TC 20-32-5

COMMANDER'S REFERENCE GUIDE

Land Mine and Explosive Hazards (Iraq)

Headquarters,
Department of the Army

FEBRUARY 2003

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Contents

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Preface

The purpose of this guide is to apprise commanders and leaders with the land mine and explosive hazards found in Iraq to support readiness and unit training, operational planning, countermeasure preparation, and protective measures against land mines, unexploded ordnance (UXO), booby traps (BTs), and improvised explosive devices (IEDs) facing United States (US) ground forces.

Land mines, UXOs, BTs, and IEDs pose deadly and pervasive threats to all personnel deployed in the Iraqi theater. Recent experiences in Afghanistan and the Balkan theater show that military forces are most vulnerable to the effects of these hazards—

- Upon initial entry into the theater of operations (TO).
- Before gaining experience with the employment techniques and characteristics of these explosive hazards.
- After extended combat operations when complacency with the hazards in the operational environment may occur.

Extensive land mine and explosive hazard awareness training is a proven and effective force protection tool. Leaders at all levels have a responsibility to ensure that their subordinates are trained on land mine, UXO, BT, and IED awareness characteristics of these devices and immediate action drills when and if these devices are encountered.

WARNING

This handbook provides general land mine, UXO, BT, and IED awareness, characteristics, and safety information. It will—

- **Help you to establish proper safety procedures.**
- **Inform you how to recognize mined areas.**
- **Acquaint you with actions to take if you find yourself in a minefield or if there is a mine strike.**

This handbook is NOT an instruction manual for working with land mines, UXOs, BTs, or IEDs. It does not supersede Field Manual (FM) 20-32 nor any standing operating procedures (SOPs), orders, or military directives in the TO.

The proponent for this publication is HQ TRADOC. Submit changes for improving this publication on Department of the Army (DA) Form 2028 directly to Commandant, US Army Engineer School, ATTN: ATSE-DOT-DD, Directorate of Training, 320 MANSCEN Loop, Suite 336, Fort Leonard Wood, MO 65473-8929.

Unless otherwise stated, masculine nouns and pronouns do not refer exclusively to men.

Chapter 1

Background

Formerly part of the Ottoman Empire, Iraq became an independent kingdom in 1932. A “republic” was proclaimed in 1958, but in reality, a series of military strongmen have ruled the country since—the latest being Saddam Hussein.

Iraq is considered one of the most mine-infested nations in the world. Iraq emplaced minefields for three main purposes—

- To protect its borders during the lengthy war with Iran (1980 through 1988).
- To ward off invasion during the Gulf War (1990 through 1991).
- To subdue the Kurdish population in northern Iraq.

Northern Iraq’s mine and unexploded ordnance (UXO) problems date back to the end of World War II, but mines were not heavily used in this region until the 1960s and 1970s. During this period, the central Iraqi government attempted to subdue Kurdish demands for autonomy through the use of mine warfare.

Iraq invaded Iran in 1980 over territorial disputes. The Iraqis were pushed back to their borders in 1982; and in 1983, the Iranians and their Pesh Merga allies occupied parts of Iraq. From 1983 to 1988, the Iran/Iraq War was characterized by large-scale attacks against entrenched, heavily fortified, and mined positions on both sides of the border. Both countries used mines extensively along their common border. Additionally, Iraq used mines extensively in the northern regions of the country to curtail internal dissident activities.

In 1990, just two years after the end of the war with Iran, Iraq invaded Kuwait. The January through March 1991 air and land war led by the United States (US) and coalition forces ousted Iraqi forces from Kuwait, restoring the sovereignty of the Republic of Kuwait. The Gulf War severely damaged Iraqi industry, public services, and military capabilities. Because of military operations during this conflict, land mines and UXOs are found throughout Iraq.

Since the Gulf War, the country of Iraq is basically divided into two regions. The government of Iraq effectively controls all of southern and central Iraq, while the Kurds control northern Iraq.

Mines in the Iraqi inventory include a wide variety of antipersonnel (AP), antitank (AT), and illumination/ signal mines. Of note, some of these mines are designed to thwart detection and disarming. For example, the SB-series of scatterable mines contain antihandling devices, are blast-resistant, and are nearly nondetectable by metallic or ferrous mine detectors.

The blast-resistant and magnetic influence-fuzed, AT, scatterable mines are sophisticated and are indicative of the potential of the mine threat worldwide.

The land mine threat from a country such as Iraq is serious. The enormous and diverse inventory, which includes blast-resistant, magnetic-fuzed, antidisturbance, and nondetectable mines can seriously degrade offensive mobility. The land mine threat must always be considered within the context of integrated obstacles, to include trenches, wire barriers, fences, and possibly berms—all of which may be covered by direct and indirect fire.

