's entrance point, and they are spaced the width of the lane (4.5 meters for mounted lanes, 1 meter for dismounted lanes).
- Left handrail markers are placed at the left limit of the lane, along the entire path. Handrail markers are placed at 15-meter intervals for mounted forces and at 5-meter intervals for dismounted forces. Commanders may have to modify the intervals based on the terrain, the visibility, the lane length, and the lane path.
- Exit markers are placed to the left and the right of the reduced lane's exit point, and they are spaced the width of the lane (4.5 meters for mounted lanes, 1 meter for dismounted lanes).

Once the entrance, left handrail, and exit markers are emplaced, the breach force emplaces the entrance funnel markers and the final-approach marker.

- Entrance funnel markers are placed at 15-meter intervals for mounted forces and at 5-meter intervals for dismounted forces. They are placed diagonal to the lane entrance and form a 45-degree V (Figure 10-22).
- The final-approach marker is centered on the lane and placed at least 200 meters from the lane entrance for mounted forces. For dismounted forces, the nature of the attack may initially preclude using a final-approach marker; however, as soon as the mission allows, a final-approach marker is placed 30 meters from the entrance. Final-approach markers for mounted and dismounted forces must be placed on high ground to ensure that they are clearly visible. The commander may modify the recommended distance for the final-approach marker, based on the terrain and the visibility.

Intermediate Lane Marking

Upgrading initial lane marking to intermediate lane marking (Figure 10-23, page 10-30) is triggered by one of two key events—the commitment of larger combat forces who are unable to directly observe the breach or the rearward passage of sustainment traffic (casualty evacuation and vehicle recovery). Intermediate lane marking has two goals:

- Increasing the lane signature to help the passage of larger, more distant combat forces.
- Providing sufficient marking for two-way, single-lane traffic.

Intermediate lane marking builds on initial lane marking by adding right handrail markers, exit funnel markers, far recognition markers, and a farside final-approach marker.

The commander sets the priority of marker emplacement based on the situation. If the scheme of maneuver requires the immediate passage of larger combat forces, the right handrail markers and the far recognition marker may be the priority. On the other hand, if it is necessary to ground evacuate casualties or to recover vehicles, emplacing right handrail markers, exit funnel markers, and a farside final-approach marker may be required first.

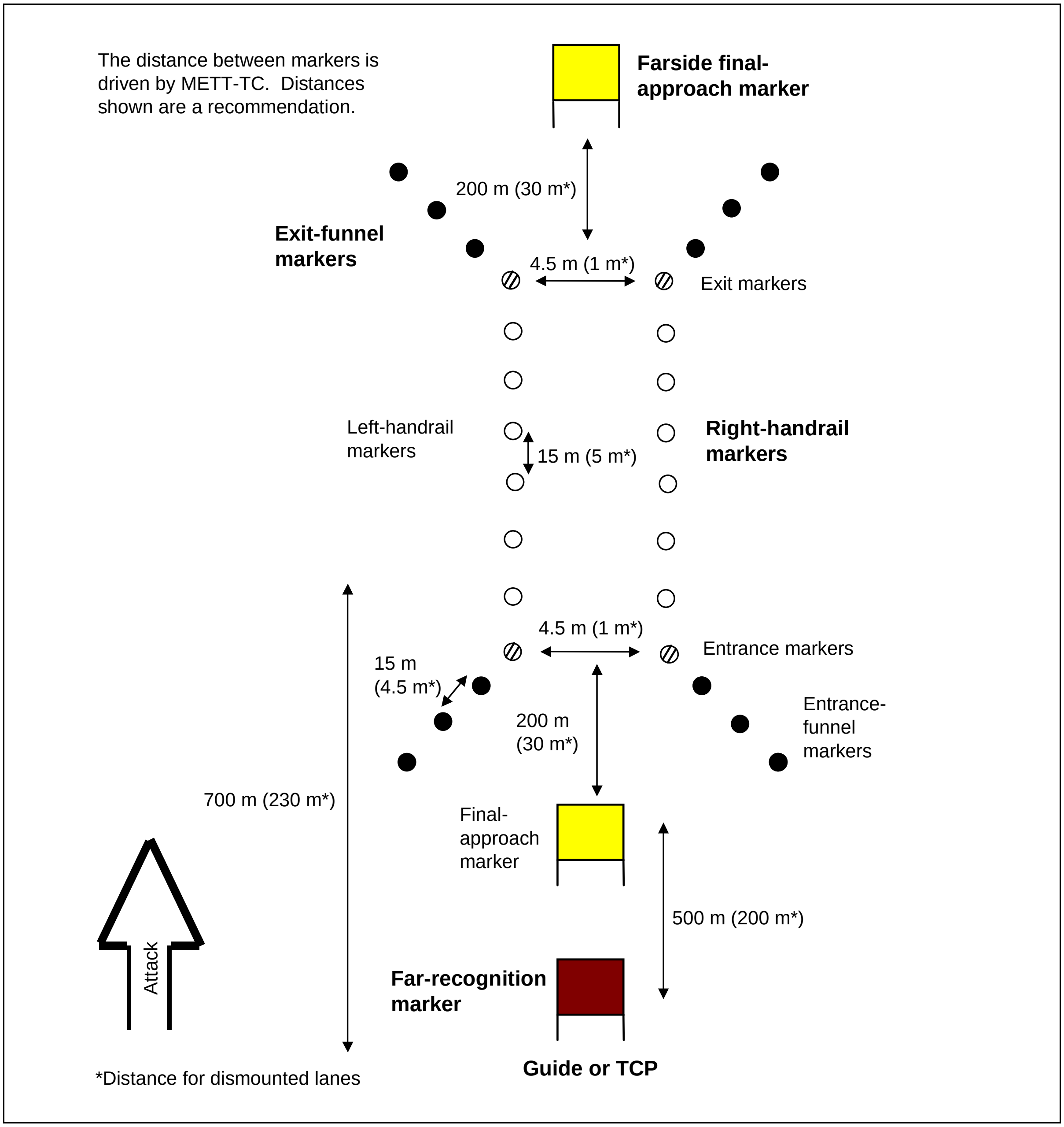


Figure 10-22. Intermediate lane marking

When upgrading to intermediate marking, the first step is to emplace the right handrail markers. Right handrail markers define the rightmost limit of the lane. They are placed the width of the lane as defined by the entrance and exit markers. The right handrail follows a path parallel to the left handrail through the obstacle. Right handrail markers are placed at the same interval as left handrail markers.

Exit funnel markers and a farside final-approach marker are emplaced to mirror the entrance markers. Exit funnel markers prevent the premature deployment of the passing force into combat formation before it is safely outside the obstacle. They also become the entrance funnel markers for rearward passing traffic, giving these forces the visual cues needed to line themselves up on the lane. The exit funnel markers are augmented by a farside final-approach marker to help rearward passing forces clearly identify the lane from their side. The farside final-approach marker is centered on the lane and placed 200 meters (mounted forces) or 30 meters (dismounted forces) from the exit.

A far recognition marker completes intermediate lane marking. It provides commanders with a visual signature or a series of signatures for guiding their movement toward the lane. For mounted forces, the far recognition marker nearest to the breach lane is placed 500 meters from the lane entrance or on the nearest terrain feature. Dismounted forces may require a system of guides instead of far recognition markers for passing combat forces; however, far recognition markers must be emplaced as soon as possible to reduce guide requirements for passing mounted sustainment traffic. This gives the assault force commander the space needed to transition his formation to companies in combat column. Far recognition markers may be emplaced before or concurrent with exit markers, based on the mission and the situation.

The commander collocates guides or TCPs at the far recognition marker when he feels the situation requires more positive control over traffic flow. Commanders should plan for the use of full-time guides once they have upgraded to intermediate marking. TCPs become mission-critical during limited visibility or in restrictive terrain. They should also be used when a single far recognition marker feeds more than one breach lane. TCPs must be manned with a minimum of two soldiers and must have FM communications with the controlling headquarters. It is essential that soldiers acting as guides or TCPs know the—

- Azimuth and distance to the breach lane and the 8-digit grid coordinate of the lane.
- Level of lane marking.
- Type of final-approach marker used.
- Traffic-control plan and march order.
- Up-to-date status of lane marking, maintenance, and so forth.

Full Lane Marking

Expanding breach lanes to full (two-way) lane marking (Figure 10-24, page 10-32) is resource-intensive and is not normally a part of an initial breach operation. A fully matured lane is one that will support uninterrupted, two-way traffic. Expanding a breach lane to a full lane involves expanding the width of the lane to accommodate two-way traffic and modifying the marking pattern to give forward and rearward passing forces the same visual signature. Upgrading to a full lane is normally assigned to follow-on engineer forces, since it is usually beyond the immediate capability of engineers with forward units.

Upgrading intermediate lane marking to full lane marking begins by temporarily closing the lane, rerouting traffic, and expanding the lane width. The initial reduced and proofed lane is always expanded to the left, in relation to the direction of the attack. Engineers reduce and proof the obstacle beginning at the left handrail to give a total lane width of 10 meters (5 meters

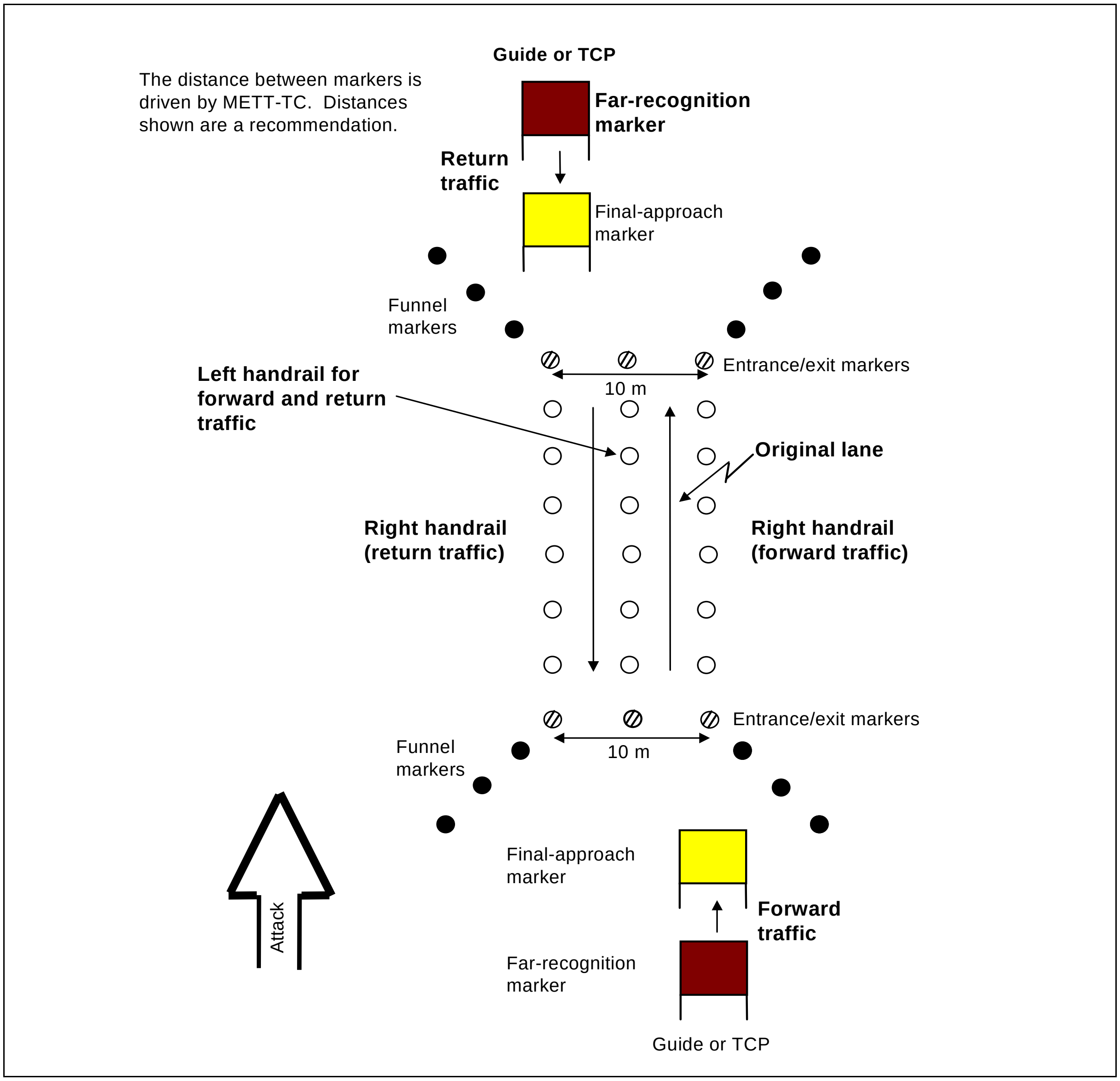


Figure 10-23. Full lane marking

each way). The expansion width requirement is the same for armored and light forces, because both forces must be able to pass mounted sustainment and combat forces during this phase.

Once the engineers expand the lane width to 10 meters, they ensure that entrance, exit, handrail, funnel, and final-approach markers are replaced on the return lane. All markings are the same as described in previous paragraphs.

The full lane-marking pattern has three entrance and three exit markers. They are placed the width of forward and return lanes and are visually different from other markers. Units must be trained to recognize that three entrance markers indicate a two-way traffic lane and that they should always use the rightmost lane.

Entrance and exit funnel markers are placed slightly different from previous marking patterns. They extend out from the entrance and exit markers on the right side only.

Final-approach markers are placed 200 meters from, and centered on, entrances of forward and return lanes. This helps forces clearly identify the entrance points from either direction.

Far recognition markers are placed a maximum of 500 meters from the lane entrance or on the nearest terrain feature from forward and return final-approach markers.

COMMANDER'S GUIDANCE FOR LANE MARKING

Table 10-1 provides a summary of lane-marking levels, guidelines on unit responsibilities, and events that trigger lane upgrade. In the table, *who* refers to the unit responsible for lane upgrade marking and *when* describes events that trigger the need to upgrade.

Table 10-1. Lane-marking levels, unit responsibilities, and trigger events

<table>
<tr><th></th><th>Initial</th><th>Intermediate</th><th>Full (Two Way)</th></tr>
<tr><td>Who</td><td>TF breach force</td><td>TF breach force</td><td>Brigade</td></tr>
<tr><td rowspan="3">When</td><td>Obstacle is reduced</td><td>Passing battalion- or company-size forces</td><td>Passing brigade- or battalion-size forces</td></tr>
<tr><td rowspan="2">Passing platoon- or company-size assault forces</td><td>Passing force which cannot see the lane</td><td rowspan="2">Situation requires uninterrupted sustainment traffic</td></tr>
<tr><td>Passing TF combat trains</td></tr>
<tr><td rowspan="5">Markers</td><td>Entrance</td><td>Add right handrail</td><td>Expand lane width to 10 meters</td></tr>
<tr><td>Exit</td><td>Add exit funnel</td><td>Adjust entrance/exit</td></tr>
<tr><td>Left handrail</td><td>Add farside final approach</td><td>Adjust left/right handrails to new width</td></tr>
<tr><td>Entrance funnel</td><td>Add far recognition</td><td>Add far recognition</td></tr>
<tr><td>Final approach</td><td>Add guides or TCPs</td><td>Add farside guides or TCPs</td></tr>
</table>

LANE-MARKING DEVICES

The majority of lane marking in the field is done by using nonstandard marking devices. When adopting a nonstandard marking device, commanders should consider the guidelines summarized in Table 10-2.

Table 10-2. Guidelines for lane-marking devices

Marker	Mounted Forces	Dismounted Forces
Handrail and funnel markers	Visible by TC and driver (buttoned up) from 50 meters	Visible by a dismounted soldier in a prone position from 15 meters
	Quick and easy to emplace, minimizing the need to expose soldiers outside the carrier	Lightweight, quick, and easy to emplace (a dismounted soldier should be able to carry enough markers for the lane and still be able to fire and maneuver)
Entrance and exit markers	Visible by TC buttoned up from 100 meters	Visible by a dismounted soldier from 50 meters
	Visually different from handrail and funnel markers	Visually different from handrail and funnel markers
	Quick and easy to emplace (may require soldiers to dismount to emplace)	Lightweight, quick, and easy to emplace
	Easily man-portable	
Final-approach and far recognition markers	Visible by TC (not buttoned up) from 500 meters	Visible by a dismounted soldier on the march from 100 meters
	Visually different from each other	Visually different from each other
	Visually alterable to facilitate traffic control through multiple lanes	Visually alterable to facilitate traffic control through multiple lanes

Figure 10-25 shows some of the devices that can be utilized for lane marking, and they are easily procured or fabricated. This is not an inclusive listing but is intended to show commanders some of the options.

Some general requirements for lane marking are—

- Markers must be able to withstand the rigors of the terrain, the weather, and the battlefield.
- Markers should be easy to modify, using minimal manpower and equipment, when visibility is limited.
- Lane-marking panels should have thermal and IR reflective marking so that they can be easily identified during limited visibility.
- Enhancements for limited visibility should be a constant source rather than a pulsating strobe. Strobes do not make the marking pattern readily apparent, particularly when approaching from an angle.

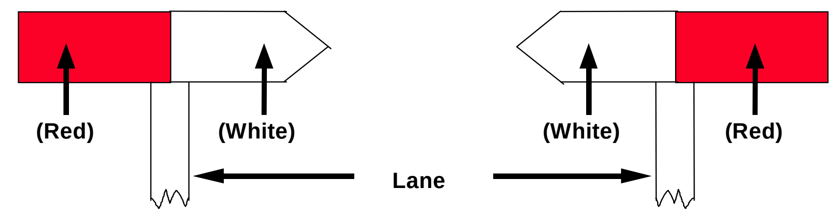
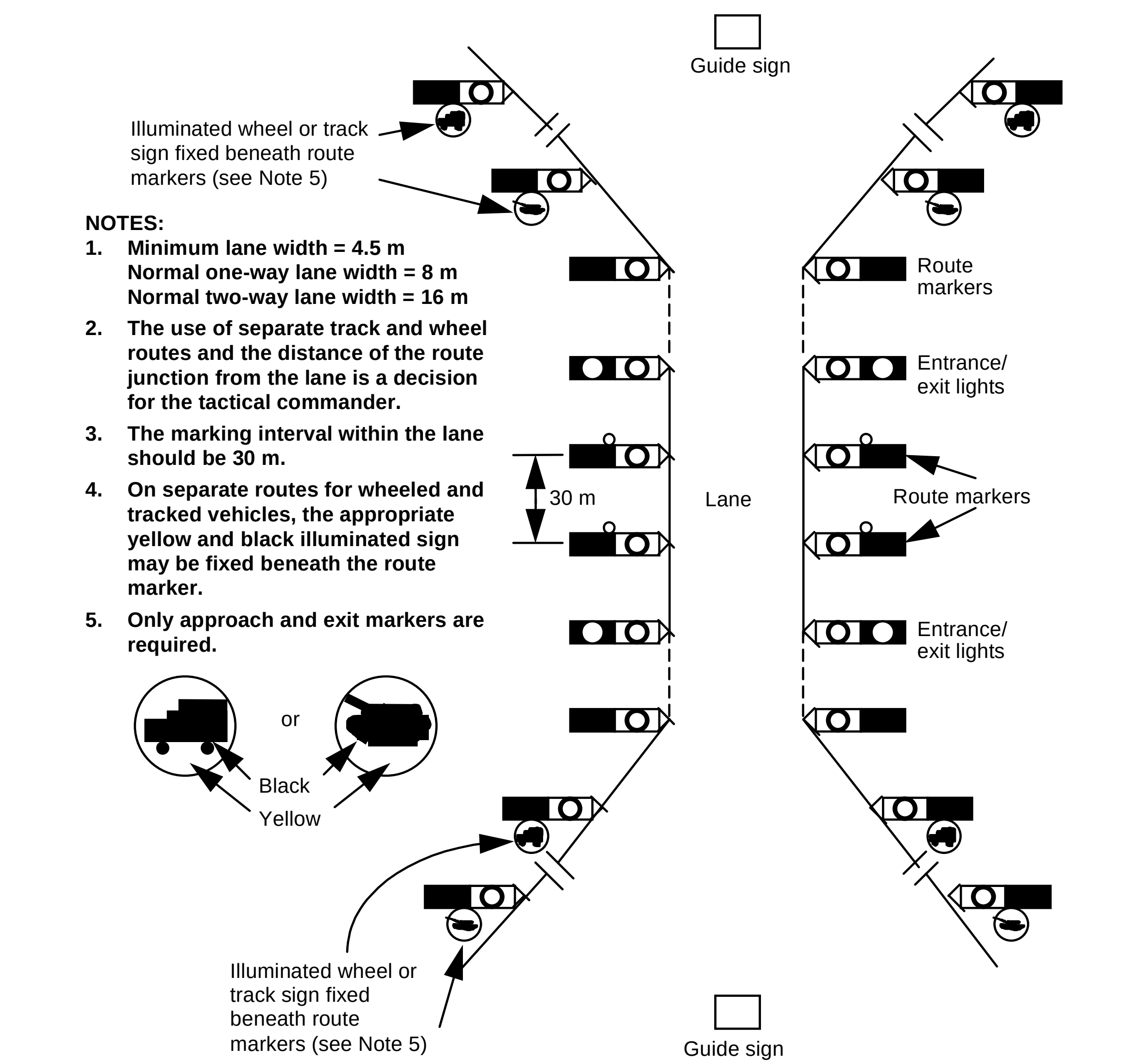


Figure 10-25. NATO standard marker



NOTES:

1. **Minimum lane width = 4.5 m**
   Normal one-way lane width = 8 m
   Normal two-way lane width = 16 m
2. **The use of separate track and wheel routes and the distance of the route junction from the lane is a decision for the tactical commander.**
3. **The marking interval within the lane should be 30 m.**
4. **On separate routes for wheeled and tracked vehicles, the appropriate yellow and black illuminated sign may be fixed beneath the route marker.**
5. **Only approach and exit markers are required.**

Figure 10-26. NATO lane-marking conversion

each left and right handrail marker. When converting full lane marking, the center handrail is marked with a modified NATO marker. The combination of a modified center handrail marker and directional arrows at each lane entrance provides allied forces with the signature necessary to distinguish two separate lanes. In addition, a barbwire or concertina fence (one strand minimum) is laid 1 meter above the ground to connect funnel markers, entrance markers, handrail markers, and exit pickets.