Chapter 2

The Use of Mines and Explosive Hazards in Iraq

MINE AND EXPLOSIVE HAZARD THREATS IN IRAQ

Iraq is one of the most heavily mined nations in the world. It is estimated that there are over 10 million mines already in the ground—8 million antipersonnel (AP) and 2 million antitank (AT). Iraq produces and exports AP mines. It remains the only known mine exporter in the world that has not instituted a ban on the exportation of mines.

Although Iraq produces its own mines, the vast majority of mines employed in Iraq are imported. It is possible to find in Iraq almost every variety of mine manufactured around the world. Five minefield types are typically found in Iraq. They are—

- **Nuisance minefields.** They are randomly emplaced and lack a discernible boundary or pattern.
- **Protective minefields.** They normally surround defensive positions and are generally placed in a linear pattern. The size of a protective minefield depends on the size of the position they are defending. Protective minefields normally contain AT and AP mines.
- **Defensive (tactical) minefields.** They are used to restrict and disrupt the movement of enemy forces. Unlike protective minefields that are placed close to defensive positions and covered by light weapons, defensive minefields are normally emplaced some distance from the Iraqi defensive positions. Iraqi engineers

normally lay defensive minefields and follow strict doctrine.

- **Restrictive minefields.** They are used to protect the Iraqi flanks and influence axes of attack. The placement of restrictive minefields is determined by senior Iraqi officers, and the minefields are laid by engineer units. Normally, restrictive minefields are very large.
- **Phony minefields.** They are normally emplaced to support withdrawal operations or between live minefields.

Land mines and unexploded ordnances (UXOs) are known to be concentrated in the northern Kurdish region, southern Iraq, and the area along the borders of Iran, Kuwait, and Syria. Explosive hazards are commonly found near water sources and in rural farmlands. Iraqi forces have not restricted their mining activities to the border areas and have emplaced mines throughout the northern region, such as Penjwin. In addition, the region near Basra in the southeast is heavily mined.

More than 25 different types of mines have been identified in the northern region. These include metal AT mines (such as the Soviet TM62-series) and low-metal, plastic-cased, Italian mines (such as the TS- and VS-series). The most common AT mine in Iraq is probably the VS-2.2. AP mines (blast and fragmentation) are found above and below ground. The most common AP mines are the Valmara 69 bounding mine; the POMZ-2 stake mine; and the VS-50, low-metal, blast mine.

In the years prior to, during, and after the Iraq/Iran war, the Iraqi armies laid millions of mines in the north to control and restrict the movement of the Kurdish population. Almost all of these minefields are still in place today.

NOTE: According to the United Nations (UN), many of these mines and minefields are still unrecorded and unmarked.

Booby traps, such as 20-liter steel drums filled with napalm attached to trip wires, have also been identified. These drums are buried, leaving only the upper portion of the device exposed, and connected to a series of bounding mines. The current condition of these improvised mines is unknown.

Some humanitarian demining has taken place in northern Iraq, but the border with Iran and Kuwait has remained virtually uncleared. Unlike minefields in the north, minefields in the south are mainly protective and defensive in nature. Most of the minefields in southern Iraq follow a very strict doctrine similar to the basic laying, recording, and reporting doctrine that North Atlantic Treaty Organization (NATO) forces have used for years. There may be cases of shallow-water mines being used in the waters along the southeastern coast of Iraq.

In late 1990, Iraq invaded Kuwait over disputed ownership of oil-rich lands. This belligerent action by Iraq was responsible for the start of the Gulf War. In addition to the mine threat already in place before the Gulf War, the Iraqi military emplaced millions of additional mines to deter movement of coalition forces. The Iraqi military extensively used scatterable AP mines (VS-50) against coalition forces. These mines, green or sand-colored, contain very little metal and are very difficult to detect. They may be partially or completely buried under shifting dust or sand. Most are made of plastic and colored to match the surrounding surface. After extended periods under the sun and weather, the mine color will change to a more neutral color and will blend into the surrounding ground. These mines are extremely difficult to see and will be highly sensitized and even more dangerous as they age. Since the end of the Gulf War, the Iraqi government has continually refused to allow UN humanitarian demining efforts within the southern half of the country, so it is impossible to accurately estimate the density and efficacy of existing minefields.