NATO uses white or green lights to illuminate markers at night (Figure 10-28). Entrance and exit markers are marked with two green or white lights placed horizontally, so that the safe and dangerous markings on them are clearly visible. One white or green light is used on funnel and handrail markers. The commander decides whether the light is placed on top of the NATO marker or placed so that it illuminates the markers. Lights must be visible from a minimum of 50 meters under most conditions and have a continuous life of 12 hours.

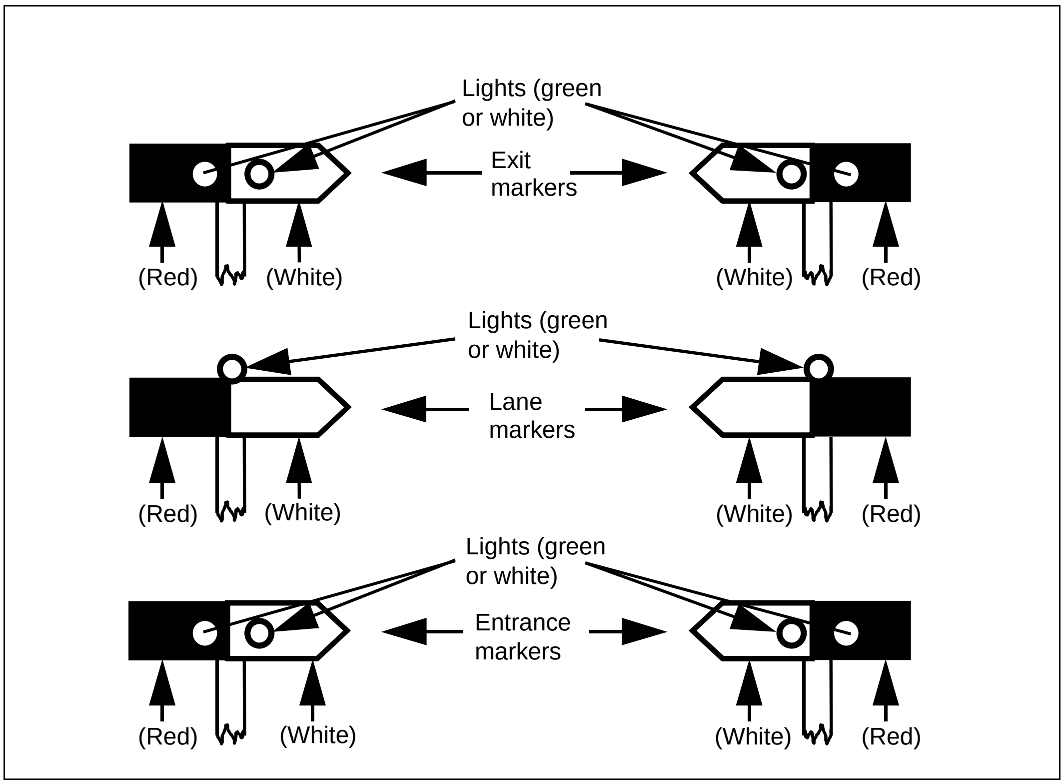


Figure 10-27. NATO standard marking for limited visibility

The mission to convert intermediate or full lane marking to NATO standard is normally assigned to corps-level engineer battalions working in the division rear area. In special cases, divisional engineer battalions may be tasked with NATO marking.

Chapter 11

Route and Area Clearance

The ability to move forces and material to any point in an AO is basic to combat power and often decides the outcome of combat operations. Maneuver relies on the availability of LOC within an AO; and during OOTW, clear LOC is essential to the movement of forces. Units must conduct route and area clearance to ensure that LOC enables safe passage of combat, combat support (CS), and CSS organizations. Clearance operations are best-suited for rear-area and stability support operations.

ROUTE CLEARANCE

Route clearance is a combined arms operation. Units must clear LOC of obstacles and enemy activity that disrupt battlefield circulation.

PLANNING

The principles of breaching operations (Chapter 9) apply to the development and execution of the route-clearance mission. The breaching tenets (intelligence, fundamentals, organization, mass, and synchronization) should be the basis for planning.

Intelligence

Incorporating the IPB and METT-TC factors into route-clearance operations will enable units to predict what the enemy will do and where it will do it. The IPB and the EBA offer ideal methods for establishing a SITEMP. After the S2 and the engineer identify the most probable threat sites, the S2 designates them as NAIs. These NAIs are the focus of the reconnaissance effort. Engineers work in concert with other reconnaissance assets to confirm the presence or absence of ambushes, UXO, and minefields. The information gathered from the IPB and the reconnaissance effort determines the method and the type of route clearance necessary. It also helps the commander determine any outside resources (EOD, SOF) that he may need.

Fundamentals

SOSR may not be executed, but it is planned as it is in breaching operations. Units must be prepared to execute SOSR fundamentals as necessary.

Organization

Task organization for a route clearance is similar to the task organization for a deliberate breach. The clearance company team is organized into breach, support, and assault forces. The breach force conducts clearing operations, the support force isolates the area being cleared, and the assault force performs security functions beyond the clearance site (traffic control points) and assists the breach force in disengagement, as required. Table 11-1 shows a sample task organization for a route clearance.

Table 11-1. Sample task organization for a route clearance

Team	Support Force	Assault Force	Breach Force
Heavy	• Mechanized infantry platoon with dismount capability • Armor platoon	• Mechanized infantry platoon • Engineer squad • Mortar section • Medical team (two ambulances) • PSYOP team • FIST • MP element	• Engineer platoon with organic vehicles • Armor platoon with plows and rollers
Light/Heavy	Two infantry platoons (light)	• Bradley platoon with dismount capability • Engineer squad • 60-mm mortar section • Medical team (two ambulances) • PSYOP team • Forward observer • MP element	• Engineer platoon with organic vehicles • Armor platoon with plows and rollers
Light	Two infantry platoons (light)	• AT/MP section with M60/MK19 mix • 60-mm mortar section • Medical team (two ambulances) • PSYOP team • Forward observer • MP element	• Engineer squad (+) • Infantry platoon (light) • AT/MP section with M60/MK19 mix

Mass

Sufficient maneuver and engineer assets must be allocated to the clearance company team. The length and the width of the route and the type of clearance to be conducted determine the size of the sweep team. Clearing a Class A military road with the deliberate sweep technique requires at least two engineer squads due to the total lane width to be cleared and the requirement for the rotation of mine-detector operators. Depending on the type of sweep operations, the commander can expect a 50 percent loss of sweep assets. Normally, as in breaching, a 50 percent redundancy of engineer assets should be allocated to the sweep team.

Synchronization

All aspects of synchronization should be implemented when planning route clearance. It is especially important that rehearsals be conducted at the combined arms level. Rehearsals should include—

- Reaction to enemy contact.
- Reaction to an ambush.
- Communications exercise.
- Fire support (obscuration smoke, immediate suppression fires, critical friendly zones for counterfire radar, and no-fire area around the clearance site).

- Consider including road repair equipment and material as part of the sweep element (for example, a 5-ton dump truck filled with soil and an ACE to spread the soil).
- Keep all radios, electronic equipment, and aviation assets at a safe distance during reduction operations.
- Block uncleared roads and trails that branch from the route being cleared. This protects units from inadvertently traveling an uncleared route.
- Debrief the chain of command and the TF S2 on the location, the composition, and the orientation of all obstacles cleared and encountered. This assists the S2 and the engineer in IPB/EBA pattern analysis.

Air-Defense Artillery

- Consider the possibility of an air attack.
- Use the following passive air-defense measures:
  - Eliminate glare by using mud, tape, cardboard, or camouflage nets to cover headlights, mirrors, and portions of windshields.
  - Reduce dust clouds by reducing speed.
  - Plan routes that offer natural concealment.
  - Use air guards.
- Increase the distance between vehicles.
- Incorporate Stinger missile teams into the support force.

Combat Service Support

- Ensure that clearance operations are supported by a logistical/combat health support (CHS) package from the brigade support area.
- Plan for air and ground evacuation of casualties. The preferred evacuation method is by air; the routine method is by ground.
  - Conduct an air-mission brief with air ambulance assets, to include pickup zones and markers. Rehearse procedures for evacuation requests.
  - Ensure that the medical team consists of one or two ambulances. Locate the medical team with the support force.
  - Identify the ambulance exchange point along the route to be cleared.
- Ensure that all personnel wear flak vests or IBASIC (Figure 11-1, page 11-6).
- Ensure that all vehicles have tow cables in the front and the rear for extraction purposes.
- Ensure that all vehicles carrying troops have hardening (sandbags on floors and sides).

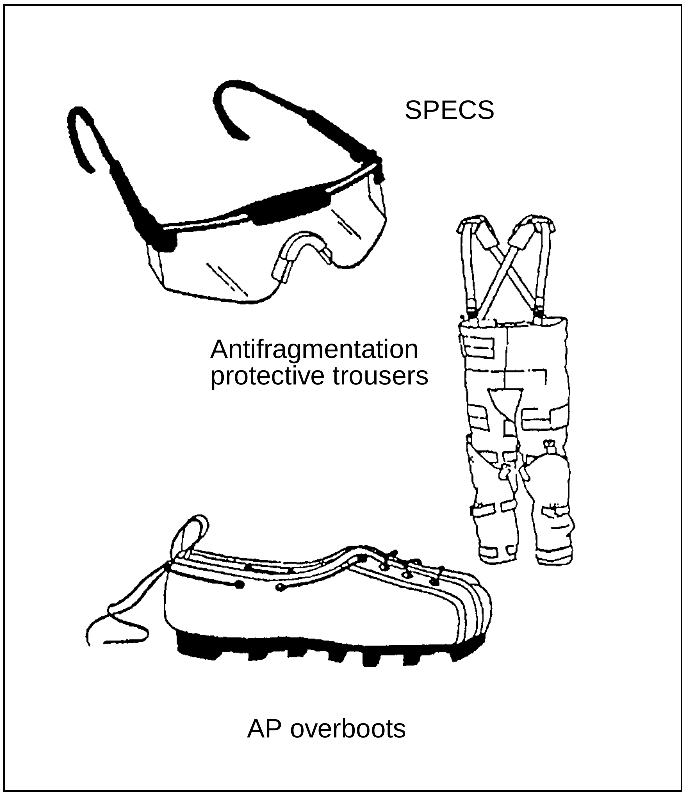


Figure 11-1. IBASIC

- Provide MP and explosive-sniffing dogs to help in clearance and provide security for convoys during and after clearing operations.

Command and Control

NOTE: The company team commander is required to operate on three separate frequencies—battalion command network, company team command network, and fire-support network.

- Designate, recognize, and include minefield indicators (Chapter 10) as part of company team rehearsals.
- Designate a reserve force (at least platoon-size) that is mechanized or air-assault capable.
- Ensure that proper rehearsals are planned and conducted according to FM 3-34.2. As a minimum, the clearance force should rehearse actions on the obstacle, actions on enemy contact, casualty evacuation, and the control of COBs.
- Ensure that the tasked unit has a clear understanding of the mission, intent, and end state. For example, the clearing unit commander should understand that his unit must clear the road width, including the shoulders, and secure the route.
- Assign clearance responsibilities to brigade and battalion assets.
- Ensure that the maneuver commander/TF S3—

Deliberate

A deliberate sweep (Figure 11-7) is very thorough and includes a complete sweep of the entire road (shoulders, culverts, ditches, and bridges). It is the most time-consuming sweep operation and relies on electronic (primary) and visual (secondary) detection systems.

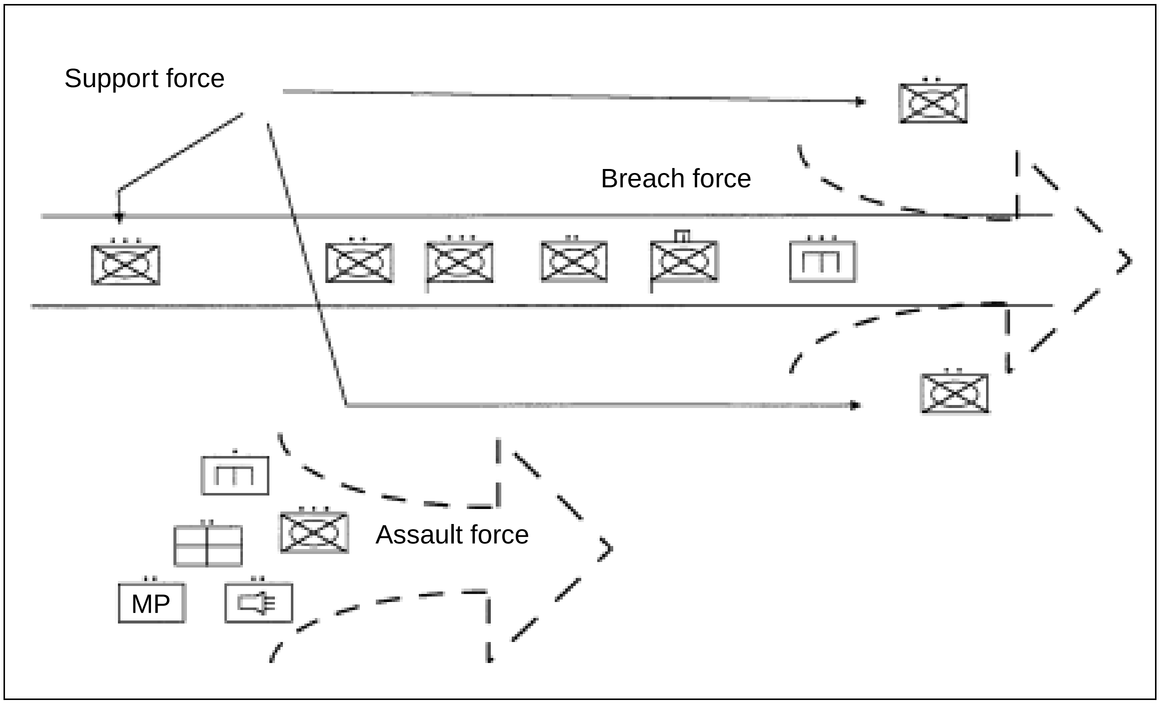


Figure 11-7. Deliberate route clearance

The platoon sweep team (Figure 11-2, page 11-9) is dismounted to focus its attention on the entire length of the route. The support force (company-size) secures at least 100 meters on the flanks and 100 meters forward to clear possible enemy direct-fire systems and overwatching elements in front of the breach force. This not only allows the breach force to focus solely on the route but also clears the area of off-route and command-detonated mines.

If enemy contact is made, the support force fixes the threat while the assault force reacts. The sweep teams withdraw to a location that provides concealment and/or security. Mechanical detection provides a third means of detection and is the method used to proof the route after the sweep team has passed through the area. The deliberate sweep includes a route reconnaissance and looks at all areas of a route, including bypasses. The deliberate sweep focuses on thoroughness rather than speed. This method is very slow and tedious and should only be used when time is not a factor; 80 to 100 meters can be covered per hour.

Hasty

A hasty sweep (Figure 11-8, page 11-14) consists of visual inspection, physical search or probing, and the use of mine detectors. It is the fastest, most risky method and is suited for an armored or mechanized team. It relies primarily upon visual detection (thermal sights or the naked eye) for minefield identification. The breach force looks for mines, wire, and other minefield indicators. The road surface, culverts, ditches, and bridges are inspected and searched. Visual detection is accompanied by a mechanical proofing system. Electronic mine detectors are used by sweep teams to check all suspected areas.

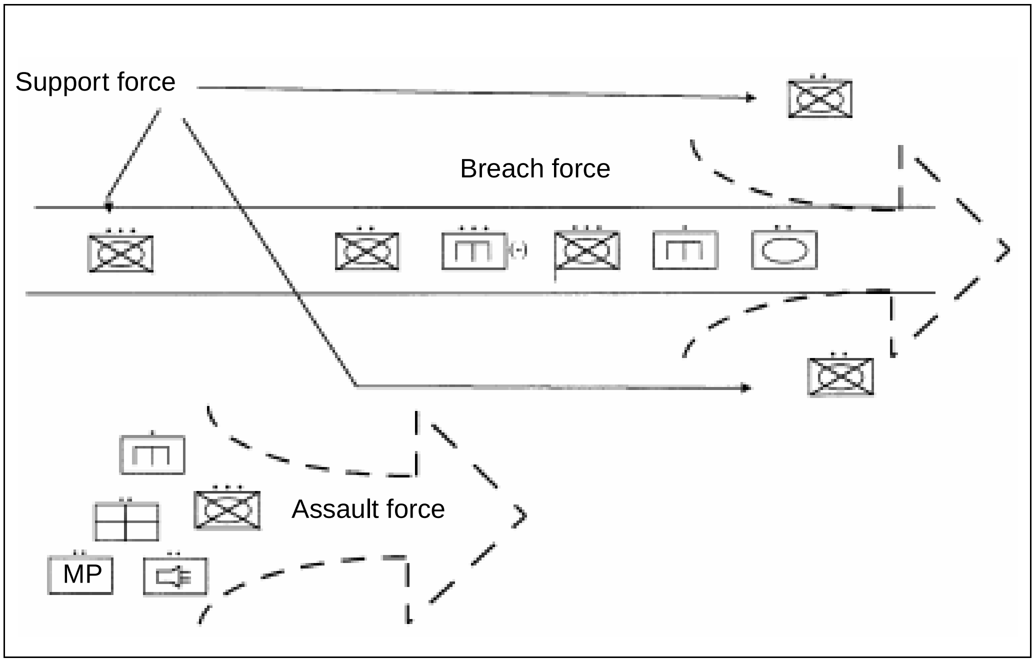


Figure 11-8. Hasty route clearance

The support force includes a maneuver platoon that provides overwatching fire and/or security. Actions upon enemy contact are the same as in a deliberate sweep. The primary objective of this technique is speed, moving approximately 3 to 5 kph. This method is extremely similar to the instride breach method when encountering minefields.

The sweep team focuses on identifying immediate risks to traffic, neutralizing those risks, and continuing on with the mission. A hasty sweep is used during the combat clearance method to validate the areas that were not deliberately cleared by the sweep team. It is also used if the METT-TC analysis does not permit a deliberate sweep or if the need for a road to be opened is urgent. Time and distance factors may be imposed. A light force may not have an MCR system but can conduct the same sweep method with an improvised roller system, or the force can use a sandbagged, 5-ton truck moving backwards as a last-resort method. Using MCRs or their equivalent is absolutely imperative due to the high risk of encountering a minefield. The mine rake or plow is not a satisfactory substitute because it destroys road surfaces.

  - Clear and secure flanks (at least 500 meters) and the farside of the area to be cleared.
  - Provide security for the cleared area.
- Fire support. Ensure that the area-clearance team has a FIST coordinator. The FIST should be collocated with the support force OIC.
- Mobility/survivability. Establish minefield control points along the area to be cleared.
- CSS.
  - Ensure that the medical team consists of one or two ambulances and that it is located with the breach force.
  - Ensure that all personnel wear flak vests or IBASIC (Figure 11-1, page 11-6).
- C2.
  - Determine the area length, using clearly definable perimeter points.
  - Coordinate with adjacent units, the host nation, NGOs, PVOs, and SOF.

TASK ORGANIZATION

The battalion TF will focus a company team (minus) as the main effort to conduct area clearance.

Support Force

This force is comprised of two maneuver platoons and an OIC. The support force provides flank security, forward security, and protection for the breach force. It neutralizes hostile forces that are encountered by the company team. The support force secures the area 500 meters beyond the area to be cleared. METT-TC factors will affect the actual distance based on the threat and the weapon systems. The support force OIC establishes static security positions around the area until the clearance operation is complete. He also has control of fires and the responsibility to neutralize any hostile force.

Breach Force

The breach force is comprised of an engineer platoon that is organized into sweep teams, a medical team, and an EOD team (or one that is on call). The sweep team (squad-size) is organized as shown in Figure 11-3, page 11-9. The breach force's mission is to sweep and clear the area of mine and explosive threats.

METHODS AND TYPES

The breach force OIC determines the perimeter of the area to be cleared and ensures that it is marked. The OIC divides the area into sections to be cleared (Figure 11-9, page 11-18). The sections should be no larger than 40 meters wide and 100 meters long. This is an optimal-sized area for a sweep team to clear at one time. The OIC assigns squad-size sweep teams to each section.

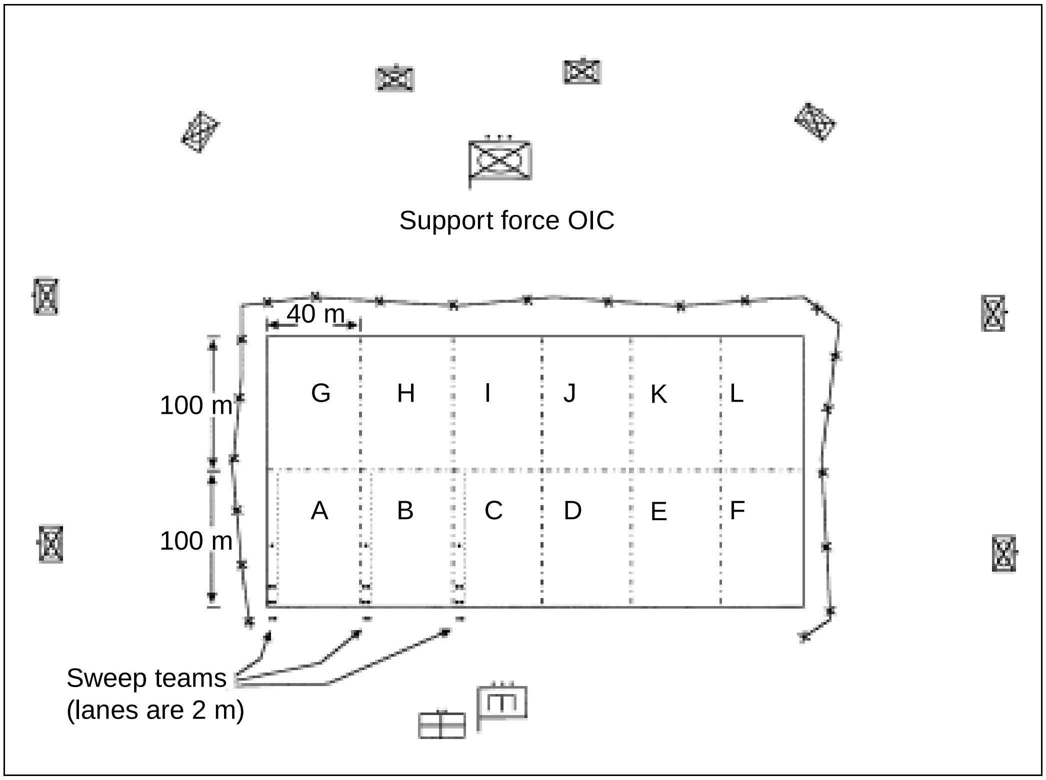


Figure 11-9. Area clearance site layout

The squads clear their assigned sections using the sweeping techniques discussed earlier in this chapter. As the sections are cleared, they are marked for safety and control purposes. This process is continued until the entire area is cleared. Progress is reported to the company team commander as required.

IMPROVISED MINE THREAT

Mines are not always employed conventionally by military forces organic to the host nation or its enemies. In many cases, they are also employed by terrorists against allied forces or the host-nation populace. In these cases, the threat increases because of the improvised methods in which the mines were emplaced. In conventional emplacement of mines, a pattern emerges from the emplacing force's doctrine, and the threat can easily be reduced by using this knowledge. There is less pattern in the case of improvised mining methods, and this makes detection and removal very difficult.

Improvised mining has many different employment techniques. In most of the techniques shown below, a UXO can easily be employed in place of a mine:

- Coupling mines. Coupling is done by linking one mine to another, usually with detonating cord. When the initial mine is detonated, it detonates the linked mine. This technique is done to defeat countermine equipment.

PART THREE

Special Mining Operations

Part three provides tactical and technical information on special-mining operations, such as using booby traps and expedient devices. It also discusses mining in rivers, urban terrain, and unique environments. Restrictions and responsibilities are outlined in detail for the employment and the clearance of special mines and devices.

Chapter 12

Mining Operations in Special Environments

Mines are emplaced and encountered in all environments, some of which need special consideration to understand effective employment, detection, and/or removal.

STREAMBED AND RIVER MINING

EMPLOYMENT

Conventional AT mines are much more effective in water than on land because water transmits the shock effect better than air. Vehicle support members, tracks, and wheels are damaged by a mine blast. Small vehicles are overturned and almost completely destroyed. Because water amplifies and transmits shock waves, mines equipped with pressure-actuated fuses are subject to sympathetic detonation at greater distances in water than on land.

M15 and M19 AT mines can be used for streambed and river mining. The M21 AT mine should not be used because it is very difficult to arm and disarm underwater, and it can be easily functioned by drifting debris. To avoid sympathetic detonation, AT mines must be at least 14 meters apart in water that is less than 61 centimeters deep, and at least 25 meters apart in water that is deeper than 61 centimeters. The mined areas are chosen to take advantage of stream and adjacent area characteristics. Water depth within the minefield should not exceed 1 meter because it is difficult to work in deeper water, and pressure-actuated fuses are usually ineffective against waterborne vehicles.

Current velocity must be considered when emplacing mines in a streambed or a river. If the mines are placed deeper than 45 centimeters, they must be recovered by engineer divers:

- A lightweight diver has diving restrictions based on current velocity.
- A scuba diver is restricted to a maximum current velocity of 0.5 meter per second.

- A surface-supplied diver is restricted to a maximum current velocity of 1.3 meters per second.

Seasonal current velocity should also be considered if the minefield is to be in place for an extended period of time. Additional information on diving restrictions can be found in FMs 20-11 and 5-490.

Since sand in inland waters continuously moves downstream, it may be difficult to locate and remove mines planted on sandbars or downstream from sandbars. If the site has a muddy bottom, the mud should not be deeper than 46 centimeters and there must be a hard base underneath it. The enemy is unlikely to choose a fording point where vehicles mire easily. If underwater obstacles (gravel, rock, stumps) are bigger than the mine, the area cannot be easily mined. If such areas must be used, place the mines so that they are exposed to vehicle wheels or tracks. Armored vehicles usually enter and exit streams at points where the incline is less than 45 percent. After entering a stream, vehicles often travel upstream or downstream before exiting. Carefully examine riverbank formations and underwater obstacles to predict the trail a vehicle will use to ford the stream.

EMPLACEMENT

When emplacing mines in streams and rivers, always work in pairs. Prepare the mine on land near the emplacement site. Coat fuse threads and wells with silicone grease (a waterproof lubricant) or a heavy grease to minimize the chances of water leaking into the mine. Waterproof joints between the pressure plate and the mine case with silicone grease. As a rule of thumb, waterproofed mines are reliable up to 3 months when immersed without waterproof coverings. Secure the mine with outriggers to prevent drifting:

- Construct field-improvised outriggers with—
  - — Two green limbs that are about 3 centimeters in diameter and 1 meter long. Green limbs are recommended because they are stronger and less likely to float than those which are dried out and dead. (Steel pickets, sign posts, fence rails, or similar items having the proper dimensions may also be used.)
  - — Two pieces of clothesline, manila line, or similar material that are about 1 meter long.
- Fasten the limbs to the underside of the mine and secure them with the line (Figure 12-1).
- Approach the emplacement position from the downstream side. To prevent dragging the outrigger or contacting objects in the stream, carry the mine by grasping its sides, not by its carrying handle.
- Place the mine and the outrigger on the stream bottom. Stake down outriggers after they are emplaced to prevent drifting. If staking is impossible, place sandbags or large rocks on the outriggers for better anchorage.
- Arm the fuse.

Street Obstacles

Hand-emplaced AP mines can be emplaced on street surfaces, on railroad lines, and in areas along shallow waterways. (See Figure 12-6.)

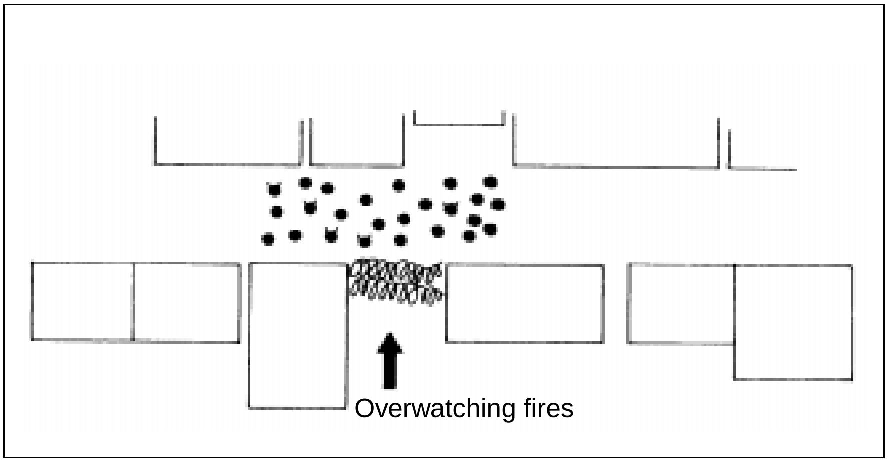


Figure 12-6. Street obstacles

Roof Obstacles

Mines and booby traps supplement wire obstacles to deny operations that require air assault onto rooftops. They also prevent occupation on roofs that afford good observation points and fields of fire. (See Figure 12-7.)

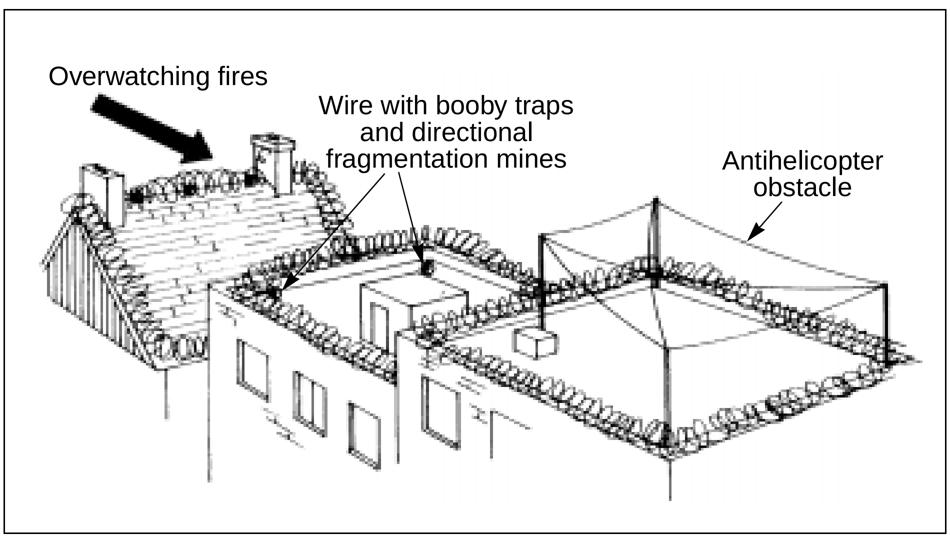


Figure 12-7. Roof obstacles

Building Obstacles

Building obstacles include areas within and adjacent to buildings. Forces can lay mines in conjunction with wire obstacles to deny infantry access to covered routes and weapon positions (Figure 12-8).

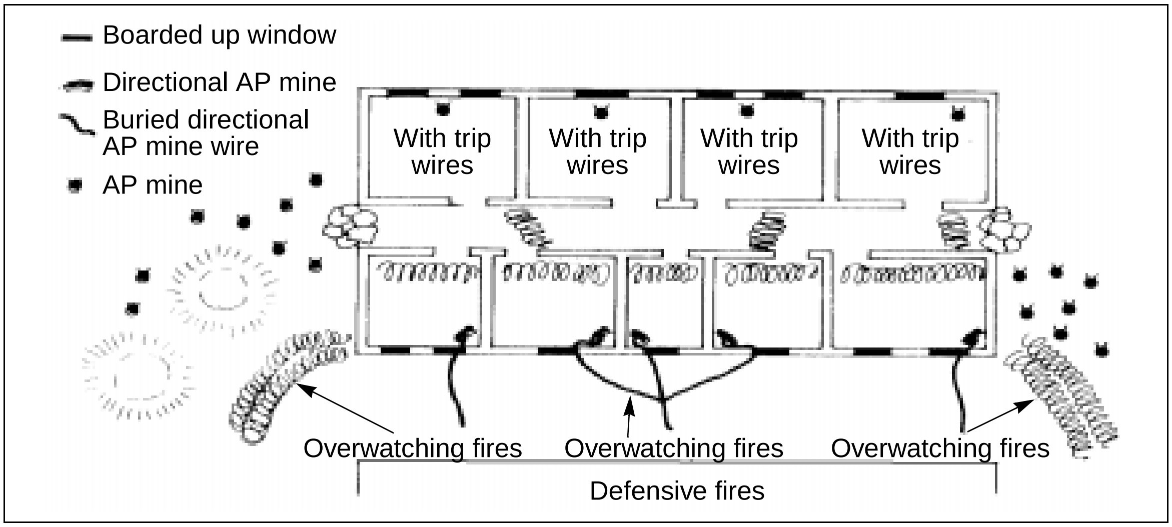


Figure 12-8. Building obstacles

Dead Spaces

Obstacles and mines can be emplaced to restrict infantry movement in areas that cannot be observed and in areas that are protected from direct fire.

Employment

The following AP mines are effective in urban terrain:

- **M14 (used by US forces in Korea only). Its small size makes it ideal for obscure places, such as stairs and cellars. It can be used in conjunction with metallic AP and AT mines to confuse and hinder breaching attempts. (See Figure 12-9.)**
- **M16 (used by US forces in Korea only). With trip-wire actuation, its lethal radius covers large areas such as rooftops, backyards, and cellars. An added advantage can be gained by attaching twine or wire to the release-pin ring to expediently rig the mine for command detonation. (See Figure 12-10.)**
- M18A1 (claymore). Numerous innovative applications of claymore munition deployment can be found for defensive warfare in urban areas (Figure 12-11, page 12-12). With remote firing, a series of claymore mines along a street establishes a highly effective ambush zone. Mines can also be employed on the sides of buildings, in abandoned vehicles, or in any other sturdy structure. Numerous opportunities exist for effectively sited, well-concealed mine employment above the terrain surface. Claymore munitions can be used to fill the dead space in the FPF of automatic weapons. They present a hazard when used in confined, built-up areas. Exercise caution when using them close to friendly forces because there is a danger of backblast.

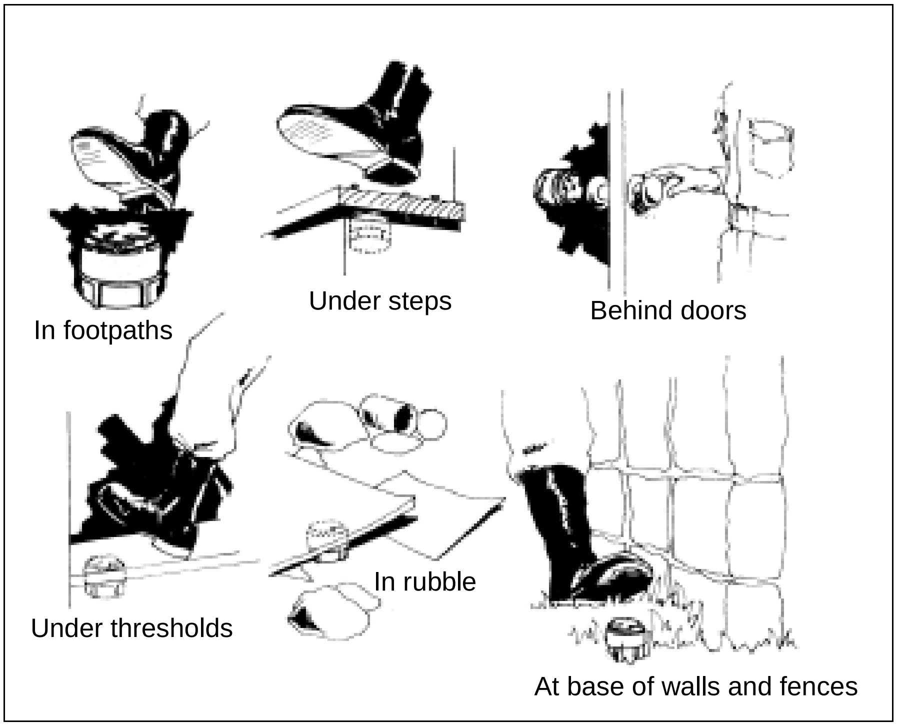


Figure 12-9. Probable M14 AP mine emplacement

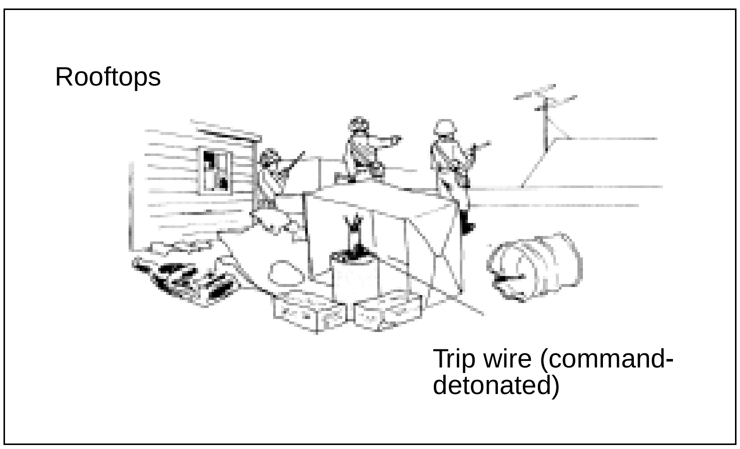


Figure 12-10. Probable M16 AP mine emplacement

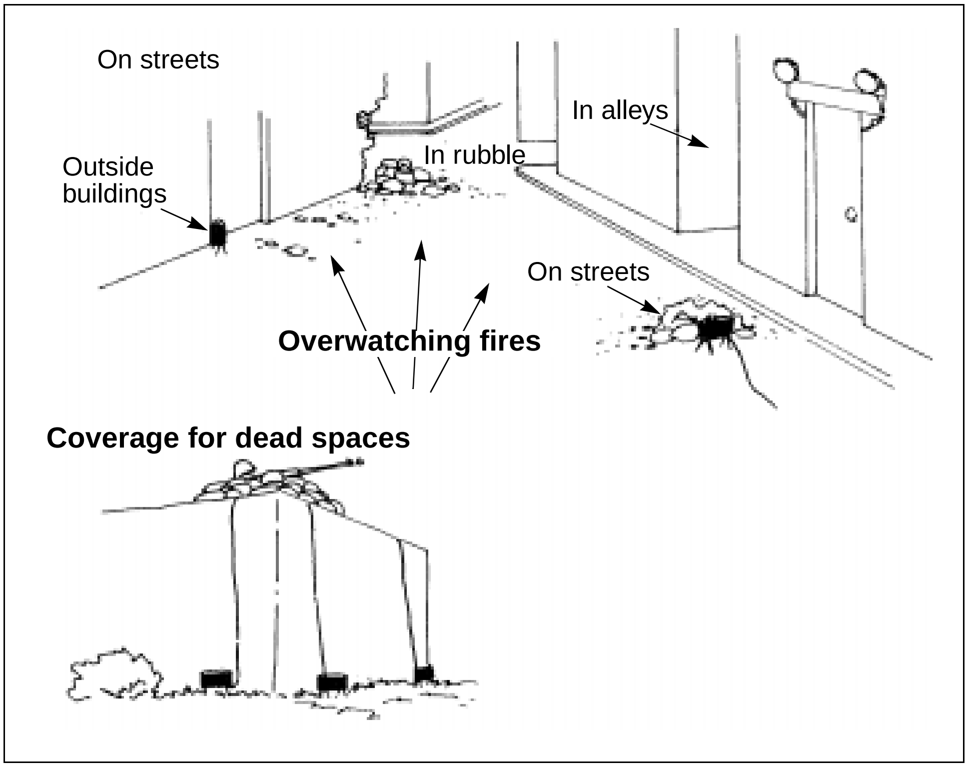


Figure 12-11. Probable M18A1 munition emplacement

CONVENTIONAL ANTITANK MINES

Enemy tanks, infantry fighting vehicles (IFVs), and direct-fire support weapons are restricted to streets, railroad lines, and, in some instances, waterways. (See Figure 12-12.) M15, M19, and M21 mines are used primarily in tactical and nuisance minefields; but they are occasionally used in protective minefields. They should be employed with other obstacles and covered by fire. Conventional AT mines emplaced in streets or alleys block routes of advance in narrow defiles. Concealment of large AT mines is accomplished by placing them in and around rubble and other obstacles. Extensive labor requirements generally prohibit burying mines in difficult terrain types.

In dispersed residential areas, obstacles are required to reduce the enemy's infantry mobility through and between houses and in open areas. They also prevent armored vehicles from moving between houses and along streets. AT minefield patterns should extend outward from the streets, incorporating open areas between buildings and streets to prevent easy bypass of street obstacles.

Significant labor and mine materials are required to deploy conventional mines between widely spaced buildings, in high-rise construction, and in industrial and transportation areas. Therefore, SCATMINEs should be seriously considered as viable alternatives. Some situations, such as the one shown in Figure 12-13, provide opportunities for the effective employment of mines in tactical and nuisance minefields.

Air Volcano

The primary advantage of the air Volcano system is its capability to site and emplace minefields accurately. This depends on the helicopter's maneuverability over the selected minefield terrain and the proper coordination between ground forces and aviation support. Disadvantages include vulnerability and the high replacement cost of the helicopter. However, in view of the system's operational concept, employment in urban terrain (which provides little exposure of the helicopter) actually increases the practicality of employing this system in urban areas. Mine survival rate on impact with a hard surface is another potential problem.

Ground Volcano

Three aspects of the ground Volcano distinguish it from other SCATMINE systems:

- The dispenser is organic to supporting combat engineers, making it readily available to support the maneuver commander's defensive plan.
- Delivery siting is accurately pinpointed to the ground.
- Better opportunities exist to record the presence of a minefield. In contrast to artillery-delivered and air Volcano systems, the ground Volcano is delivered by engineers who are normally located with and report directly to the maneuver commander.

Some primary factors may degrade ground Volcano deployment in urban terrain. The requirement to emplace minefields before an actual attack in order to reduce system vulnerability is the most significant factor. This makes the minefield detectable and provides more reaction time for the enemy to alter their scheme of maneuver. The delivery of mines depends on terrain trafficability. The prime mover and the launch vehicle must negotiate the terrain over which mines are to be dispensed.

Modular Pack Mine System

The MOPMS is ideally suited for employment in urban terrain (Figure 12-15, page 12-16). The module can be hidden from enemy view, and the mines can be dispensed after attackers are committed to a route of advance. Additionally, mines can be emplaced rapidly under enemy fire. In contrast to other SCATMINE systems, the commander controls when and where mines are dispensed and how they are detonated, regardless of the enemy situation.

Gator

When considered for employment in urban terrain, Gators encompass the same problems as artillery-delivered and air Volcano mine systems.