Generally, the presence of UXO indicates a former battleground. Most battle areas were mined, so it is possible to encounter two threats at the same time– mines and UXOs. During the Gulf War, coalition forces used cluster bomb submunitions during the air campaign that preceded the ground war. These munitions have a high failure rate and constitute a significant UXO threat that continues today. The cluster bomb casing and internal storage elements will fall to the ground either ahead of or beyond the danger area where the cluster bomblets are released, depending on the weapon. Unexploded submunitions constitute significant danger to friendly forces and are just as dangerous as mines. If encountered, the cluster bomb case provides a good indicator that unexploded submunitions may be located nearby.

WARNING

Do not touch or move a UXO. The reasons for ordnance failure are many, but once fired or thrown, the fusing system will likely activate, making the ordnance unstable for handling. If the round did not function initially, any subsequent stimulus or movement may trigger the UXO to function.

IRAQI MINEFIELD DOCTRINE

Iraqi forces employ the following tactics, techniques, and procedures:

- Iraq uses minefields as the primary means to channel and concentrate enemy forces into prepared kill zones.

- Minefields are used, instead of ambushes, in security and operational zones to harass, interdict, and cause attrition of enemy forces.
- Minefields employed by Iraqi forces include five basic types—nuisance, protective, defensive, restrictive, and phony.
- When fire coverage is not feasible, the minefield will be deep and made difficult to penetrate by employing AP mines, antilifting devices, and obstacles (such as wire entanglements, tank traps, earth berms, field-expedient flame obstacles, and flooding).
- Iraqi doctrine does allow for the use of mixed AP and AT minefields but does not allow the mixing of different fuze types in a single minefield.

OFFENSIVE AND DEFENSIVE MINEFIELDS

In Iraqi doctrine, the purpose of a minefield is to impede, delay, and disrupt enemy advance, to channel enemy forces into predetermined kill zones, and to cause attrition of enemy forces. Iraqi forces will employ mines on the most probable direction of enemy attack to the entire depth of the defense, covering the defending force flanks and gaps between friendly units. Instead of ambushes, minefields are used in security and operational zones to harass, interdict, and cause attrition of enemy forces. The amount of time available, the type of enemy force, the availability of mines, and the mine-laying equipment available dictates minefield density and mine placement.

As a defensive technique, Iraqi minefields are covered by direct and indirect fire and are supplemented by wire entanglements (Figure 2-1, page 2-6), tank traps, earth berms, and possibly field-expedient flame obstacles, such as trenches filled with fuel or oil with command-initiated igniters. Iraq has been known to augment the canalizing effect of its minefields with flooding.

Figure 2-1. Iraqi Wire Obstacles Constructed in Kuwait

Iraqi forces may employ a mixed minefield, such as AT, AP, or a combination of AT and AP minefields. The five basic types of minefields employed by Iraqi forces include—

- Nuisance (also referred to as harassment and disruptive).
- Protective.
- Defensive.
- Restrictive (also referred to as screening, barrier, and obstructive).
- Phony (also referred to as false and dummy).

NUISANCE MINEFIELDS

Nuisance minefields may be employed by Iraq in front of defensive positions; however, the primary use is along withdrawal routes. The purpose of nuisance minefields is to delay, disrupt, or confuse the enemy.

The minefield may or may not be covered by fire but will most likely include a variety of mine types equipped with antihandling devices and booby traps.

According to Iraqi doctrine, the harassment minefield is the only type of minefield that does not require marking;

however, the minefield is registered and will remain under observation by the unit planting the mines until their forces depart the area.

PROTECTIVE MINEFIELDS

Protective minefields—

- Impede and slow an enemy attack.
- Provide an opportunity for a counterattack.
- Channel the enemy attack toward a specific defensive position.
- Provide early warning of an enemy forward movement and reconnaissance.

This type of minefield is laid in front of units on the probable axes of an enemy attack and may be employed by Iraqi forces deep in enemy territory. In rear slope positions, the minefield and barbed wire will be located behind the lines of the peak. The minefields are located within protective range of small-arms fire and may be covered by AT weapons fire, artillery fire, patrols, screens, and surveillance. To camouflage a protective minefield and have it blend in naturally with existing terrain, the mines are planted and covered individually by hand.

Iraqi doctrine calls for marking and providing safe corridors through all protective minefields that are located near Iraqi defensive positions.

DEFENSIVE MINEFIELDS

Defensive minefields are laid according to the division plan to prevent penetration of defensive positions against armor and to reinforce defensive positions. Defensive minefields are laid in front of defensive positions. The minefield is within the range of the division's medium weapons, such as mortars, AT weapons, and antiaircraft guns. In the event that the minefield is located beyond the range of medium weapons, it is covered by artillery fire.

Mines employed in the defensive minefield may be equipped with antilifting devices, warning flares, and booby traps and will be monitored by patrols and screens (Figure 2-2). Regardless of how the minefield is laid, Iraqi doctrine states that the minefield must be well-marked.