DECEPTION MEASURES

Phony minefields can be established rapidly with negligible effort and cost. They have the distinct advantage of blocking the enemy but not friendly forces. Although it is difficult to fake a surface-laid minefield, expedients such as soup pans, seat cushions, and cardboard boxes have historically proven effective in delaying and channelizing attacking forces. These objects, as well

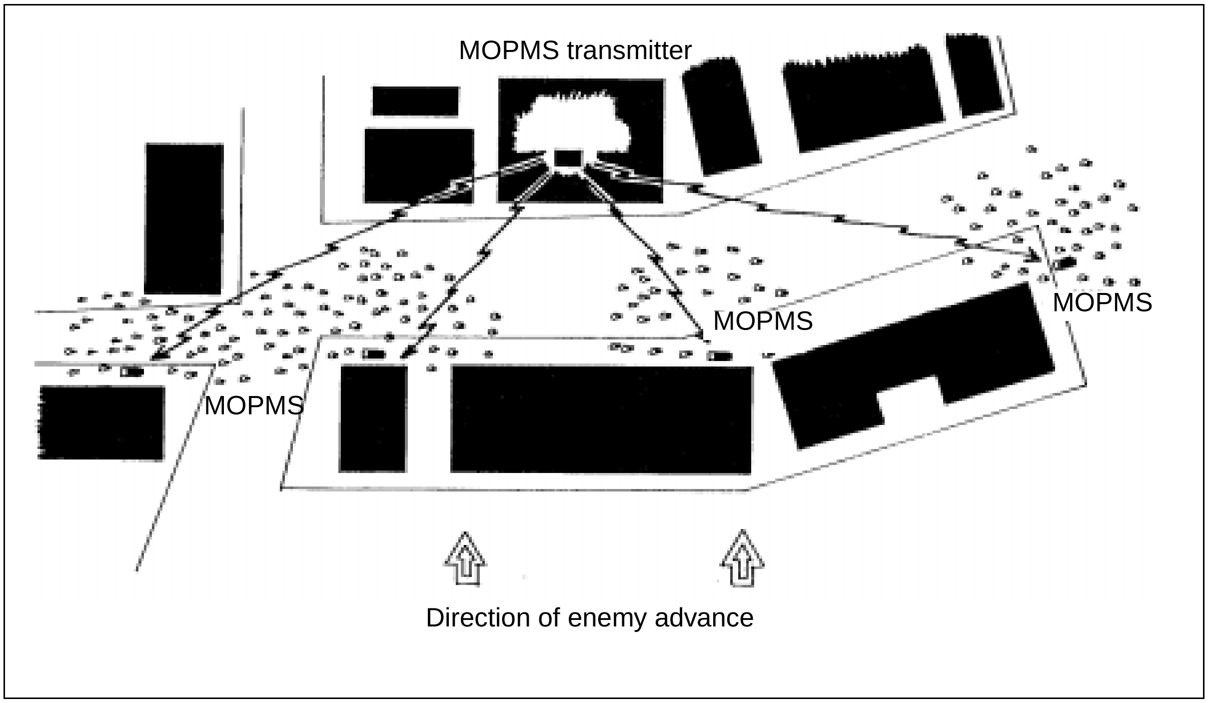


Figure 12-15. MOPMS employment

as other ones readily available in urban areas, can be used as phony minefields or used to cover real mines. A more realistic phony minefield could be created with inert or training mines.

Inadequate minefield camouflage in urban terrain is viewed as a critical constraint in deploying conventional mines and SCATMINEs. Smoke can be deployed from various dispensers, but it must be dense and accurately employed and released.

SPECIAL ENVIRONMENTS

COLD REGIONS

Mine employment in cold regions poses special problems—the principal one being emplacement. Mine burial is extremely difficult in frozen ground. The freezing water in soil causes it to have high strength and penetration resistance, so digging times are greatly increased if not impractical. However, there are several means to overcome this problem. In some cases, the minefield can be laid out before the soil freezes. To do this, dig holes for each individual mine and insert a plug into the hole to protect its shape and prevent it from being filled in. A wide variety of material can be used for plugs. Ideally, the plug should be economical, easy to remove, and rigid enough to maintain the depth and shape of the hole. Sandbags, plastic bags filled with sand or sawdust, or logs make excellent plugs. If the minefield cannot be prechambered, mechanical means can be used to dig holes. When available, civilian construction equipment (particularly large earth augers) can be used to drill holes for mine emplacement.

Chapter 13

Booby Traps and Expedient Devices

During war and OOTW, booby traps can be found anywhere at anytime. They can kill or incapacitate their unsuspecting victims. This chapter provides information on booby-trap employment concepts, detection techniques, marking and recording procedures, and removal guidelines.

This chapter also provides an overview of expedient devices and their employment considerations.

SECTION I. SETTING BOOBY TRAPS

US policy restricts the use of booby traps by US personnel. This does not preclude their use by other countries, so US forces may encounter them during operations.

The use of booby traps is limited only by the imagination of the force employing them. They—

- Are usually explosive in nature.
- Are actuated when an unsuspecting person disturbs an apparently harmless object or performs a presumably safe act.
- Are designed to kill or incapacitate.
- Cause unexpected, random casualties and damage.
- Create an attitude of uncertainty and suspicion in the enemy's mind, thereby, lowering his morale and inducing a degree of caution that restricts or slows his movement.

Many booby traps are constructed using military equipment and ammunition. Improvised traps are used during counterinsurgency missions in low-intensity conflicts.

The corps commander is the employment authority for booby traps. He can delegate this authority to the division commander. If authority is given to set booby traps, US personnel will adhere to the rules for international law applicable to armed conflict. There are several uses of booby traps that are prohibited. Remember, these restrictions are not observed by all countries; US personnel must still be cautious when approaching objects in areas where booby traps are supposedly prohibited.

International law prohibits the use of booby traps as follows:

- Booby traps and other devices are prohibited if they are attached to or associated with—

- — Internationally recognized protective emblems, signs, or signals.
- — Sick, wounded, or dead personnel.
- — Burial or cremation sites or graves.
- — Medical facilities, equipment, or supplies.
- — Children's toys or other portable objects or products that are designed for their feeding, health, hygiene, clothing, or education.
- — Food or drink.
- — Kitchen utensils or appliances except in military establishments, military locations, or supply depots.
- — Objects that are clearly religious in nature.
- — Historic monuments, works of art, or places of worship.
- — Animals or their carcasses.

- Booby traps are prohibited in cities, villages, and other areas that contain civilians if combat between ground forces is not taking place or does not appear to be imminent, unless—
  - — Booby traps are placed on or in the close vicinity of a military objective.
  - — Measures (guards, warning, or fences) are taken to protect civilians from booby-trap effects.

TACTICS

Booby traps are psychological weapons. They make the enemy cautious and slow it down. These actions, in turn, cause enemy casualties. Do not waste time attempting to set elaborate traps that are undetectable or impossible to disarm. Also, do not waste time developing difficult sites, because simple traps usually have the same chance of catching the enemy. Even if booby traps are detected and cleared, their aim is achieved.

The principles governing the use of booby traps and nuisance mines are identical, so consider using them in conjunction with one another. They have characteristics that make them suitable for use in different situations:

- Nuisance mines are quicker to lay and safer to use than booby traps, and they are normally used in outside locations where they can be buried.
- Booby traps are normally used in urban areas, structures, and places where mines are easily detected.

Booby traps and nuisance mines are particularly suited for defensive operations. They are used to—

- Slow the enemy's advance.
- Deny the enemy use of facilities and material.
- Warn of enemy approach.

- Deter the enemy from using ground not covered by direct fire.
- Plan defensive operations.

In offensive operations, booby traps and nuisance mines are employed on an opportunity basis during raids and patrols. Formal instruction is not usually issued by the staff.

Exercise caution when using bobby traps in offensive operations because they may hinder the operation. In advance and pursuit operations, they are primarily used by patrols and raiding parties. They slow down enemy follow-up actions and hinder the enemy's repair and maintenance teams after raids.

The following considerations pertain to defensive operations but may be relevant to offensive operations and must be considered when briefing troops:

- Booby trapping is rarely given a high priority and is usually peripheral to other engineer tasks.
- Nuisance mines are more cost-effective than booby traps, unless booby traps are used in situations that allow their full potential to be exploited. If it is easier, use nuisance mines instead of booby traps.

To maximize the effect of booby traps and nuisance mines, the staff provides engineer commanders with the following information:

- Purpose. Booby traps are time-consuming and dangerous to set. Do not waste time and effort setting traps that are unlikely to be actuated or that are not specifically designed to achieve the required aim. For example, if booby traps are being used against troops, small, simple traps designed to incapacitate will achieve this result just as well as complicated ones with large charges. If the aim is to destroy vehicles, use mines.
- Location. The precise location for booby traps and nuisance mines can only be determined by the setting unit. Areas must be delineated and recorded so that there is no threat to friendly forces in the event of reoccupation.
- Time setting starts and time available for setting. The time setting starts affects other engineer tasks, and the length of time available for setting governs the number of men required.
- Number of safe routes required. Safe routes are important during general withdrawals where authority has been given to booby-trap positions as they are evacuated. They also provide safe areas for the covering force to launch counterattacks.
- Likelihood of reoccupation. Even if the enemy has not detonated booby traps, they might have interfered with them. Therefore, do not set booby traps when areas are to be vacated to meet short-term tactical requirements or when reoccupation is expected soon.

Intelligence personnel provide information to assist the setting unit in maximizing the effect of booby traps. The nature and the type of traps required depend on the enemy unit. For example, while paying particular attention to dead space and defilade positions, use mines or widely dispersed traps (with large charges) against a mechanized enemy. Conversely, use small traps and AP mines (in places that afford cover) against an infantry enemy.

SITING

If the first obstacle or installation the enemy strikes is booby-trapped or nuisance-mined, he is delayed while he clears it. The enemy is further delayed by an increased degree of caution. His troops know that additional traps and mines can be encountered. Booby traps and nuisance mines are generally located—

- In and around buildings, installations, and field defenses.
- In and around road craters or any obstacle that must be cleared.
- In natural, covered resting places along routes.
- In likely assembly areas.
- In the vicinity of stocks of fuel, supplies, or materials.
- At focal points and bottlenecks in the road or rail systems (particularly the ones that cannot be bypassed).

The setting-party commander is responsible for the detailed siting and design of booby traps. Consider all the information about the enemy soldier and his operating procedures when selecting places and objects to trap. Also, consider the traps from the enemy's point of view and assess the courses open to the enemy when he encounters them. This can expose weaknesses in your initial plan and bring about changes to the proposed layout, or it can result in a different location being selected. In addition, determine the effort required by the enemy to bypass the traps. This shows whether the imposed delay justifies the effort required to set the booby traps in the selected location.

TYPES OF TRAPS

Booby traps are designed to—

- Be actuated by persons carrying out their normal duties.
- Take advantage of human nature.

The following booby traps can often be detected because they are designed to make the person do something:

- Bait. Usually consists of objects that arouse someone's interest, such as attractive or interesting items that have apparently been left behind or discarded during a rapid evacuation.
- Decoy. The most common decoy consists of two traps—one designed to be detected, the other designed to actuate when personnel deal with the first one. The first trap can be a dummy. A classic form of a decoy is to place booby traps or nuisance mines in locations from which the decoy mine can be removed.
- Bluff. A bluff is a hoax and usually consists of a dummy trap.

- Double bluff. A double bluff only appears to be a bluff. Personnel believe the trap is safe or can be disarmed. For example, a number of traps can be set that are disarmed when the detonating cord is removed from the charge. The double bluff is achieved by setting another trap that appears to be the same, but it actually explodes when the detonating cord is removed from the charge. Double bluffs rely on a reduced awareness and alertness caused by repetition.

COMPONENTS AND PRINCIPLES

There are two initiation methods for explosive booby traps—electric and nonelectric. Both methods can be constructed using many different types of FDs. FDs can be secured to the charge (direct connection) or located away from it (remote connection). They are actuated by one or more methods. It is impossible to describe every type of trap that may be encountered; however, most are constructed and operated by using components similar to those listed below:

- FD.
- Power source (battery, for example).
- Connection (usually detonating cord or electric wires).
- Blasting cap.
- Main charge.

Figure 13-1, page 13-6, shows how typical electric and nonelectric traps can be made.

ACTUATION METHODS

Many sophisticated booby-trap devices are now being manufactured that operate on vibration, sound, temperature change, and other methods. Current intelligence on the booby trap being used in the AO should be gathered so that countermeasures can be developed and practiced. Most FDs found in the combat zone are simple mechanisms designed to be actuated by pull, pressure, pressure release, or tension release (Figure 13-2, page 13-7).

METHODS OF CONNECTION

Procedures can be varied when it is safe to do so. For example, instead of connecting the FD to a charge already in position, preconnect trap components and then position the trap.

Small charges (up to 1 kilogram) are sufficient for AP traps, but larger quantities can be used to increase their effect. Shrapnel can be produced by packing stones, scrap metal, nails, or other material around the charge. AT traps require large charges (up to 6.75 kilograms for wheeled vehicles and 11.25 kilograms or more for tracked vehicles).

REMOTE

Follow the procedures listed below when assembling a remotely connected trap using an M142 FD (similar to the illustration in Figure 13-3, page 13-7):

- Design the trap and collect necessary materials.

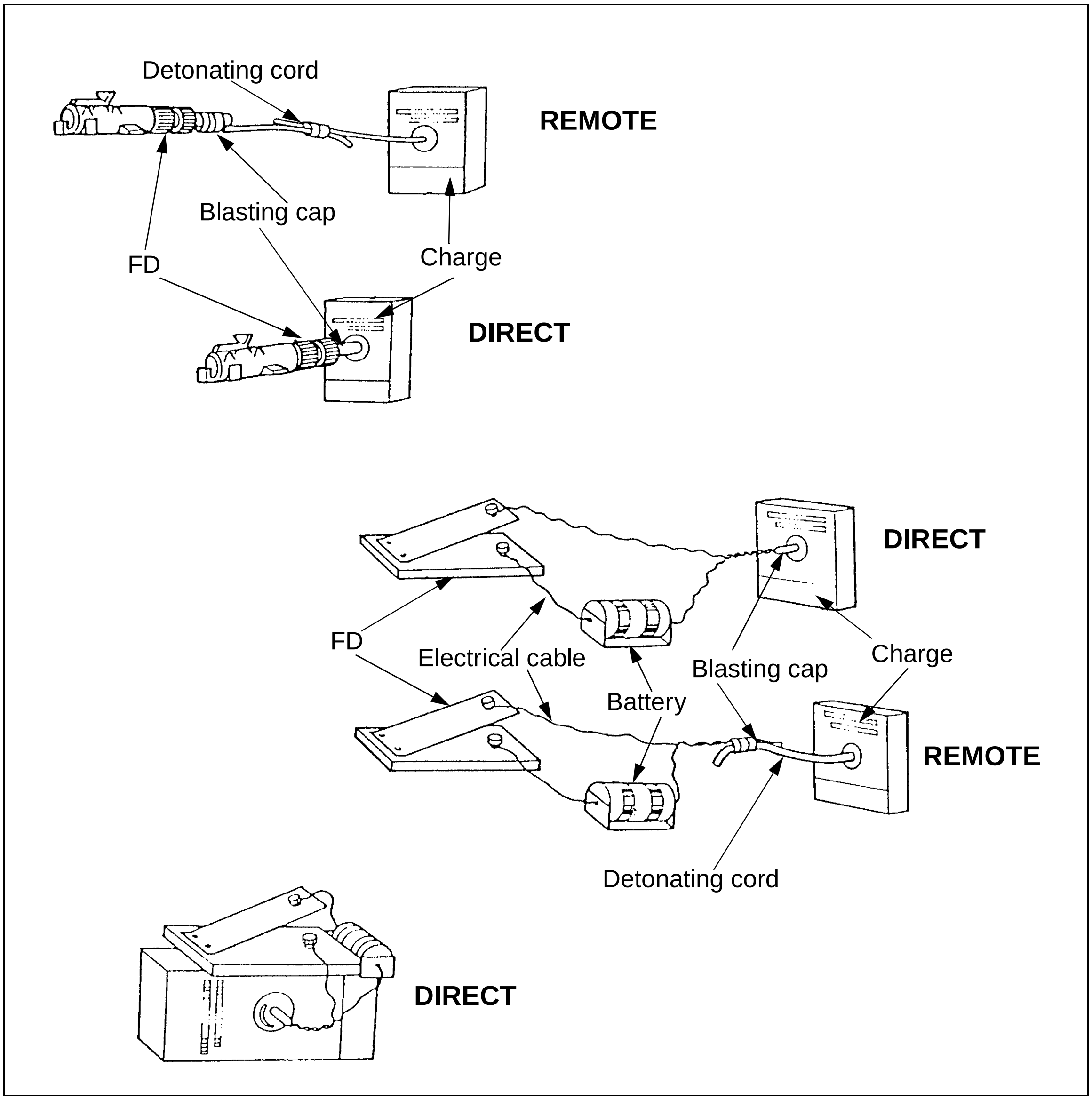


Figure 13-1. Typical electric and nonelectric booby traps

- Test the M142 FD.
- Lay the detonating cord from the charge location to the FD location.
- Position the charge.
- Connect the detonating cord to the charge.
- Prepare the coupler.
- Tape a length (46 centimeters, minimum) of detonating cord to the coupler's blasting end.
- Prepare and position the M142, set it to operate in the desired manner, and remove the round- or square-headed pin.

- 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.

INDICATIONS

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, like mine sense, 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. 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.

DETECTION

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. You have to rely on manual search techniques and, if available, special equipment.

CLEARING METHODS

The method used to neutralize or disarm a trap depends on many things, including time constraints, personnel assets, and the type of trap. Remember, a trap cannot be considered safe until the blasting cap or the detonating cord has been removed from the charge. This is your first objective and is particularly important for electric traps, which may contain a collapsing circuit.

Use the safest method to neutralize a trap. For example, if the FD and the detonating cord are accessible, it is usually safer to cut the detonating cord. This method does not actuate the trap, but inserting pins in the FD might.

COMBAT CLEARANCE

Clearing booby traps and nuisance mines in AOs is done primarily by engineers. Therefore, engineer advice is important during the planning stages of any operation where booby traps are likely to be encountered. Intelligence regarding the possible presence and types of traps must be provided to engineer units as soon as possible. This allows the unit to take necessary action and provide relevant training. Clearance of booby traps cannot be undertaken as a secondary task, because engineer clearing teams might require protection that necessitates combined arms training. Before engineer planning can start, the staff provides commanders with the latest intelligence information and, if possible, the following information:

- Amount of clearance required.
- Acceptable damage.
- Time requirements.
- Availability of special equipment.
- Security requirements.

Intelligence information regarding the nature, type, and location of traps has a direct bearing on the number of clearing parties necessary and the degree of protection required. For example, in built-up areas where traps have to be cleared in buildings that offer protection from enemy fire, direct protection is usually provided by the normal combat situation. On the other hand, in open areas where clearing parties may be required to clear traps covered by direct enemy fire, protection arrangements must be more specific.

Engineer commanders must be aware of the time needed to clear various types of traps in differing terrain situations. Remember, increasing the number of clearance parties may not necessarily reduce the time required to clear traps. This is particularly true when traps are set close together or set deep along a narrow front that is the only available route.

Initially, clear areas of immediate tactical importance and traps that present a specific threat. For example, clear only the portion of a building required for observation and those traps presenting an immediate hazard. This enables clearing parties to concentrate on other areas of tactical importance.

Clearing traps by hand is the only way that damage can be avoided and security guaranteed. When it is vital to avoid equipment or structure damage, consider using available EOD assets. It is often necessary to balance the requirement to remain silent and avoid damage with the requirement to maintain momentum.

When traps are being cleared in direct-support combat situations, they are normally dealt with by using unit resources and locally manufactured or acquired aids. Specified equipment is rarely available. Equipment varies with the situation but usually consists of selected items from Table 13-2. In areas with a high incidence of booby traps, assemble and reserve special clearing kits.

CLEARING INSTALLATIONS AND FACILITIES

Clearing by hand is necessary in installations and facilities (fuel dumps, ammunition dumps, electric substations) where an explosion could result in the loss of resources. In other situations, the item's importance or the resulting damage might not be obvious. For example, a small charge placed against the control valves of a dam or against the main cable entering a telephone exchange results in unforeseen damage that can take days to repair. Therefore, you should seek a specialist's advice, if possible, when clearing booby traps in industrial areas and unfamiliar locations.

CLEARING OBSTACLES

If an enemy has time to create obstacles, he also has time to set booby traps and lay nuisance mines. The obstacle itself is usually clear of traps to encourage a false sense of security and lead troops into more dangerous areas. Therefore, regard all obstacles as booby-trapped until proven otherwise. The simplest, safest way to deal with movable obstacles is to pull them. Before an obstacle can be pulled, you must first clear the area from which the pull will be made.

CLEARING SECURE AREAS

When clearing secure areas and time is not a major factor, use specialized clearance equipment as much as possible. The following equipment might be available for use:

- Cameras. Cameras have a wide range of applications. They can be used with different types of film, such as infrared and ultraviolet, to disclose evidence that is indiscernible to the naked eye. For example, infrared photography reveals differences in the heat emitted by objects and can often disclose recent digging and buried or concealed objects.
- Explosive detector dogs (EDDs). Although EDDs can detect minute quantities of explosives and the presence of trip wires, they are trained to detect the charge and not the FD. This extremely limits their usefulness in detecting booby traps. They also tend to become confused if the area contains explosive odors other than those emitting from booby traps.
- Electronic countermeasures. Electronic countermeasures can be used to explode electric booby traps and to prevent remotely controlled, improvised explosive devices from being detonated by radio.
- Robots. In their simplest form, robots can be used to detonate or neutralize booby traps. More sophisticated models can be remotely controlled to carry out simple tasks, such as videotaping or cutting wires.
- Body armor.
- Electric meters.
- X-ray equipment.

CLEARANCE METHODS

- Pulling. This method uses a grapnel and a rope to pull the trap. It is used when the resulting damage is acceptable. It is the safest method and is particularly applicable to traps set in open areas. Do not disturb any part of a booby trap when placing the grapnel and pulling the cable. Carefully select the site from where the pull is to be made because it might be mined or trapped. When a booby trap is pulled and does not explode, wait at least 30 seconds before approaching it in case delay devices have been used. Disposal of unexploded traps depends on their condition when inspected. The procedure for pulling booby traps is similar to that for pulling mines (see Chapter 11).
- Trip wires. Check the area for AP devices before proceeding. Place a grapnel hook as close as possible to the trip wire. Do not touch the trip wire until the pulling party is in a covered area.
- Pull and release. Pull away objects that conceal and operate pull and release mechanisms.
- Pressure mechanism. Pull pressure mechanisms from under objects that conceal and operate them. If this is impossible, blow them in place. In many cases, it might be easier to pull the charge rather than the FD. Take extreme care when attempting this, because additional mechanisms are often concealed in or under the main charge.
- Destroying in place. When destroying booby traps in place, explode a small charge near the booby trap's charge. Again, use this method only if damage from the explosion is acceptable. When it is impossible to place the explosive close enough to ensure detonation of the main charge, carefully place it alongside the mechanism. Do not assume the main charge is safe to handle just because the mechanism has been destroyed. Actuate pressure mechanisms by suspending one-half pound of explosive above the pressure plate.
- Clearing by hand. This method involves neutralizing, disarming, removing, and disposing of traps without causing damage. It is extremely hazardous and should only be used when pulling or destructing traps in place is impossible or unacceptable. Clearance should only be conducted by EOD personnel or experienced engineers. Carefully examine all aspects of the trap before deciding how to clear it.
- Explosive line charge. Using this device produces quick results when only a narrow path is required through a booby-trapped area. It gives clearance for the same distance to either side, only where it is in contact with the ground.
- Armor. This method is used where traps with small charges (designed as AP devices) are located in open areas. Armored vehicles track back and forth over the area. This shortens the clearing time with little risk of casualties.

SECTION III. EXPEDIENT DEVICES

Expedient devices are constructed in the field with locally available material. They are employed against vehicles or personnel in the same manner as other mine systems. Expedient devices—

- Supplement a unit's low supply of conventional mines.
- Hinder reconnaissance, clearance, and neutralization of minefields.
- Create enemy attitudes of uncertainty and suspicion to lower morale and slow movement).

AUTHORIZATION

Because expedient devices have nonstandard design and functioning, take special precautions to protect friendly forces. Consider neutralization, disarming requirements, and adequate marking procedures. The use of expedient devices is restricted under the Convention of Conventional Warfare. Expedient devices have the same international restrictions as booby traps. The corps commander is the employment authority for expedient devices. He can delegate this authority to the division commander. If authority is given to use expedient devices, US personnel will adhere to the rules for international law that are applicable to armed conflict.

EMPLOYMENT AND CONSTRUCTION TECHNIQUES

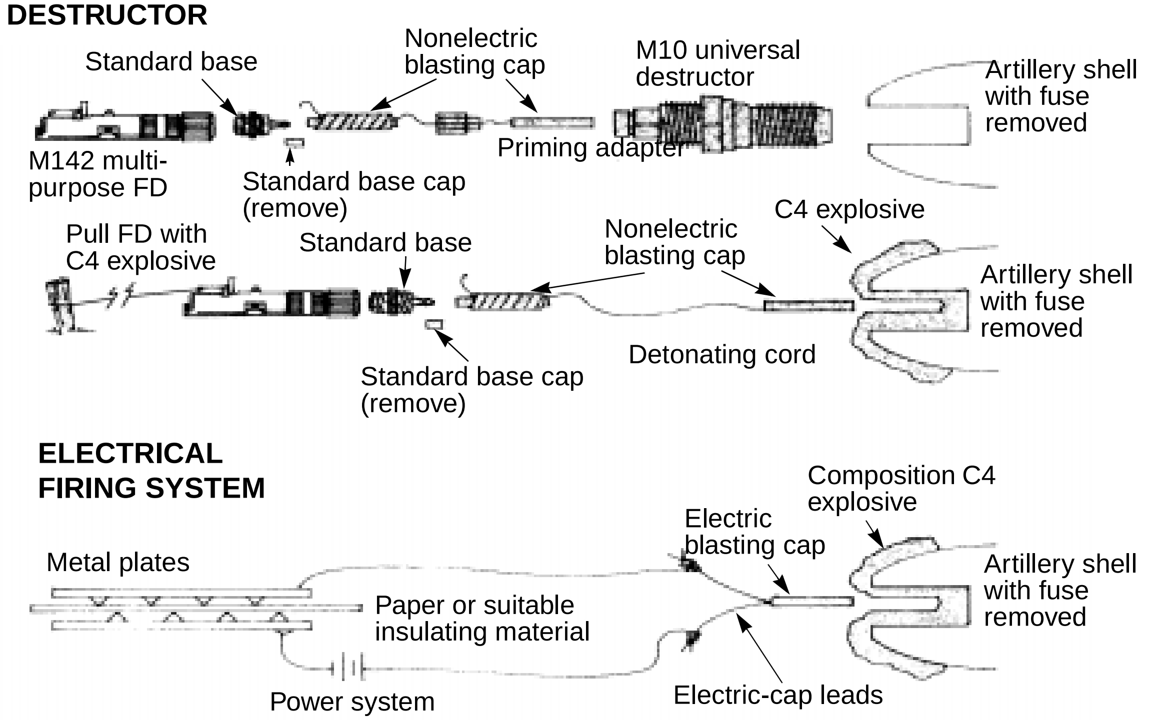
If issued mines are not readily available on the battlefield, expedient devices can be manufactured in the field. Construction varies based on available materials and the ingenuity of the personnel who are fabricating the devices. Expedient devices pose a potential safety hazard to friendly forces—those who are constructing them and those who may later encounter them. Construction should be performed by personnel who are familiar with the materials being used. Innovative designs should be checked and tested before arming and emplacing the devices.

As a minimum, test the fusing mechanism separately to ensure that it functions as designed. Improper fuse operation is the most common cause of malfunction. Also, test the fuse and the firing chain (base charge, blasting cap, and detonating cord) without the main charge to ensure proper operation. Emplace the device after satisfactory performance of the firing mechanism. First, emplace heavy items (such as artillery shells) that are used as the main charge, and then add the firing mechanism. Take care when moving or emplacing expedient devices because their nonstandard manufacture and potentially faulty construction make them highly sensitive to jars and shocks. Construct devices at the emplacement site whenever possible.

Expedient devices are prepared in the field using standard US FDs, detonators, and demolition materials. All devices discussed in this chapter can be made to function electrically or nonelectrically using modernized demolition initiators (MDIs). AP devices must be command-detonated.

HIGH-EXPLOSIVE, ARTILLERY-SHELL DEVICE

The HE, artillery-shell device (Figure 13-15) can be readily adapted to expedient mining. Remove the artillery fuse and replace it with a standard FD and a length of detonating cord or with an MDI blasting cap. If properly assembled, a destructor may also be used. If a destructor is not available, firmly pack the fuse well with composition C4 explosive and insert a length of knotted detonating cord or a blasting cap.



NOTE: For command-detonation, an M34 blasting machine can replace the metal plates and the battery.

Figure 13-15. HE, artillery-shell device

The device can be activated by a variety of methods depending on the type of FD used. When MDI blasting caps are used, the device is command-detonated. The device can also be adapted to function electrically by adding an electric cap and a power source.

This device can be used as an AT or an AP device. When used as an AP device, it must be command-detonated.

NOTE: Use only serviceable US ammunition that has remained in the possession of US forces. Never use captured ammunition or UXO found on the battlefield. It may be armed, booby-trapped, or deteriorated.

PLATTER CHARGE

The platter charge (Figure 13-16) consists of a suitable container that is filled with uniformly packed explosive and placed behind a platter. The platter is metal (preferably round, but square is satisfactory) and weighs 1 to 3 kilograms. The explosive required is equal to the weight of the platter. The container may not be necessary if the explosive can be held firmly against the platter (tape can be used). The charge should be primed from the exact rear center, and the blasting cap should be secured with a small amount of C4 to ensure detonation.

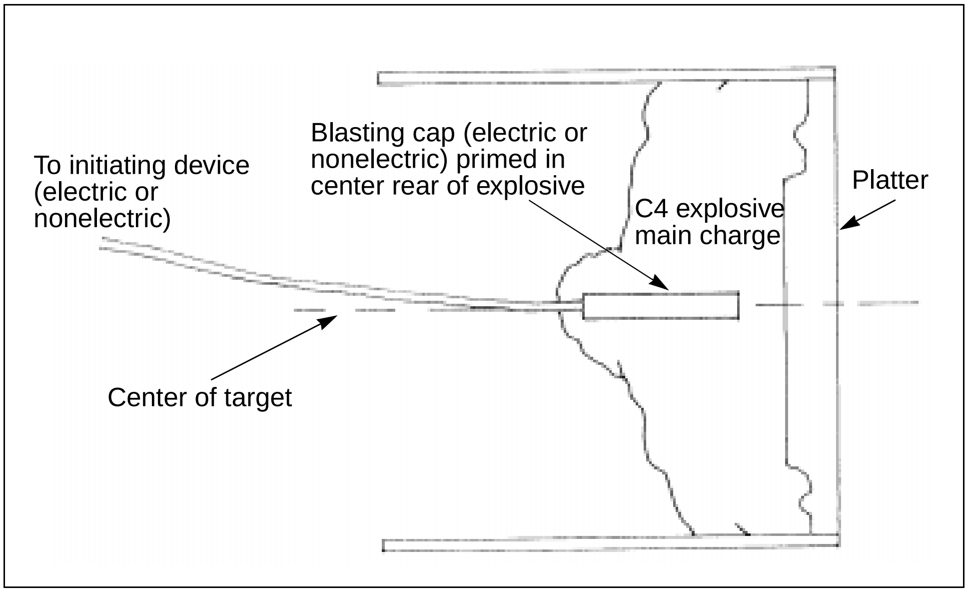


Figure 13-16. Platter charge

The charge should be aimed at the direct center of the target. The effective range (primarily a matter of aim) is approximately 35 meters for a small target. With practice, experienced personnel can hit a 55-gallon drum (a relatively small target) at 25 meters with about 90 percent accuracy.

The platter charge can be used as an AT or an AP device. When used as an AP device, it must be command-detonated.

IMPROVISED CLAYMORE

For the improvised claymore device (Figure 13-17, page 13-32), a layer of plastic explosive is attached to the convex side of a suitably dense, curved base (such as wood or metal). A hole must be made in the exact rear of the base. A blasting cap is placed in the hole to prime the device. Shrapnel is fixed to the explosive with a suitable retainer (cloth, tape, mesh screen).

The device must be command-detonated. Command detonation is best achieved with electrical priming or an MDI. A blasting device is attached to the electric cap via firing wires laid at least 50 meters from the device. Ensure that personnel have adequate cover when detonating the improvised claymore.

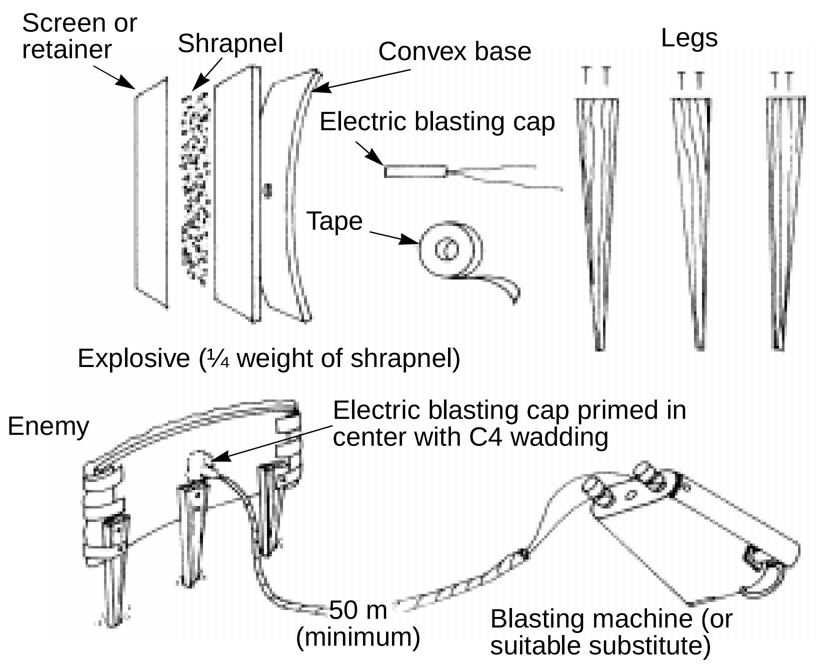


Figure 13-17. Improvised claymore device

GRAPESHOT ANTIPERSONNEL DEVICE

Place shrapnel in the bottom of a cylindrical container to make a grapeshot AP device (Figure 13-18). The shrapnel is tamped and held in place with a suitable separator (wadding). Explosive (approximately one-quarter the weight of the shrapnel) is packed to a uniform density behind the wadding. The device is primed in the center of the explosive with an electric cap or an MDI.

NOTE: The United Nations Convention of Certain Conventional Weapons mandates that all fragment munitions produce fragments that are visible by X ray (such as metal or rock).

This device must be command-detonated. The explosive propels the shrapnel outward from the container. The grapeshot is very effective against personnel targets.

BARBWIRE ANTIPERSONNEL DEVICE

The barbwire AP device (Figure 13-19) can be made directional by placing the wire against an embankment or a fixed object. This causes the force of the explosion to expel the barbwire fragments in the desired direction. One roll of standard barbwire is placed into position, and one block of C4 is placed in the center of the roll and primed. This device must be command-detonated.

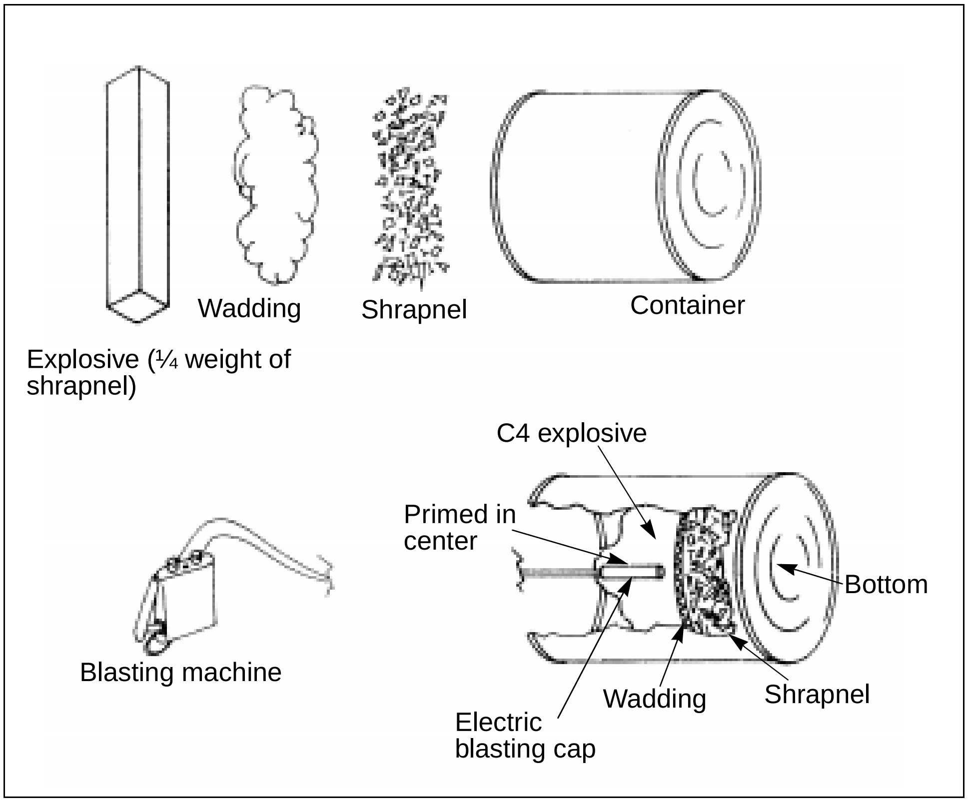


Figure 13-18. Grapeshot AP device

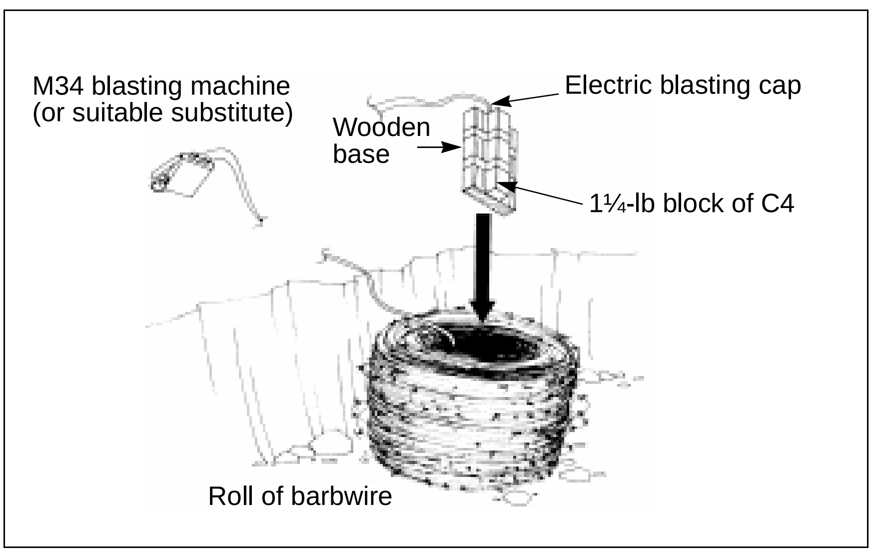


Figure 13-19. Barbwire AP device

- Disarm the mine.
  - Clear the soil carefully from the top of the fuse to the positive safety-pin hole. When using the M605 fuse, clear away all the soil from the fuse area.
  - Insert the positive safety pin through the positive safety-pin hole.
  - Insert the locking safety pin through the locking safety-pin hole.
  - Cut the slack trip wires that are attached to the release-pin ring.
- Check for AHDs.
  - Hold the mine body firmly in place with one hand.
  - Feel for AHDs with the other hand by digging around the sides of and underneath the mine.
- Remove the mine.
  - Remove the mine from the hole. Ensure that the safety pins remain in place.
  - Remove the M605 fuse with the M25 wrench.
  - Replace the shipping plug in the fuse well.

SECTION II. ANTITANK MINES

AT mines are designed to immobilize or destroy tanks and vehicles and their crews. They perform this function by producing an M-Kill or a K-Kill. An M-Kill is achieved by destroying one or more of the vehicle's vital drive components (usually breaking the track on a tank), causing the target to be immobilized. The weapon system and the crew are not destroyed in an M-Kill; the weapon system is immobile but continues to function. A K-Kill results when the weapon system or the crew is destroyed.

Conventional AT mines are distinguished by their effects and their fusing systems. Blast AT mines, such as the M15 and M19, derive their effectiveness through the blast generated by their detonation. These usually produce an M-Kill, but a K-Kill may result. Mines such as the M21 use a shaped charge or an SFF designed to penetrate the underside of a vehicle's armor. A K-Kill normally results unless the mine detonates under the vehicle's track.

M15

The M15 (Figure A-12, page A-12) is a blast AT mine that is contained in a round sheet-steel casing. The primary fuse well is located in the top center of the mine. There are two secondary fuse wells—one on the side and one on the bottom. The primary fuse well accepts the M603 pressure-actuated fuse. Standard FDs can be used in the secondary fuse wells with the M1 activator. The M624 tilt-rod-actuated fuse can also be used with this mine.

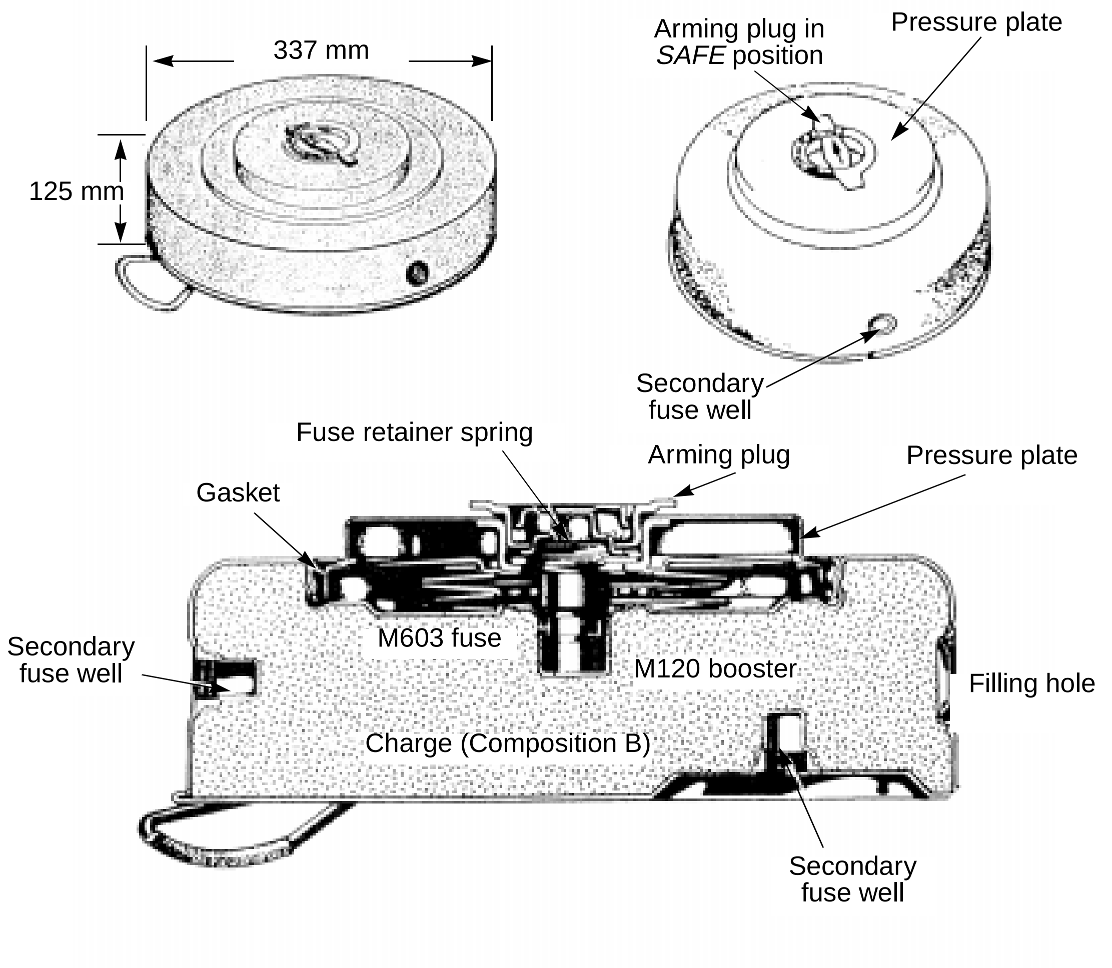


Figure A-12. M15 AT mine

CHARACTERISTICS

Main Charge	Diameter	Height	Weight	No Mines per Box	Weight per Box
Comp B, 9.9 kg	337 mm	125 mm	13.5 kg	1	18 kg

- The M15 is employed in protective, tactical, and nuisance minefields.
- The M15 is surface-laid or buried.
- The M15 requires a force of 158 to 338 kilograms to detonate the M603 fuse and a force of 1.7 kilograms to deflect the tilt rod and detonate the M624 fuse.
- The M15 is designed to defeat heavy tanks.
- The M15 produces an M-Kill upon contact.