Figure 2-2. Trip Flares and Bounding Fragmentation Mines on the Enemy Side of Iraqi Minefields

RESTRICTIVE MINEFIELDS

Restrictive minefields are laid to repel a hostile attack against the flanks of formations by changing the direction of enemy attack and by channeling the enemy toward selected kill zones where they would be exposed to heavy, dense weapons fire.

When used in deep defensive positions, restrictive minefields can be located forward, on the flanks, or in the rear when they are employed within the depth of a defensive position.

Restrictive minefields remain under observation by Iraqi forces and will be covered by fire whenever possible. When fire coverage is not feasible, the minefield will be deep and made difficult to penetrate by employing AP mines and antilifting devices. It will be supplemented by wire entanglements, tank traps, earth berms, and possibly, field-expedient flame obstacles (such as trenches filled with fuel or oil with command-initiated igniters).

The minefield will be well-marked; however, if surprise is a factor, the mines are planted manually to allow for better camouflage. If the primary purpose for the minefield is to influence enemy lines of communication (LOC), the mines may be planted mechanically and not camouflaged.

PHONY MINEFIELDS

Phony minefields are used to deceive enemy forces into believing that a given area is mined. They are set up to resemble other minefields and may be used as openings between positions and between real minefields. Phony minefields are marked in the same manner as live minefields and are observed and covered by fire. According to Iraqi doctrine, live mines are not planted in phony minefields. The concept of "false" or "dummy" minefields is taught in Iraqi doctrine; however, none have been observed or confirmed.

AIR ASSAULT AND AIRBORNE LANDING ZONE MINEFIELDS

Iraqi forces may emplace directional fragmentation mines in likely helicopter landing zones and in potential airborne, air assault, or special operations forces landing areas.

SCATTERABLE MINES

Iraqi ground forces will likely use scatterable mines beginning at the distant approaches to the defense.

Using multiple rocket launchers or other delivery means, remote mining will be conducted at the start of an enemy attack, in front of the forward edge of the battle area (FEBA), on the lines of commitment of follow-on forces, and in the direction of the enemy's penetration.

MINEFIELD DIMENSIONS

Iraq has not established doctrinal standards for the dimensions of its operational minefields; however, standards do exist for model and training minefields. Minefield dimensions are determined by existing conditions, such as terrain features, available troops, mines and obstacle equipment, time, and the enemy situation.

In a typical Iraqi minefield, the first line of mines is arranged in groups of four and located at least 18 meters behind the wire boundary facing the enemy (Figure 2-3). Each cluster of four mines is T-shaped, with the mines spaced 3 meters apart. The group of mines may be spaced to form a zigzag pattern, sometimes called a staggered linear formation. The first line of mines is trip wire-fuzed with 6 yards of wire attached to stakes that run parallel to the barbed wire. The mines will detonate when the wire is disturbed. The second line is at least 18 meters behind the first line and arranged in a similar manner. At least 18 meters behind the second line is the encircling barbed wire. AT minefields are arranged in the same manner; however, the centerline of the T-shaped arrangement is placed toward the enemy in a staggered linear formation and located 18 meters from internal mines.

MARKING MINEFIELDS

It has been Iraqi policy to mark most minefields thoroughly. Exceptions are nuisance and scatterable

Figure 2-3. Typical Mine Cluster With a Single AT Mine (VS-2.2) and Three AP Mines (Type 72)

minefields. Unmarked minefields remain under the observation of the Iraqi unit that planted the minefield until its forces clear the minefield. Iraqi doctrine calls for accurate marking of all other types of minefields when they are planted. Each headquarters that issues an order to plant a minefield is responsible for marking, registering, and reporting the minefield location to the next higher headquarters.

The marking of minefields is carried out by using barbed wire or having the minefield correspond to clearly defined obstacles, such as planted hedges, edges of roads, edges of forests, streams, and so forth.

IRAQI LAND MINE WARFARE DURING DESERT STORM

Iraq, following its invasion of Kuwait, quickly demonstrated what could be accomplished with the rudimentary basics of mine warfare equipment and manual labor. This was accomplished by what was essentially an army of a third-rate country using a hodgepodge of former Soviet- and western-based engineer doctrines. Its application of land mine warfare techniques was in conjunction with a carefully thought-out and orchestrated plan for engineer preparation of the battlefield. Land mines actually emplaced by Iraqi forces before the Gulf War are presented in Table 2-1.