— Give the band, the stop, the pull ring, the shipping plugs, and the closure assembly to the NCOIC.

REMOVAL

- Disarm the mine.
  - Clear the camouflage away from the mine carefully.
  - Attach the band and the stop to the fuse.
  - Insert the cotter pin into the band and the stop. Spread the ends of the cotter pin.
  - Remove the extension rod.
- Check for AHDs.
  - Hold the mine firmly in place with one hand, without putting pressure on the fuse.
  - Feel for AHDs with the other hand by digging around the sides of and underneath the mine.
- Remove the mine.
  - Remove the mine from the hole.
  - Remove the fuse from the mine.
  - Install the closure assembly on the fuse.
  - Install the shipping plug into the fuse well of the mine.
  - Remove the closing plug from the bottom of the mine.
  - Remove the booster from the mine.
  - Install the closing plug into the booster well.

SECTION III. FIRING DEVICES AND ACTIVATORS

An FD performs the function of a mine fuse by providing an alternative means to detonate the mine. It is normally used in conjunction with a standard fuse so that a mine will have two separate explosive chains. The purpose of the second firing chain is to prevent the enemy from disarming or removing mines after emplacement. When used for this purpose, the FD is called an AHD and it is designed to function by detonating the attached mine or another explosive charge nearby if unauthorized personnel attempt to remove or tamper with the mine. **NOTE: US forces will not employ AHDs on AP mines.** Both the M19 and the M15 have two secondary fuse wells for attaching an FD and an activator.

There are two standard US FDs—M5 pressure release and M142 multipurpose. They utilize a spring-loaded striker and a standard base and are designed to function in one or more of the following modes:

- Pressure.
- Pressure release.
- Tension.
- Tension release.

M5 PRESSURE-RELEASE FIRING DEVICE (MOUSETRAP)

The M5 FD (Figure A-34) is activated by the release of pressure. Lifting or removing a restraining weight releases the striker to fire the cap.

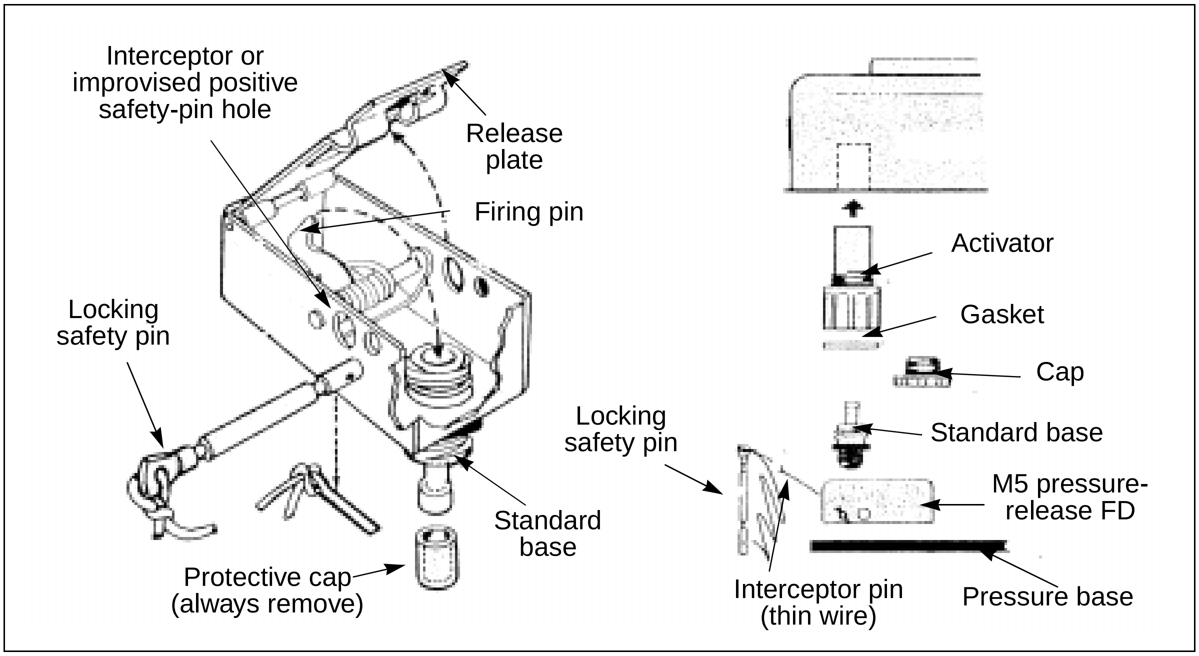


Figure A-34. M5 FD

CHARACTERISTICS

- Case: Metal.
- Color: Olive-drab.
- Length: 445 millimeters.
- Width: 239 millimeters.
- Height: 175 millimeters.
- Internal action: Mechanical with hinged striker release.
- Initiating action: Removal of restraining weight, 2.25 kilograms or more.
- Accessories: Pressure board.
- Safeties: Safety pin and hole for interceptor pin.
- Packaging: Four complete FDs and four plywood pressure boards are packaged in a paper carton, five cartons are packaged in a fiberboard box, and 10 fiberboard boxes are shipped in a wooden box.

without a blasting cap attached, and it is not adaptable to any activator or secondary fuse well. When the M142 is used as an AHD, the coupling device is removed and an M1 or M2 standard base is used.

CHARACTERISTICS

- Case: Plastic.
- Color: Olive-drab.
- Diameter: 190.5 millimeters.
- Length: 571.5 millimeters.
- Internal action: Spring-driver striker.
- Safeties: Positive safety pin, square-head pivot pin, round-head pivot pin, and alternative safety-pin hole.
- Accessories: Nail and screw fasteners, coupling assembly, tension-release attachment, 15-meter spool of trip wire, and vinyl instruction sheet.
- Packaging: Round, metal can containing FD with accessories.

ARMING AND DISARMING

Arming and disarming procedures vary based on the activation mode. Detailed instructions are printed on a weatherproof, vinyl sheet included in each FD package.

M1 AND M2 ACTIVATORS

When FDs are employed with M15 and M19 AT mines, they require the use of an M1 or M2 activator.

Activators are essentially detonator boosters that are designed to magnify the explosive force generated by an FD with a standard base and transfer the force to the main charge. Activators may be used with either type of FD to supply an AT mine with a secondary fuse for antihandling purposes. The M1 activator is used with the M15 AT mine, and the M2 activator is used with the M19 AT mine. The activator also performs the function of an adapter for attaching the FD to the mine. One end of the activator is threaded externally for insertion in the secondary well of the mine; the other end is threaded internally to receive the standard base coupling of the FD.

The M1 activator (Figure A-37, page A-34) is 54 millimeters long (with cap), is made of olive-drab plastic, contains a detonator, and has a threaded closing plug and a gasket. It has a cylindrical, unthreaded cap that is cemented to the opposite end of the body and contains a tetryl booster charge. The threaded end, which screws into the mine, is 25 millimeters in diameter.

The M2 activator is similar to the M1 except that it contains an HE pellet, and its overall length, with cap, is 53 millimeters.

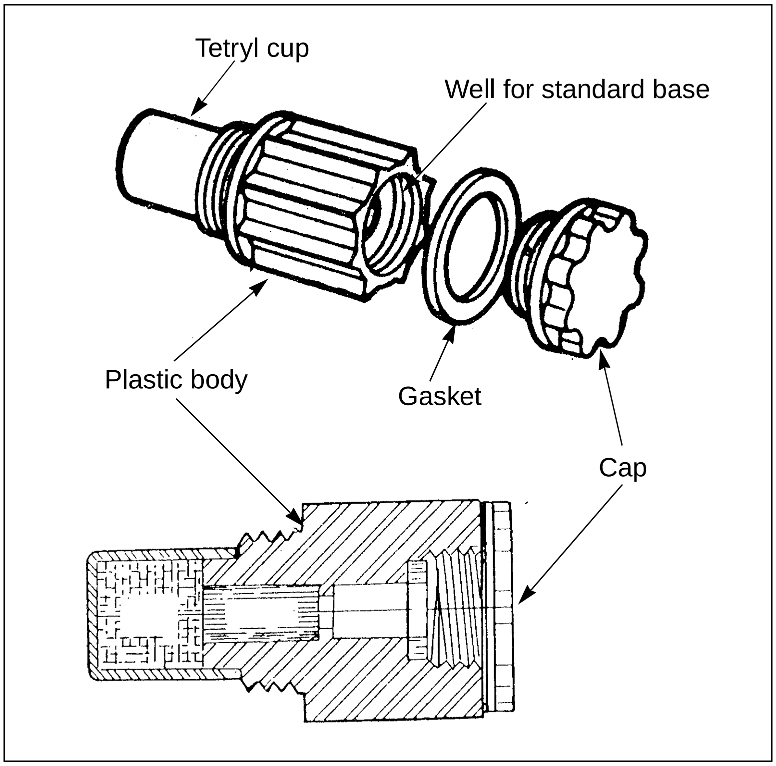


Figure A-37. M1 activator

Appendix B

Controls and Components of Special-Purpose Munitions

This appendix provides characteristics and detailed descriptions of US special-purpose munitions. The use of these munitions is outlined in Chapter 4.

SELECTABLE LIGHTWEIGHT ATTACK MUNITION

The SLAM is a multipurpose munition with antidisturbance and antitamper features. There are two models of the SLAM—one is self-neutralizing (M2) and the other is self-destructing (M4). The M2 is solid green and has no labels, brands, or other distinguishing marks. The M4 is green with a black warhead (EFP) face.

Employment methods for the SLAM are outlined in Chapter 4.

Figure B-1 describes and illustrates the major components of the SLAM.

Component	Description
Mounting holes (1)	The mounting holes are used to secure the carrying strap or the mounting wire to the SLAM when attaching the SLAM to trees and so forth.
Bore sights (2)	Two bore sights and an omega sight are located on the top of the SLAM and are used to aim the SLAM at targets.
Selector switch (3)	The selector switch is used to select operating modes and times. It has eight detent positions. The switch is against a stop (in the shipping position), which is the only switch position that allows the SLAM to fit in the reusable environmental protective pack. Turning clockwise, there are three positions for selecting the operating time (4, 10, and 24 hours). Setting any of these positions will select an internal sensor mode of operation, which is a magnetic sensor for mine mode and a passive infrared sensor for side-attack mode. These three positions will cause the SLAM to self-destruct (M4) or self-neutralize (M2) at the end of the selected operating time. Continuing clockwise, the last four positions select an internal timer, which sets the minutes until demolition. These positions are 15, 30, 45, and 60 minutes.
Activation-lever shear pin (4)	There is a shear pin mounted across the SLAM's lever slot. If the shear pin is sheared, thereby breaking the seal, the lever may have been pulled and the SLAM may be an electronic dud. If the shear pin is broken, it should only be used in the command-detonation mode.
Safety pin (7)	The safety pin slides from the body and starts the SLAM's timing. It is pried from its latch with the tip of the lever. Once the safety pin is pulled, it cannot be reinserted.

Figure B-1. SLAM components

Component	Description
Passive infrared sensor (8) and cover (9)	The SLAM is equipped with a passive infrared sensor that detects trucks and light armored vehicles by sensing the change in background temperature as vehicles cross in front of the SLAM. The sensor is directional and is aligned with the EFP. The sensor is active when the SLAM is operating with the selector switch set to 4, 10, or 24 hours and the sensor cover is removed to expose the infrared sensor (such as, during the side-attack mode). The SLAM will self-destruct (M4) or self-neutralize (M2) if the selected time expires before it is detonated by vehicle passage.
Blasting-cap well and plug (10)	The threaded plug seals the blasting-cap well. It is removed to mount a standard military blasting cap with a priming adapter.
Warhead (11)	The warhead is an EFP that is designed to defeat light armored vehicles. The EFP forms within the first 5 inches of flight and has an effective range of 25 feet.
Housing assembly (12)	The housing assembly contains the fusing, electronics, and S&A components. It also provides a structural interface for the warhead, the sights, the activation lever, the passive infrared sensor, the selector switch, and the safety pin.

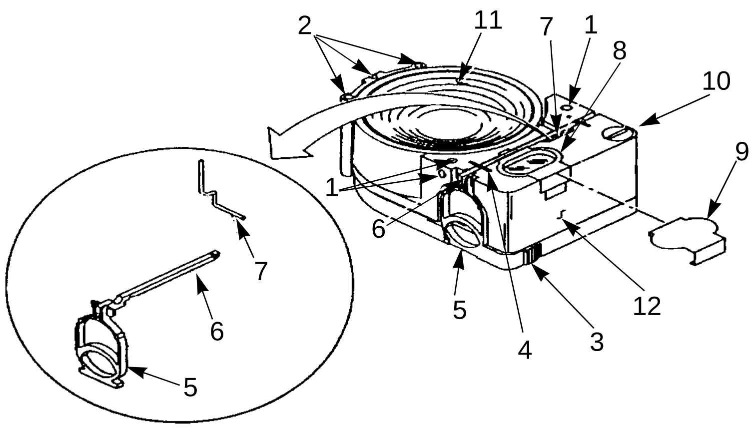


Figure B-1. SLAM components (continued)

M93 HORNET

The M93 Hornet is a lightweight (35 pounds) AT/antivehicular munition that one person can carry and employ. It is a one-time use, nonrecoverable munition that is capable of destroying vehicles using sound and motion as detection methods. The Hornet will automatically search, detect, recognize, and engage moving targets, using top attack at a maximum standoff distance of 100 meters. It is employed by units equipped with an M71 RCU. The RCU is a hand-held 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 SD times, and destruct the Hornet. Employment methods of the Hornet are outlined in Chapter 4.

Figure B-2 describes and illustrates the major components of the Hornet. Figure B-3, page B-4, describes and illustrates the controls and indicators of the Hornet.

Component	Description
Support legs (1)	Support legs are used to stabilize the Hornet when it is deployed.
Active battery-pack cover (2)	The active battery-pack cover provides a seal to protect and secure the active battery pack. The latch is lifted up to remove the cover, the active battery pack is installed, and the cover is then reinstalled and latched down. A line secures the battery-pack cover to the control panel of the munition.
SD switch (3)	The SD switch is a six-position rotary switch that is used to select the SD time and unlock the arm control switch. The SD switch is also used to unlock the arming lever. This is done by rotating the switch to the setting "U." A red lock element is extended 1/8 inch from the side of the munition when the SD switch is in the unlock position. The SD time is preset to Setting 1 when the Hornet is shipped. SD times are as follows: Setting — Time 1 — 4 hours 2 — 48 hours 3 — 5 days 4 — 15 days 5 — 30 days
Arm control switch (4)	The arm control switch consists of an arming lever interlocked with the SD switch and the S&H band assembly to prevent inadvertent actuation. Until the S&H band assembly is removed and the SD switch is placed in the unlock position, the arming lever cannot be moved to the arm position. An internal lock secures the arming lever in the arm position.
Microphones (5)	When the geophone seismic sensor detects a potential target, usually at ranges up to 600 meters, it alerts the munition to start listening with the three microphones that extend from the munition body. They track the two loudest noise sources that are heard.
Antenna (6)	The antenna provides a means for the Hornet to receive M71 RCU commands.
Capture screws (7)	These are four flat-head screws that secure the bottom plate to the munition body. They are removed along with the bottom plate to access the battery compartment.
Bottom plate (8)	The bottom plate provides a seal to protect and secure the battery compartment and connect the batteries once they are installed.
D-cell batteries (9)	The battery compartment houses four D-cell batteries. A drawing on the inside of each battery tube shows battery orientation.
Dowel pin (10)	The dowel pin ensures that the bottom plate is in the correct orientation to properly connect the batteries.

Figure B-2. Hornet components

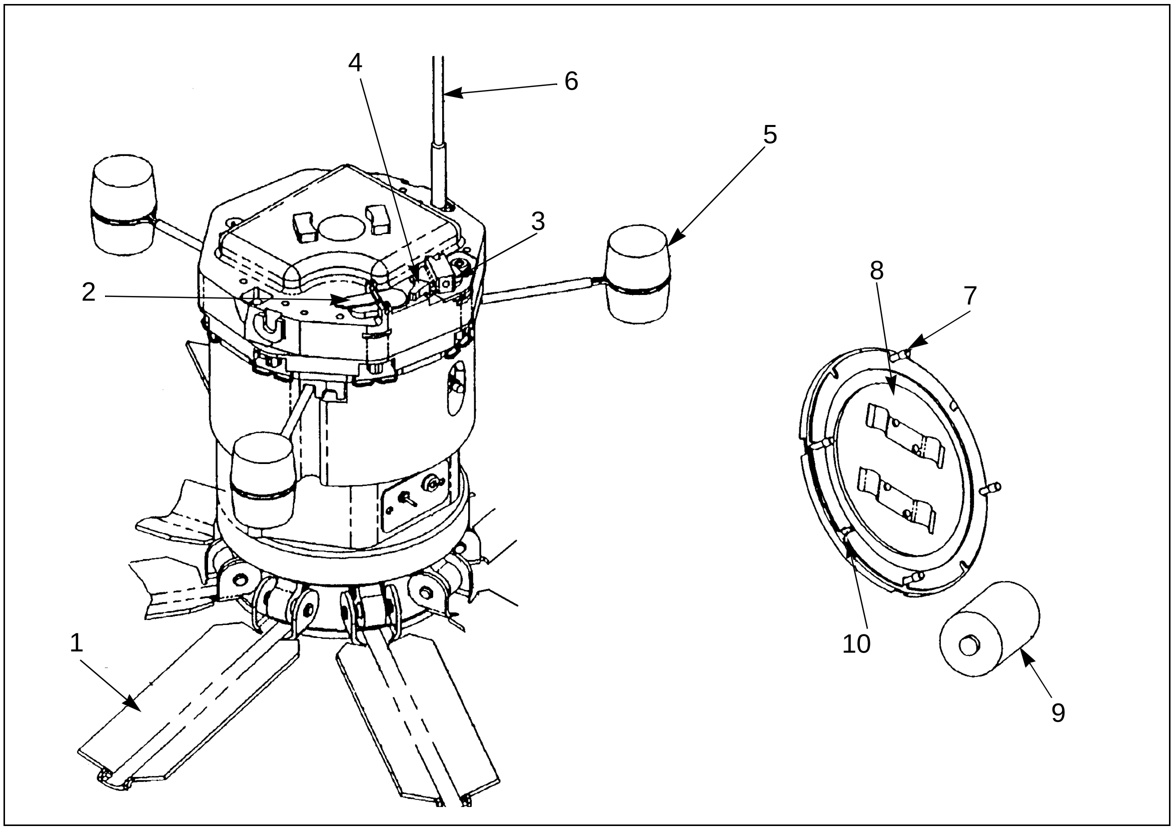


Figure B-2. Hornet components (continued)

Component	Description
Magnetic coupling device (MCD) (1)	This device is used as part of the RCU interface. The RCU interface consists of the MCD and keyed tabs. In the remote arming mode, the RCU is placed on top of the MCD and minefield code data is transferred to the munition. Upon successful encoding, the status light begins to flash.
Target switch (2)	The target switch is a toggle switch used to select the type of target engagement. This gives the operator the choice between detecting and destroying only heavy armored vehicles or all vehicles.
Manual select switch (3)	The manual select switch is a push-button switch, protected by a plastic cover that must be removed to access the switch. Successful activation of the switch will cause the status light to flash. This switch is used to allow the operator to employ the Hornet without the RCU.
Status light (4)	The status light is a visual indicator for the operator during the munition setup. It is a green light-emitting diode (LED) that indicates a self-test was successfully performed or an operating-mode selection was successfully selected.
SD switch (5)	See Figure B-2, page B-3.
Arming lever (6)	See Figure B-2.
Active battery-pack cover (7)	See Figure B-2.

Figure B-3. Hornet controls and indicators

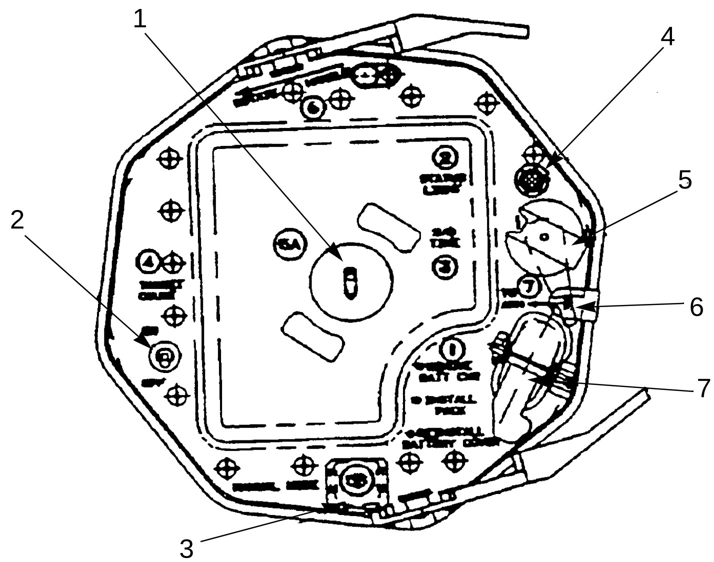


Figure B-3. Hornet controls and indicators (continued)

Appendix C

Threat Mine/Countermine Operations

This appendix is intended to complement the information presented in other manuals on threat obstacle tactics. It applies to most threat armies and their surrogates. Commanders should use this information to give added realism to unclassified training, although obstacle employment norms can change with METT-TC factors for a given AO. Therefore, preoperational training on templating, intelligence, reconnaissance, and reduction procedures must be based on the best information available before deployment.