Table 2-1. Types of Mines

AP Mines	AT Mines	Illumination Mine
VS-50	VS-1.6	VS-T
Valmara 59	VS-2.2	
Valmara 69	L9A1 Barmine	
P-25	TM-46	
P-40	TM-57	
TS/50	TM-62M	
PMN	Type 72	
Type 72	PT-MI-BAIII	
PRB M409	MAT 76	
MON-50	PRB M3	
MON-100		

Iraq employed conventional wisdom in denial operations. Any adversary, with time on his side, could have created the same defensive plan. The integration of land mines and barriers created a formidable obstacle to coalition operations. Iraqi combat engineers were effective during the build-up period. Drawing upon years of practical experience and a huge inventory of land mines, they fortified both the Kuwaiti coastline and the Saudi border with over 400 kilometers of explosive obstacles. Iraqi minefields, containing more than 3.5 million land mines, were complemented by an array of other obstacles, such as fire trenches, berms, and concertina entanglements. Iraqi forces intended to slow an allied advance and channel it into kill zones, allowing Iraqi reserve units additional time to react to allied movements.

In past practice, this defensive scheme served the Iraqi force well. However, during operations in Kuwait, the Iraqi military was forced to violate a basic tenet of defensive operations. They were unable to cover the obstacle complexes with effective fire (direct or indirect). If the Iraqi forces had been able to cover their defensive lines, the minefields along the border could have greatly complicated any direct breaching of Iraqi-fortified zones. Additionally, the Iraqi forces lacked a suitable terrain feature in western Kuwait with which a minefield could be anchored. This allowed coalition forces greater maneuver options. Lastly, had the obstacle plan been rapidly emplaced within days, using their scatterable and mechanically emplaceable land mines, the allied offensive may have been required to reduce the minefields and obstacle complexes “in stride” without the advantage of months of prior planning.

Chapter 3

Countermine Predeployment and Sustainment Training

Before deploying and once in Iraq, units should conduct mine and unexploded ordnance (UXO) awareness training. They should focus on countermine and counter booby trap refresher training as part of their mission readiness preparation. This training should include—

- Familiarization with the mine threat, typical mine emplacement techniques and tactical purposes, known minefield locations, mine and minefield indicators, minefield markings, reaction to mine strikes (both mounted and dismounted), and first aid. Training should be provided by qualified trainers in the unit, countermine subject matter experts (SMEs), or the Countermine/Counter Booby Trap Center (CMCBTC), Fort Leonard Wood, Missouri.

NOTE: Mine awareness training is not solely mine recognition.

- Navigation skills for all vehicle commanders, using global positioning systems (GPSs), maps, and compasses.
- Convoy and patrol reaction to suspected mined areas, UXO, and booby traps (BTs). Additionally, leaders must know how to respond to improvised explosive devices (IEDs).
- The proper use of handheld metal detectors—the AN/PSS-12, the F1A4, and the Handheld Standoff Mine Detection System (HSTAMIDS), as appropriate, to support route and area clearance operations and mine strike extraction.

- Area clearance tactics, techniques, and procedures (TTP).
- The use of available clearance tools, including the Panther, mine plows and rollers, mine clearing/armor protection (MCAP) dozers, mine detection dogs (MDDs), flails, and miniflails. Training should include leader familiarization with—
  - Nonstandard countermine tools.
  - Organization, training, and deployment of rapid-response, mine strike extraction teams.
  - Medical evacuation (MEDEVAC) procedures.
- Route clearance operations and TTP using—
  - Commercial, off-the-shelf countermine equipment (mine-protected vehicles, interim vehicle-mounted mine detectors [IVMMDs], the Panther, and MDDs).
  - Mission table(s) of organization and equipment (MTOE) items (mine plows and rollers and handheld mine detectors).
- Methods of breaching complex obstacles, including berms and trenches filled with water and shallow-water mines. Training must include employment and organization of standard breaching assets, including mine plows and rollers, the Panther, mine clearing line charges (MICLICs), and MCAP dozers.
- The integration of combined arms assets for area and route clearance operations and countermine operations in an urban environment. Countermine operations are a combined arms function requiring the integration of intelligence, maneuver, mobility, survivability, and combat service support (CSS) assets to accomplish the mission. Leaders must plan,

organize, rehearse, and execute countermine operations using all available assets. For example, leaders should integrate the expertise of the explosive ordnance disposal (EOD) teams into mine situational exercises and training, the clearance of military operations on urbanized terrain (MOUT) or rubbled buildings, and minefield extraction drills.