Appendix G contains a compilation of countermine data.

MINE OPERATIONS

Threat formations contain considerable organic minefield emplacement capability. Threat rapid-mining capability presents a serious challenge to friendly maneuver.

To lay mines and place obstacles rapidly during offensive operations, threat armies form a special team from regimental and divisional assets. This team is called a *mobile obstacle detachment* (MOD). The MOD places AT mines on the most likely avenues for armored attacks or counterattacks. MODs are positioned on the flanks of a march formation for rapid deployment and are normally close to AT reserves. During the march, MODs reconnoiter avenues into the flanks and identify the most likely avenues for tank movement. At secured objectives, MODs reinforce existing obstacles and place new obstacles to assist in the defeat of counterattacks.

The combined arms commander orders the organization of MODs and determines their composition based on the combat situation and available troops. Engineer elements in a division MOD come from the divisional engineer battalion and normally consist of three armored tracked mine layers known as *GMZs* (Figure C-1, page C-2). This platoon-sized element has two or three trucks that carry mines for immediate resupply. For the regimental MOD, the regimental engineer company normally provides a platoon-sized unit equipped with two or three GMZs. The platoon travels in BTR-50/60s and has 600 AT mines.

The GMZ dispenses mines at a predetermined spacing of 5.5 meters. Mine-laying helicopters also support the MOD. The HIP and HIND-D helicopters carry two or three dispenser pods of AP or AT mines. Artillery-fired SCATMINEs can also support the MOD. Three GMZs can lay a 1,200-meter, three-row minefield, containing 624 mines, in 26 minutes. Doctrinally, this minefield would be broken into several minefields, each 200 to 300 meters long.

Threat armies use obstacles extensively throughout the depth of their defense, and their tactics are chosen well. Shallow obstacles are reduced quickly and easily. For example, a shallow, one-row minefield is essentially reduced by blowing one or two mines in the row. A threat rapidly emplaced minefield

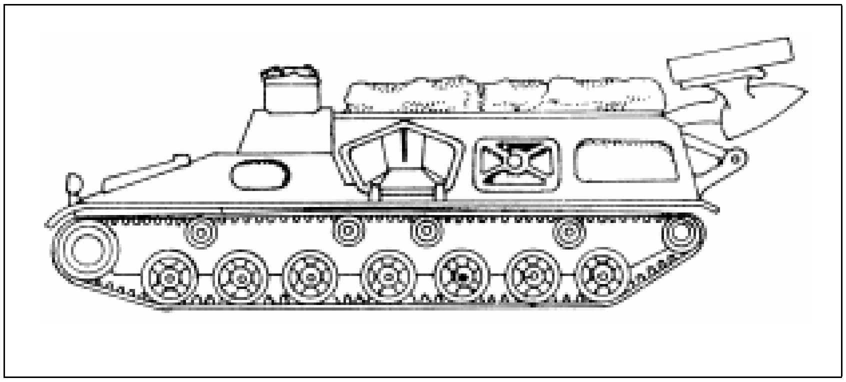


Figure C-1. GMZ armored tracked mine layer

consists of three or four 200- to 300-meter rows, spaced 20 to 40 meters apart, with mines spaced 4 to 6 meters apart. As a rule, the minefield covers the depth of a football field.

Table C-1 provides detailed information on standard threat AT and AP minefields. Terrain and tactical situations dictate the actual dimensions and distances of minefields.

Table C-1. Normal parameters for threat-style minefields

AT Minefields	
Front (situation-dependent)	200 to 300 meters
Depth	40 to 120 meters
Number of rows	3 or 4
Distance between rows	20 to 40 meters
Distance between mines	4 to 6 meters for antitrack mines; 9 to 12 meters for anithull mines
Outlay, normal	550 to 750 antitrack mines per kilometer; 300 to 400 antihull mines per kilometer
Outlay, increased effect	1,000+ antitrack mines per kilometer; 500+ antihull mines per kilometer
Probability of destruction	57% for antitrack mines (750 per kilometer); 85% for antihull mines (400 per kilometer)
AP Minefields	
Front (situation-dependent)	30 to 300 meters
Depth	10 to 150 meters
Number of rows	3 or 4
Distance between rows	5+ meters for blast mines; 25 to 50 meters for fragmentation mines
Distance between mines	1 meter for blast mines; 50 meters (or twice the lethal radius of fragmentation) for fragmentation mines
Outlay, normal	2,000 to 3,000 HE/blast mines per kilometer; 100 to 300 fragmentation mines per kilometer
Outlay, increased effect	2 to 3 times the normal outlay
Probability of destruction	15 to 20% for HE/blast mines (2,000 per kilometer); 10 to 15% for fragmentation mines (100 per kilometer)

the intended effect. The air Volcano can be used to reseed existing minefields or to close lanes and gaps. The target area must be clear of friendly forces before an air Volcano mission is executed.

Use of the air Volcano in close operations should be a primary planning consideration. It can quickly reach the outer edge of the forward operating base where AAs need a minefield obstacle. The threat level will be lower, and the station time will increase.

Aviation Configuration

Two air Volcano aircraft should be used (one primary, one backup). The requirement for security aircraft depends on METT-TC factors, but security should be used whenever possible.

Fire-Support Coordination

The forward command post FSE coordinates and executes fires in support of air Volcano missions. The FSE, the engineer liaison officer, and the G3/S3 representative coordinate to ensure that the air coordination/tasking order supports the mission and the planned SEAD fires. The division/brigade main will be available to support the forward command post as necessary.

The brigade/TF FSE is responsible for coordinating through the forward command post to the division/brigade main FSE. If the forward command post has jumped, the brigade/TF FSE coordinates directly with the division/brigade main FSE.

REAR OPERATIONS

Employment

The primary purposes of the air Volcano in rear areas is to protect key terrain from possible airborne/air-assault forces and to fix/disrupt enemy forces long enough to allow the tactical combat force or ready-reserve force time to react and meet the changing enemy situation.

The least preferred employment method is to deliver tactical minefields to brigade and corps support areas. This employment tactic is normally used when all other available assets have been exhausted. The flexibility of the air Volcano system makes it ideal for employment against a mounted Level III threat in the rear. The target area should be out of the direct view/fire of the threat and on a choke point that allows cover for the reacting forces.

Aviation Configuration

The air Volcano aircraft could be employed individually or with security/escort aircraft. The use of OH-58D KWs as security aircraft allows units to develop the situation and helps place minefields in the proper location to assist inbound attack aircraft or fires. If the air Volcano aircraft is not provided security aircraft, it is recommended that ground forces provide covering fires.

Fire-Support Coordination

The division/brigade rear FSE coordinates and executes fires in support of air Volcano missions. The FSE, the engineer liaison officer, and the G3/S3 representative coordinate to ensure that the air coordination/tasking order supports the mission and the planned SEAD fires. The division/brigade main will be available to support the division/brigade rear as necessary.

The headquarters element that controls the rear area coordinates with the division/brigade rear FSE. The division/brigade rear FSE coordinates with the division/brigade FSE for fire support and air assets.

MINEFIELD EFFECTS

Turn

A turn minefield manipulates enemy maneuver in a desired direction. It forces or entices enemy formations to move in a different direction rather than breach the obstacle. This means the bypass must be easily identified. Turn minefields are extremely lethal, with approximately 80 percent probability of mine encounter. The typical width is 557 by 320 meters for air Volcano. Figure D-2 shows two turn minefields combined to create a turn-effect obstacle group. It takes 160 canisters (800 AT/160 AP mines) to emplace one turn minefield. One air Volcano aircraft can lay one turn minefield (see Table D-2).

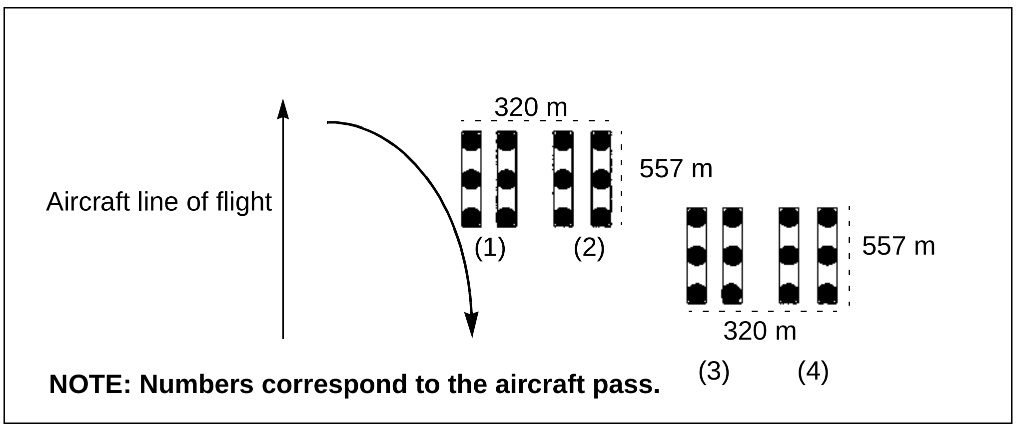


Figure D-2. Turn obstacle

Table D-2. Air Volcano minefield data

Type of Minefield	Depth (m)	Frontage of Minefield (m)	Number of Strips	Canisters per Strip	Total Canisters	Minefields per Aircraft
Disrupt	120	278	1	40 (20 each side)	40	4
Fix	120	278	1	40 (20 each side)	40	4
Turn	320	557	1	80 (40 each side)	160	1
Block	320	557	1	80 (40 each side)	160	1

Block

A block minefield (Figure D-3) is designed to stop an enemy advance along a specific AA or allow it to advance at an extremely high cost. Block minefields are obstacles with intensive integrated fires. They should be employed in a

— Fire. In the event of a fire away from the mines, attempt to contain or extinguish the fire by any available means. If the fire is near the mines or in them, clear the area to a minimum distance of 1,000 meters and notify fire-fighting personnel immediately. When training with M88 canisters, clear the area to a minimum distance of 30 meters.

— Accidental discharge. Immediately clear the area to a distance of 640 meters and notify EOD. The mines arm approximately 2½ minutes after firing. When training with M88 canisters, terminate arming until the problem can be identified and corrected.

— Failure to fire. Remove the canister from the aircraft and place it in the dud pit. Notify EOD immediately. When training with M88 canisters, remove the canister from the aircraft, separate it from the other canisters, repack it, and return it to the ASP.

- Site layout (Figure D-6).

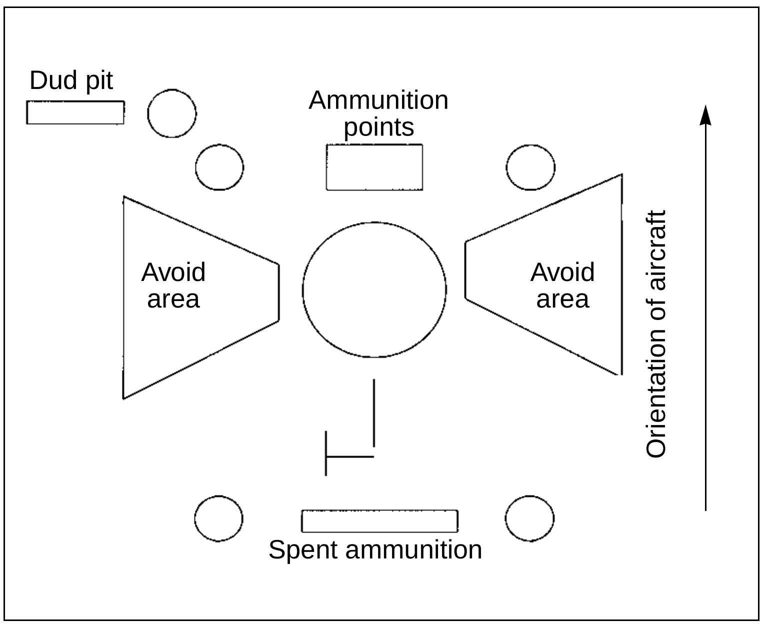


Figure D-6. Site layout

— Berming of the site is not required for a tactical arming point.

— The following rules apply when the site is located next to a refuel point:

> A minimum of 1,000 meters must exist between arming points and refuel points when the total quantity of explosives is less than 600 kilograms. For quantities greater than 600 kilograms, refer to FM 5-250.

NOTE: Each M87 canister contains 3.4 kilograms of explosives; a full load (160 canisters) contains 550 kilograms of explosives.

    > The refuel point for armed aircraft must be located at least 375 meters from other aircraft refueling points.

    > Parked, armed aircraft must be at least 36 meters from other armed aircraft to prevent the detonation of explosives on adjacent aircraft. This distance will not prevent damage to adjacent aircraft; a 130-meter distance is required to prevent damage by fragments and to ensure that the aircraft remains operational.

  — A dud pit (bermed when possible) for damaged or misfired ammunition should be established beyond the ammunition points.

  — Arming points should be laid out as shown in Figure D-6.

Dearming. After the mission is complete, the aircraft returns to the arming point for dearming. Spent canisters should be discarded at least 30 meters from the aircraft, at the 4- and 8-o'clock positions. Live canisters should be returned to ASPs for future use or repackaging. Canisters that misfire should be placed in the dud pit.

Flight Planning and Preflight.

- The flight crew analyzes the mission using METT-TC factors and determines the flight profile to be used during mine emplacement. It will select (or have designated) one or more of the following control measures to be used during mine emplacement:

  — Visual identification (start and stop markers on the ground).

  — Time-lapse (tables to determine the minefield length).

  — Number of canisters fired.

  — Doppler/GPS (start and stop coordinates).

- The crew member(s) will ensure that the air Volcano is installed properly, that all installation checks are completed, and that mine canister pallets are loaded as directed by the pilot or the SOP.

- The flight crew conducts ground checks according to the checklist in TM 1-1520-237-10 to confirm proper operation of the air Volcano prior to takeoff.

Before Arrival at the Target Area.

- During the equipment check, the crew chief turns on the DCU power-control switch, verifies that no malfunctions were indicated during the initial built-in test, and turns off the DCU power-control switch.

- After completion of *run-up* with the aircraft at flight idle, the crew chief turns on the DCU power-control switch.

- Before arrival at the release point, the pilot will make the following checks (listed on the Volcano card [a sample is shown in Figure D-7]):

  — Verify that the DCU is on.

  — Verify that the mine SD time is properly set.

Appendix E

Safety and Training

Mine training is inherently dangerous, in part, because several different types of mines and fuse systems are used throughout the world. Detailed safety instructions for each type of mine are provided throughout this manual. This appendix merely points out the safety aspects of live-mine training that are common to all types of mines.

Conduct mine training as if the mines were live. This is the only way soldiers form a habit of correctly and safely handling mines and gain a true appreciation of the requirements and the time it takes to perform an actual mine-warfare mission. Live-mine training gives soldiers the confidence they need to handle mines and their components. Accidents can usually be traced to ignorance, negligence, deliberate mishandling, overconfidence, mechanical failure, or fright. The first four can be overcome by training and proper supervision. Mechanical failure rarely happens; but if it does, it can be controlled by training and proper supervision. The last item, fright, is mastered through well-controlled, live-mine training.

STORAGE

There are three types of mines used in mine training:

- Inert. Does not contain explosives.
- Practice. Contains an LE charge or a smoke-producing component to simulate detonation.
- HE. Involves actual mines used in combat

Conventional mines are painted to enhance concealment, retard rusting of exposed metal parts, and help identify the type of mine and filler (HE, LE, or chemical agent). Older manufactured mines are painted according to the Five-Element Marking System; newer mines use the Standard Ammunition Color-Coding System (see Table E-1, page E-2).

NOTE: Mines that are color-coded and marked according to the old system have been on hand for several years. Ensure that all ammunition, whether color-coded according to the old or new system, is properly and fully identified.

Always handle mines with care. The explosive elements in fuses, primers, detonators, and boosters are particularly sensitive to mechanical shock, friction, static electricity, and high temperatures. Boxes and crates containing mines should not be dropped, dragged, tumbled, walked on, or struck. Do not smoke within 50 meters of a mine or its components.

Table E-1. Mine color-coding system

Type of Ammunition	Five-Element Marking System (Old)	Standard Ammunition Color-Coding System (New)*
Persistent casualty chemical agent	Gray with green markings and two green bands	Gray with green markings and two 12-mm green bands
Nerve agents	Gray with green markings and two or three green bands	Gray with green markings and three 12-mm green bands
Incendiary	Gray with violet markings and one violet band	Light red with black markings and one yellow band
HE	Olive drab with yellow markings	Olive drab with yellow markings
Practice mines	Blue with white markings	Blue with white markings
Inert mines	Black with the word *INERT* in white	Blue with the word *INERT* in white
*Chemical ammunition containing an HE has one 6-mm yellow band in addition to the other markings.		

When it is necessary to leave mines in the open—

- Set them on dunnage at least 5 centimeters above the ground.
- Place a waterproof cover (such as canvas) over them, and leave enough space for air circulation.
- Dig drainage trenches around stacks of mines to prevent water from collecting under them.
- Protect mines and their components against moisture by waterproofing them with grease coatings, tar paper, or tarpaulins.

Additional maintenance procedures are as follows:

- Do not open mine boxes in a magazine, at an ammunition dump, or within 30 meters of an explosive store. Use copper or wooden safety tools, if available, to unpack and repack mines.
- Do not fuse mines within 30 meters of an explosive or ammunition holding area. Mines can be fused at the mine dump.
- Use specifics authorized by the US Army Materiel Command and applicable TMs to disassemble mines and their components.
- Remove safety pins, safety forks (clips), and other safety devices as the last step when arming the mine; and replace them before the mine is moved again. These devices prevent accidental initiation of the mine while it is being handled.
- Place tape over open fuse cavities and secondary fuse wells. Ensure that they are clear of obstruction and free of foreign matter before attempting to install the fuse, the detonator, or the FD.
- Take steps to prevent moisture or water from accumulating around the mine and subsequently freezing if the temperature fluctuates around freezing. Mines usually function satisfactorily at temperatures between 40 and 160°F. Most mines are not appreciably affected by temperature changes, but mines can become neutralized by ice formations (see Chapter 12).

- If the probe encounters resistance and does not go into the ground freely, carefully pick the soil away with the tip of the probe and remove the loose dirt by hand. Care must be taken to prevent functioning the mine.
- When a solid object is touched, stop probing and use two fingers from each hand to carefully remove the surrounding soil and identify the object.
- If the object is a mine, remove enough soil to show the mine type and mark its location. Do not attempt to remove or disarm the mine. Use explosives to destroy detected mines in place or use a grappling hook and rope to cause mines to self-detonate. Metal grappling hooks should not be used on magnetic-fused mines.

Probing is extremely stressful and tedious. The senior leader must set a limit to the time a prober is actually probing in the minefield. To determine a reasonable time, the leader must consider METT-TC factors, weather conditions, the threat level, the unit's stress level, and the prober's fatigue level and state of mind. As a rule, 20 to 30 minutes is the maximum amount of time that an individual can probe effectively.

AN/PSS-12 Metallic Mine Detector

The AN/PSS-12 mine detector (Figure F-1, page F-4) is a man-portable metallic mine-detection system that is used to detect AT and AP land mines. Its search head contains two concentric coils—the transmitting coil and the receiving coil. During operation, the transmitting coil is energized with electric pulses to build up a magnetic field. The magnetic field induces currents in metal objects near the search head, and the currents build up a magnetic field in the metal objects. Depending on the metal's composition and quantity, the magnetic field may be strong enough to be picked up by the receiving coil. The signals from the receiving coil are processed in the AN/PSS-12's electronics. When a signal is considered positive, the electronic unit provides an audible alarm to the operator.

WARNING

It is important to understand that magnetic detection is only effective when there a sufficient amount of alloy in the mine.

Unpacking

The system is stored and transported in a single carrying case.

- Open the pressure-relief valve in the carrying case.
- Release the latches on the carrying case and open the top.
- Remove the bag that contains system components.
- Unzip the bag and ensure that all components are present (Figure F-2, page F-4).
- Remove the following items from the bag carefully:

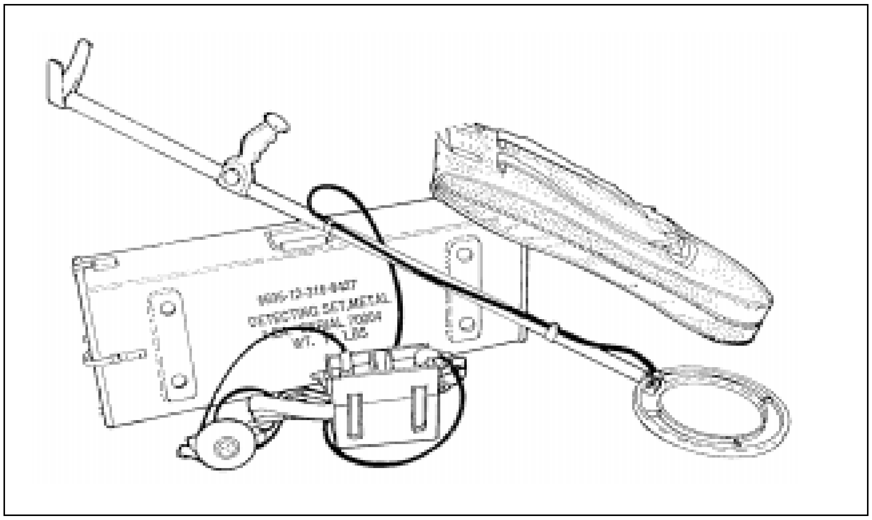


Figure F-1. AN/PSS-12 metallic mine detector

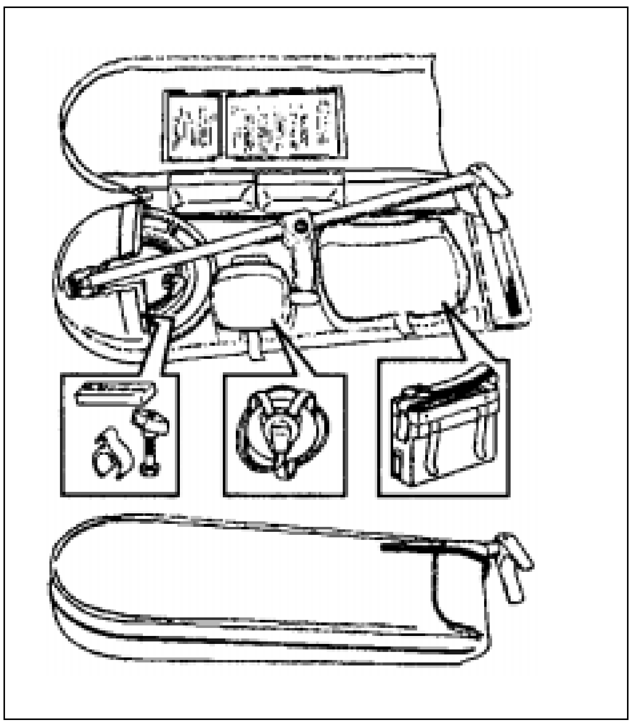


Figure F-2. AN/PSS-12 packed components

- — Wand and search-head assembly with cable and plug.
- — Electronic unit.
- — Headset with cable and plug.