Chapter 4

Countermine Mission Planning/ Preparation

INTRODUCTION

Mine strikes are sudden, violent, and often fatal. Mines that are well-placed by competent adversaries will give no indication of their presence. Constant shifting of sand within the southern and desert regions will conceal mines that were once surface-laid. Northern Iraq has extreme temperature changes with heavy snowfall and rain. This causes the earth's surface to expand and contract, pushing the mines to the surface. Once surfaced, snowmelt and heavy rains move the mines downstream from where they were originally laid. Comprehensive mission planning, coupled with rehearsals, will significantly reduce the likelihood of a mine strike and could minimize the effects of one.

MISSION PLANNING

- Establish boundaries of known mined areas and minefields. Obtain the latest minefield data maps. Avoid these areas if possible.
- Confirm the latest intelligence on enemy activity in the operating area. Consult psychological operations (PSYOP), civil affairs, and special operation forces (SOF) liaisons to obtain mine threat information from the indigenous population.
- Identify and familiarize leaders with enemy methods of mine warfare, minefield patterns, and likely ambush sites or tactical use of mines,

booby traps (BTs), and improvised explosive devices (IEDs).

- Confirm radio call signs and frequencies for explosive ordnance disposal (EOD), medical evacuation (MEDEVAC), and engineers, including army, joint, and coalition forces.
- Rehearse nine-line MEDEVAC and unexploded ordnance (UXO) procedures.
- Limit travel, if possible, through known mined regions to daylight hours unless the route is regularly secured and proofed by friendly forces.
- Coordinate with the Intelligence Officer (US Army) (S2), Assistant Chief of Staff, G2 (Intelligence) (G2), PSYOP, civil affairs, and SOF elements for current or focused mine intelligence.
- Plan countermine rehearsals into premission planning and time allocation before deployment.
- Plan mine strike reactions for both mounted and dismounted scenarios.
- Rehearse complex obstacle breaching drills, including clearing areas of shallow-water mines.

NOTE: Ensure that combat lifesavers (CLs) or medics are included in the mission task organization.

PERSONNEL PREPARATION

- Ensure that all personnel have current mine awareness training. Complacency kills.
- Ensure that Kevlar helmets and vests are serviceable and properly fastened and worn.
- Replenish and carry individual first aid kits.
- Carry a personal extraction kit. As a minimum, each individual should carry the following expedient equipment:
  - Fifty markers, pins, poker chips.

  - A trip wire feeler.
  - A probe, screwdriver, bayonet.
- Rehearse extraction drills for both mounted and dismounted scenarios.

VEHICLE PREPARATION

- Ensure that each vehicle has an extraction kit that includes the following items:
  - Markers, spray paint, chalk dust, poker chips.
  - A trip wire feeler.
  - Probes, grapnel hooks with rope.
  - A pencil and a notebook.
  - String and marker tape.
  - Medical bandages and pads.
  - A full water bottle.
  - Expedient minefield and mine marking materials (picket posts, picket pounders, barbed wire, mine signs).
  - Sandbags and Kevlar blankets.
  - A camera and binoculars.
  - A Global Positioning System (GPS), maps, and a compass.
  - Current minefield and obstacle overlay maps (dirty battlefield overlays).
  - A tow chain, bar, rope.
  - Basic-issue items (BIIs), such as fire extinguishers and equipment. Ensure that extinguishers and equipment are securely tied down inside and out to prevent the items from becoming missiles during a blast.
- Ensure that there is a metal detector with fresh batteries, if available, in every second vehicle.

- Ensure that armored vehicles have the top hatches open, with the hatch pins in to mitigate blast pressure effects.
- Ensure that there is a complete CL bag within the convoy. Include additional major trauma items for bleeding, puncture, and loss-of-limb wounds. Ensure that the items are not out of date.
- Ensure that there is a stretcher in every second vehicle.
- Ensure that vehicle radios work and that long-range communications tests are conducted.
- Ensure that the engineer vehicle has—
  - Hand-emplaced minefield marking set (HEMMS) poles.
  - Materials to mark shallow-water mines (highly visible string, fluorescent paint, highly visible flotation devices, five 8-ounce nonmetallic anchoring devices).
  - Materials to mark shallow-water breach sites (highly visible floating rope).
  - Enough modernized demolition initiator (MDI) (waterproofed, if necessary) to conduct hasty in-stride breaching or route clearance operations.
  - At least two complete improved body armor sets, individual, countermine (IBASIC) personal protective equipment suits, including helmet visors.
- Ensure that vehicle floors are sandbagged, as appropriate (the additional weight may affect vehicle handling).
- Ensure that seat belts are operational and available for use.