- Ensure that the bag contains the following spare parts and test items:
  - — Spare plastic bolt.
  - — Spare cable clamps.

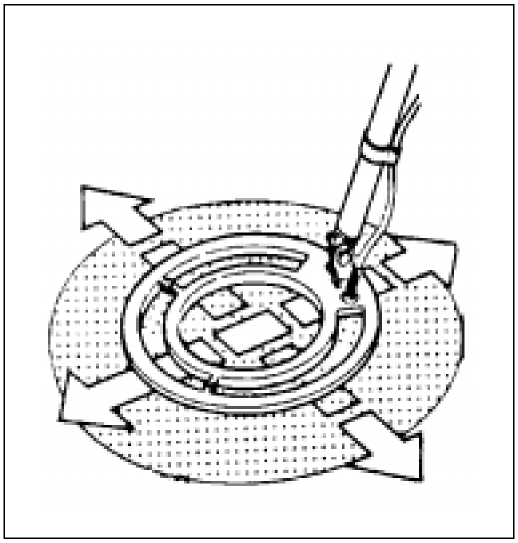


Figure F-6. X-pattern sweeping movement

- If you are searching for large, metal objects, detecting and localizing is faster when the sensitivity control is turned down (counterclockwise).

- Keep mine detectors at least 2 meters apart during setting and adjustment phases to prevent interference.
- Change the batteries and readjust the unit if the indicator lamp flashes. The search sensitivity is not affected when the lamp is flashing; if searching continues, a constant audible tone will sound and the unit will be unusable until fresh batteries are installed.
- Discontinue searching and readjust the unit's sensitivity if the check tone disappears or its frequency decreases.
- Ensure that only the inner part of the telescopic pole is used when the equipment is operated by a soldier in the prone position.
- Turn the unit off after completing the search operations.

Disassembly and Packing

- Ensure that the on/off switch on the electronic unit is in the *OFF* position.
- Detach the cable connection on the electronic unit for the magnetic search head, and replace the protective caps on the plug and socket.
- Release the electronic unit's battery-cover latches, and remove the battery cover.
- Remove the batteries, and ensure that none of the battery cases have ruptured; if they have, notify your supervisor. Reinstall the battery cover and latch it.
- Remove the two cable clamps, which are holding the search head's cable, from the telescopic pole.

- Collapse the telescopic pole to its travel length, and turn its outer tube until it is locked by the catch. Loosen the plastic restraining bolt, and fold in the magnetic search head.
- Pack the components in the carry bag as shown in Figure F-2, page F-4. For long-term storage, do not put batteries in the carry bag. Close and zip the carry bag.
- Place the carry bag in the metal transport case, and latch the case. Close the pressure-relief valve.

As in probing, the senior leader must set a limit to the time an individual can use the mine detector. The time limit is determined by METT-TC factors, weather conditions, the threat level, the unit's stress level, and the individual's fatigue level and state of mind. As a rule, 20 to 30 minutes is the maximum amount of time an individual can use the detector effectively.

EVACUATION DRILLS

A well-developed, well-rehearsed evacuation drill is necessary to extract an individual or a unit from a mined area. Units must develop evacuation drills for dismounted and mounted operations. Each type of operation should include two drills—one using a mine detector (mounted extraction) and one without using a mine detector (dismounted extraction).

Mounted Extraction

- The convoy commander halts the convoy and reports to higher headquarters.
- No vehicles move and no troops dismount unless directed to do so.
- Elements provide 360-degree security from vehicles.
- Troops thrown from vehicles should not move. Personnel are extracted by using dismounted evacuation procedures if electronic detectors are not available.
- The senior leader, if engineers are not available, assesses the situation and directs vehicles to back up along the entry-route tracks. If an immediate threat exists, occupants of damaged vehicles evacuate out the rear of the vehicle and along the vehicle-entry tracks. If no immediate threat exists, occupants of damaged vehicles remain in the vehicle until it is extracted.
- Engineers, if available, sweep the area and provide a cleared path for movement. They—
  - — Clear a lane that is wide enough for the towing vehicle.
  - — Use all available tow cables to increase the distance before towing if an M88 is unavailable. Remember, an M88 has a wider track base than other tracked vehicles.
  - — Ensure that all towing-shackle sets are complete and mounted.
  - — Ensure that the towing vehicle has tow cables on the front and the rear if possible.

Make Risk Decisions and Develop Controls

This step requires decision makers to identify actions that can reduce the probability and/or severity to acceptable levels. This may be accomplished by taking actions to reduce the probability of a mine strike or by providing more protection to the soldier or materiel to reduce severity of a mine strike. Often, it is a combination of the two.

Implement Controls

Leaders must apply the identified controls to reduce the probability and severity of a mine strike.

Supervise

This step ensures that controls are implemented and that a measure of quality control exists to ensure a quantified level of clearance.

The key to using risk management successfully is to employ it at each echelon—from the commander, through the tactical planner, to the soldiers executing the mission. Each level identifies hazards, eliminates or reduces hazards as feasible, and communicates the residual hazards to the next lower echelon. As such, each echelon works as a filter to control unacceptable risks.

- Training provides soldiers with an understanding of equipment limitations and plays a critical role in the risk-management process. Capabilities and limitations of Army systems are taken into consideration during the development of doctrine and TTP.
- Risk management at the tactical planning level requires a thorough knowledge and awareness of the hazards and potential controls that can be employed. The planning process requires a methodical and disciplined technique to identify the hazards and develop appropriate controls for operating in a mined environment. The controls for countermine operations, discussed in Chapters 9 and 11 and in FM 3-34.2, provide a framework for risk-managing hazards associated with mines.
- The execution level is the culminating point of risk management. It is where soldiers and leaders employ the systems provided to accomplish the mission. The amount of residual hazards remaining after the filtering process from echelons above may well determine success. The individual soldier is the last element to control any residual hazards.

Optimizing the components of risk management at the tactical planning level is more challenging as emerging technologically dependent systems bring more variables into the mission. While tactical intelligence is the key element in identifying mine-related hazards, technical knowledge is the key element in assessing the risks associated with mine hazards. This knowledge assimilates the tactical intelligence with the capabilities of the unit's equipment, the performance of threat mines, and the protection provided to our soldiers by their vehicles or personal protective equipment. The staff engineer, using his engineer C^2 system to risk-manage each COA, provides the maneuver commander and his staff with information on risks and potential controls early on in the planning process. Each subsequent commander must perform the same analysis and incorporate the mine threat into risk management.

RECORDING AND MINE-DATA TRACKING

Obtaining and disseminating information are the keys to battlefield management. Units encountering minefields or explosive devices should follow a five-step process—stop, secure, mark, report, and avoid. Units must provide adequate information to their higher headquarters to ensure that follow-on elements are well informed. Information must include known or suspected minefield locations, types of mines (if known), the marking method, the time encountered, and any additional information that may be of use to the clearing unit.

Division and maneuver brigade engineer planning cells must establish a central control cell for mine-clearance information. The central control cell—

- Maintains a current situation map and overlay that depicts friendly and enemy mines and obstacles.
- Maintains and updates information on minefield tracking and route status.
- Receives and maintains minefield recording forms within the unit's AO (includes host-nation minefield data if available).
- Maintains a database of mine information.
- Processes, analyzes, updates, and disseminates the information to subordinate commanders and staff.

MINE-INCIDENT REPORT

A mine incident includes any unplanned activity involving a mine, UXO, or booby trap. It also includes near misses that could have resulted in potential damage or injury. The mine-incident report is a technical report that follows a serious-incident report. The report should be submitted as soon as possible (the local SOP will indicate time requirements). A sample mine-incident report is shown in Figure 11-12, page 11-25.

TRAINING

Modern combat is complex, lethal, and demanding. Soldiers must be capable of performing their missions in any type of battlefield environment. Current doctrine and TTP provide soldiers with guidelines to accomplish their tasks and quality equipment provides the means. The common thread that connects doctrine, tactics, and equipment is quality training. To fight and win, units must train their soldiers to execute all wartime missions successfully. They must use every training opportunity to improve soldier, leader, and unit task performance. Without quality training, no amount of world-class equipment can make the soldier effective or make him survive in a wartime environment. Even the best doctrine in the world is worthless unless soldiers receive effective training. This is especially true with mine-awareness training.

Soldiers must be trained to think mine awareness as well as perform mine-related actions. Decisions, actions, and reactions must become automatic to every soldier. This requires that all soldiers receive mine-awareness training early in their careers. It must begin at early entry training with basic individual tasks and continue through advanced unit training with collective

mag	magnetic
Mar	March
MBA	main battle area
MC	mobility corridor
MCAP	mine-clearing/armor-protection kit
MCB	mine-clearing blade
MCD	magnetic coupling device
MCO	Marine Corps order
MCOO	modified combined obstacle overlay
MCR	mine-clearing roller
MCRP	Marine Corps reference publication
MDI	modernized demolition initiation
MDV	mine-detection vehicle
Met+VE	meteorological data/velocity error
METL	mission-essential task list
METT-TC	mission, enemy, terrain, troops, time available, and civilian considerations
MHE	material handling equipment
MICLIC	mine-clearing line charge
MIDAP	minefield-detection algorithm and processor
MILSTD	military standard
min	minute(s)
min	minimum
MLRS	Multiple-Launched Rocket System
mm	millimeter(s)
MOBA	military operations in built-up areas
MOD	mobile obstacle detachment
MOPMS	Modular Pack Mine System
MOPP	mission-oriented protective posture

MOOTW	military operations other than war
MOUT	military operations on urbanized terrain
MP	military police
MRB	motorized rifle battalion
MRC	motorized rifle company
MRR	motorized rifle regiment
MSD	movement support detachment
MSR	main supply route
NA	not applicable
NAI	named area of interest
NATO	North Atlantic Treaty Organization
NAVSEA	Naval Sea Systems Command
NBC	nuclear, biological, chemical
NCO	noncommissioned officer
NCOIC	noncommissioned officer in charge
NE	northeast
NGO	nongovernment organization
NLT	no later than
nm	nautical mile
no	number
NSN	national stock number
OBSTINTEL	obstacle intelligence
Oct	October
OIC	officer in charge
OP	observation post
OPCON	operational control
OPLAN	operation plan
OPORD	operation order

P	pace(s)
pam	pamphlet
PIR	priority intelligence requirement
PIRS	passive infrared sensor
PL	platoon leader
PL	phase line
PLS	palletized load system
plt	platoon
PSG	platoon sergeant
psi	pounds per square inch
PSYOP	psychological operations
pt	point
PVO	private volunteer organization
QASAS	quality assurance ammunition specialist
R&S	reconnaissance and surveillance
RAAM	remote antiarmor mine
RAC	risk-assessment code
RCU	remote-control unit
RDX	cyclonite
recon	reconnaissance
rep	representative
RF	radio frequency
ROKUS	Republic of Korea, United States
RP	reference point
RSO	range safety officer
RTO	radio-telephone operator
S&A	safing and arming

S&H	safety and handling
S&T	supply and transport
S2	Intelligence Officer (US Army)
S3	Operations and Training Officer (US Army)
S4	Supply Officer (US Army)
SAW	squad automatic weapon
SCATMINE	scatterable mine
SCATMINWARN	scatterable minefield warning
sct	scout
SD	self-destruct
SE	southeast
SEAD	suppression of enemy air defense
sec	second(s)
SEE	small emplacement excavator
SFC	sergeant first class
SFC	sergeant first class
SFF	self-forging fragmentation
SIR	serious incident report
SITEMP	situation template
SLAM	selectable lightweight attack munition
SOEO	scheme of engineer operations
SOF	special-operations forces
SOP	standard operating procedure
SOSR	suppress, obscure, secure, and reduce
SPECS	Special Protective Eyewear Cylindrical System
SPOTREP	spot report
SSG	staff sergeant
SSN	social security number

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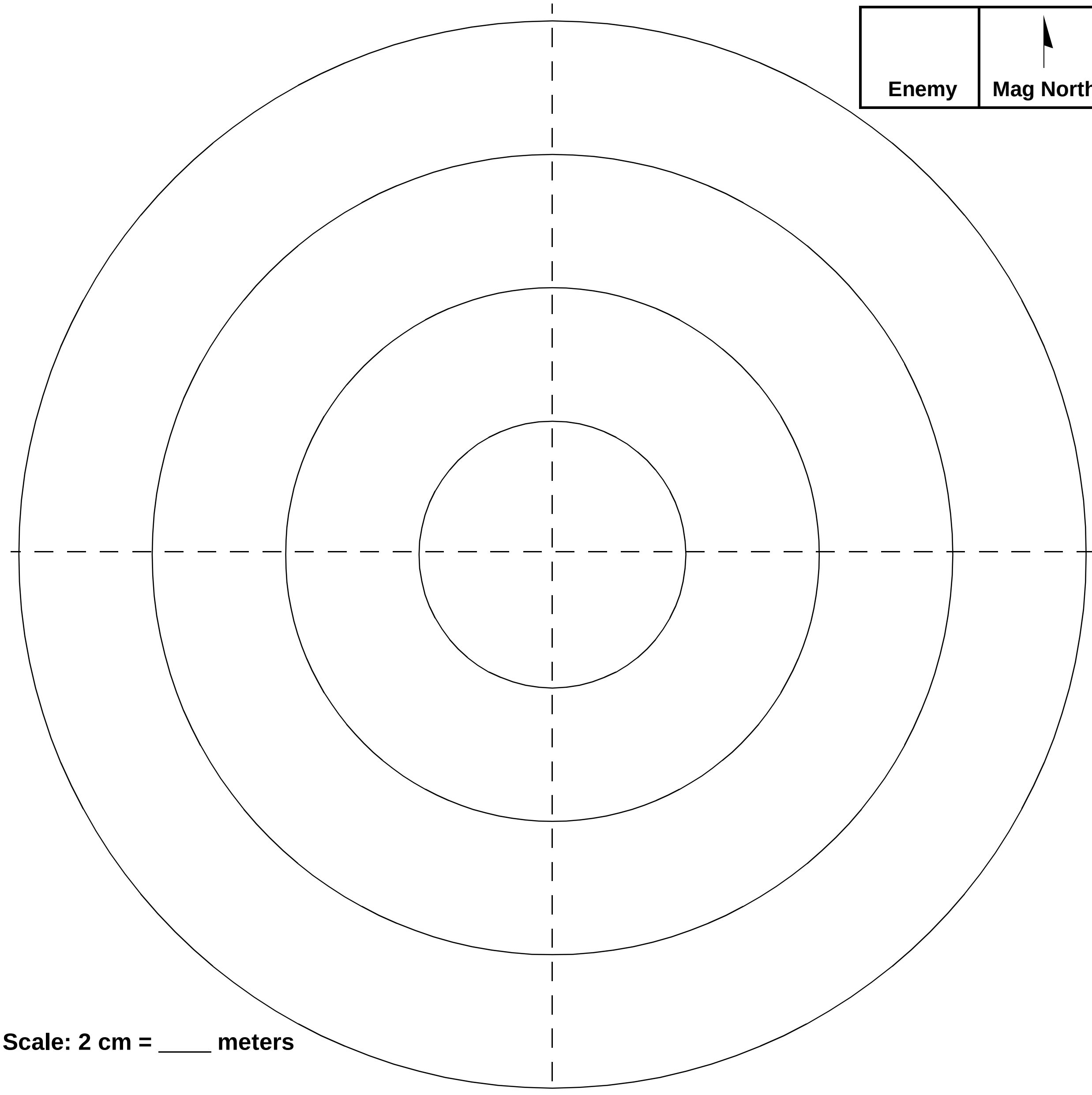
HASTY PROTECTIVE ROW MINEFIELD RECORD

For use of this form, see FM 20-32; the proponent agency is TRADOC.

Azimuth Block

Enemy	**Mag North**



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Scale: 2 cm = ____ meters

Tabular Block

Row	Type	Actuation	Mine Number
Remarks			

Identification Block

Unit	
Reference Point	
Remarks	
Map and Sheet No.	
Name of OIC	
Signature	Time and Date
Mines Removed	
Mines Transferred	

DA Form 1355-1-R, ______ (This form supersedes all previous forms.)

HASTY PROTECTIVE ROW MINEFIELD RECORD

For use of this form, see FM 20-32; the proponent agency is TRADOC.

INSTRUCTIONS)

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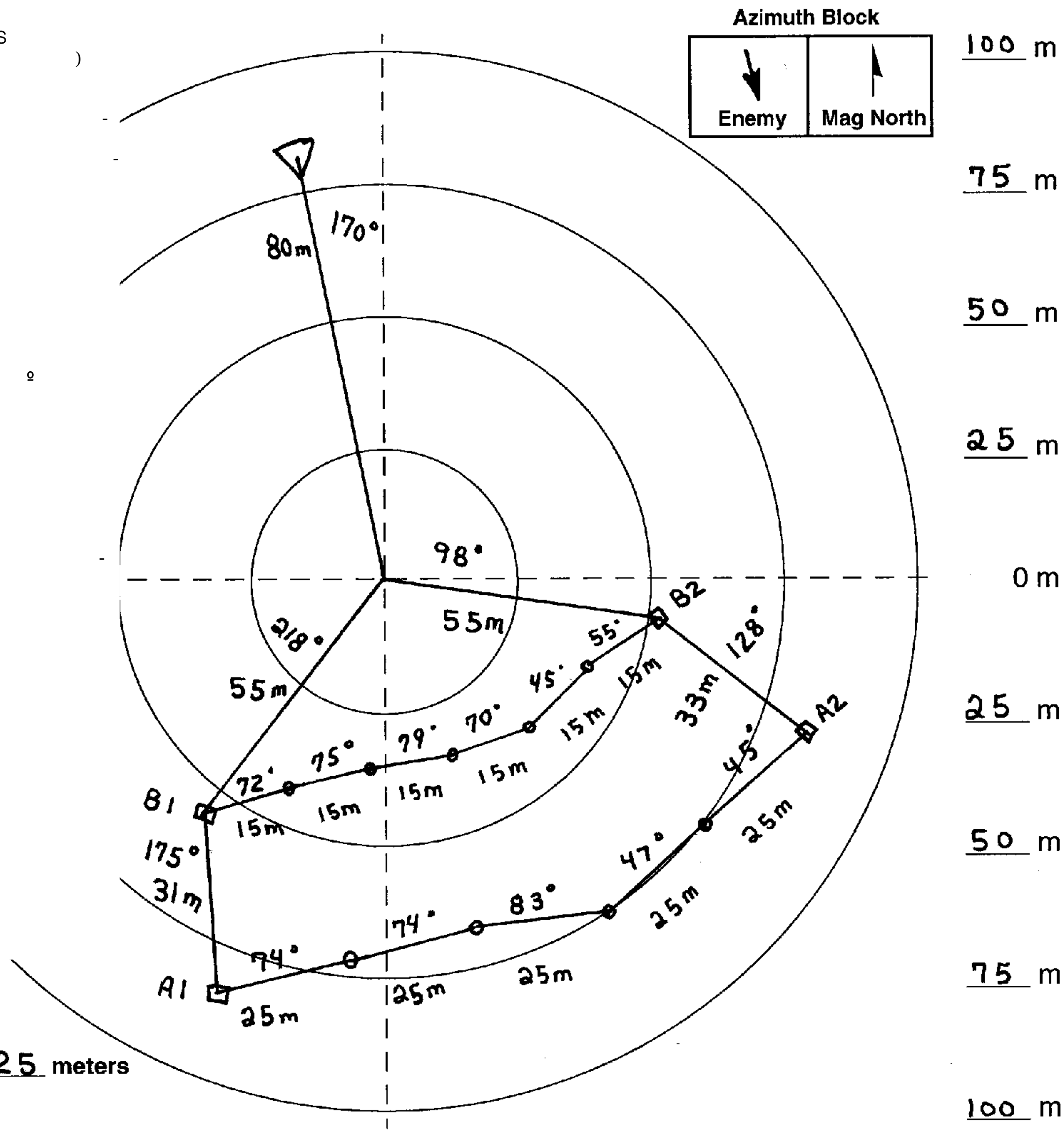

Scale: 2 cm = 25 meters

Tabular Block

Row	Type	Actuation	Mine Number
A	M-15	Pressure	1, 4
A	M-21	Tilt-Rod	2, 3
B	M-15	Pressure	1, 3, 5
B	M-15	Tilt-Rod	2, 4

Remarks Points: A1, A2, B1, B2 are marked with orange tent pegs flush to the ground.

Identification Block

Unit 2nd PLT. C. Co. 317th Eng. BN.	
Reference Point Tree stump right side of the road w/white eng. tape at NA 14503505	
Remarks Landmark: Center of road junction at NA 13403409	
Map and Sheet No. Talbot #5568	
Name of OIC 2nd LT. Roy Bean 123-45-7611	
Signature Roy Bean	Time and Date 1400Z/1 JUL 01
Mines Removed	
Mines Transferred	

Reverse of DA Form 1355-1-R, ______ (This form supersedes all previous forms.)