EQUIPMENT

- Ensure that metal detectors are operational, tested, and have fresh batteries.
- Ensure that there are spare (fresh) batteries for the handheld metal detectors.
- Ensure that spare radio batteries are carried.
- Ensure that there are slave cables in every convoy to jump-start vehicles.
- Ensure that there are VS-17 panels and red smoke to mark helicopter landing zones (LZs).
- Ensure that glint tape is affixed on top of Kevlar helmets to protect dismounted soldiers from friendly air attack.
- Ensure that engineers have complete demolition bags, sledgehammers, and picket drivers.
- Ensure that load plans and equipment checklists are available.

PRECOMBAT CHECKS AND INSPECTIONS

The following precombat checks (PCCs) and precombat inspections (PCIs) (Figures 4-1 through 4-3, pages 4-6 through 4-9) are not meant to replace the unit's current PCCs and PCIs, but to supplement them.

Date:			
	GO	N/A	Remarks
Mission Planning			
Obtain minefield data and maps			
Confirm intelligence on enemy activity			
Brief leaders on enemy mine TTP			
Confirm radio call signs, frequencies, EOD, and MEDEVAC			
Rehearse MEDEVAC procedures			
Rehearse UXO procedures			
Plan routes			
Obtain mine intelligence (S2, G2, PSYOP, CA, SOF)			
Plan countermine rehearsals			
Plan mine strike reaction drills			
Rehearse complex breaching drills			
Coordinate with CLs and medics			

Figure 4-1. Mission Planning Checklist

Date:			
	GO	N/A	Remarks
Personnel Preparation			
Personnel trained on mine awareness			
Kevlar helmet is serviceable and fitted			
Glint tape is available for the top of the helmet			
Kevlar vest is serviceable and fitted			
First aid kit is complete			
Personal extraction kit is in the vehicle along with 50 markers, trip wire, a feeler, and a probe			
Pencil and notebook are in the vehicle			
Extraction drills are rehearsed			

Figure 4-2. Personnel Preparation Checklist

Date:			
	GO	N/A	Remarks
Vehicle Preparation			
Vehicle BIIs			
Equipment securely tied down			
Seat belts operational			
Tow chain and bar			
Vehicle extraction kit			
Markers, spray paint, chalk dust, and so forth			
Trip wire feeler			
Probes and a grapnel hook with rope			
Pencil and notebook			
String and marker tape			
Extra medical bandages and pads			
Full water bottle			
Minefield and mine marking material			

Figure 4-3. Vehicle Preparation Checklist

Date:			
	GO	N/A	Remarks
Vehicle Preparation			
Sandbags and Kevlar blankets			
Mine detector with batteries			
Camera and binoculars			
Armored vehicles have the top hatch open			
CL bag			
Stretcher			
Radio/long-range communication check			
GPS, maps, and a compass			
Minefield and obstacle overlays			
Load plans and equipment checklist			
Engineers			
HEMMS poles			
Material to mark shallow-water mines			
IBASIC, two sets, complete			
MDI, waterproofed			

Figure 4-3. Vehicle Preparation Checklist (Continued)

Chapter 5

Conduct of Operations

Plan convoy and patrol movements carefully to avoid exposing troops to unnecessary mine risks. Consider the following during the operation:

- Regard all routes as mined until known to be cleared when operating in unfamiliar areas. Though the use of an uncleared route may significantly reduce travel time, the danger to men and materiel is too great.
- Avoid roads covered with snow (northern Iraq) and other debris or those with no visible vehicle tread marks.
- Stay in uniform at all times. Wear flak vests and helmets with the chin straps fastened to minimize mine strike injuries.
- Never leave a well-marked and traveled route or a hard-surface route.
- Approach bridges, culverts, and road bypasses with extreme caution because they are often mined.
- Ensure that patrols and convoys closely track their location on the map. Ensure that they travel with a navigational aid, such as a Global Positioning System (GPS), and call in their location every 15 minutes.
- Maintain radio contact with higher headquarters in the event of a mine strike. It is very unlikely that radio transmissions will set off other mines.
- Vehicles should remain as far apart as tactically feasible (at least 35 to 50 meters apart based on the terrain).

- Maintain a distance of 15 to 25 meters during dismounted movement. This reduces the possibility of multiple casualties during a mine strike.
- Ensure that each patrol has two combat lifesavers (CLs) with complete CL bags.
- Assign specific personnel within the convoy (one per vehicle) or patrol to watch for mines or mine indicators.
- Use translators to contact local friendly guides to assist in movement through minefields.

Chapter 6

Mine/Explosive Hazard Indicators

MINE INDICATORS

When mines are properly laid and camouflaged, it is extremely difficult, if not impossible, to visually locate a mined area. Highly trained and alert soldiers will significantly improve the chances of safely executing missions in and around mined areas. Aerial detection may assist in locating mounds, clumps of disturbed soil, or other indicators of mining activity. Mine detection dogs (MDDs), if available, will also assist in the location and reduction of mines and unexploded ordnance (UXO). Follow the five key fundamentals listed below to improve the chances of successfully detecting and avoiding mines, UXO, booby traps (BTs), and improvised explosive devices (IEDs).

- **Evaluate the terrain.** Think how you would employ mines to shape the battlefield or create casualties given the terrain on which you are fighting. Understand the terrain and how your adversary would shape the terrain to support his scheme of maneuver or inflict casualties.
- **Understand how the enemy fights.** Familiarity with the history of the conflict; the threat doctrine; mine usage and emplacement techniques; and threat force, coalition, or United Nation (UN) minefield records will help to identify likely mined areas and how the mines were employed.
- **Identify local improvised mine and minefield indicators.** Not all armies or belligerents mark their minefields, and many non-first-world countries rely on improvised

devices to mark minefield locations and hazard areas. Many local factions, militia, or military units will lay mines and mark them with readily available materials rather than formal marking methods adhering to a doctrine. These markings are generally used to warn their own troops and local civilians of the presence of mines. Friendly units operating in these environments must know and understand these markings.

- **Recognize natural mining indicators.** With the exception of stake mines and the majority of directional fragmentation mines, most hand or mechanically laid mines are buried. Once the natural surface of the ground is disturbed following burial of a mine, nature usually has a way of showing where this event took place. Unusual erosion or dead animals are vital clues to alert soldiers of possible mines in the area.
- **Use all detection assets available.** Predicting where mines are emplaced, detecting or avoiding them, and reducing or clearing mined areas is a combined arms issue. Use all of the assets available to focus resources to find and avoid mined areas or to develop intelligence and fidelity about mined areas that must be traversed. Seek mine intelligence collected by intelligence specialists, special operation forces (SOF), psychological operations (PSYOP), civil affairs, and so forth; and distribute this information to military planners and patrols to complete the common operational picture. Remember, if you discover intelligence about the mine threat, report it to enhance force mobility and protect the force.

The only notice you may have that mines are present is when someone spots a mine or a person or vehicle detonates a mine. Relying on visual inspection of an area or route to locate mines and explosive hazards is problematic and should not be relied upon as the primary method to locate these hazards. Visual inspection and alertness may work for UXO that resides on the surface but are not sufficient to locate buried land mines. Soldiers must be taught to be alert for signs of anything out of place or unnatural as they maneuver through an area. If a soldier sees something that arouses his interest, the patrol must stop, assess the indicator, and then look for other indicators to either confirm or deny the suspicious area before continuing or taking further action. In most cases, it will be difficult to decide if you are in a mined area or on the safe side of a minefield. Determining what to do next is a function of the mission, the time available, the resources on hand, and the tolerance for casualties.

NOTE: This is probably the most important element of mine awareness training.

CATEGORIES OF MINE INDICATORS

Mine indicators are loosely grouped into three categories. These categories include—

- **Man-made indicators.** Indications of human activity or the use of conventional mine marking systems or materials.
- **Improvised markings.** Deliberate marking of mines using naturally available materials, such as rocks or tree limbs.
- **Natural indicators.** A change in the natural environment of the ground and vegetation after mine action has taken place, including differences in the color of vegetation or areas absent of vegetation when compared to the surrounding environment.

MAN-MADE INDICATORS

In some of the southern areas of Iraq, the Iraqi military used wooden stakes attached to barbed wire with red rectangular signs to mark mined areas. By doctrine, red rectangular mine sign spacing was not to exceed 50 meters. Two white stakes at the entrance lane and three red stakes at the exit lane delineate the entrance and exit locations for passage lanes through the minefield. Red and white metal arrows are also used to mark the passage lanes. Conventional markings of Iraqi minefields include—

- **Friendly sides of the minefield.** Metal stakes 10 to 15 meters apart with two strands of barbed wire, 4 feet off the ground, with red rectangular metal signs.
- **Enemy side of the minefield.** A single strand of barbed wire attached to short, metal stakes, not more than 1 foot off the ground.

The Iraqi military also uses small trees as fixed posts to attach barbed wire to mark their minefields. The following list provides examples of some of the known and possible indicators of mine, UXO, and IED activity:

- Red rectangular or triangular signs with a written warning on one side. Signs are placed on posts or wire with the writing visible on the safe side. If you can read the writing, you are generally on the safe side and have not yet entered the minefield. (Refer to Figures 6-1 and 6-2, page 6-5, and Figure 6-3, page 6-6.)
- Ongoing UN minefield clearance operations are delineated with wooden posts with red and white tops.
- Triangular metal or cloth signs with a picture of a mine strike victim.
- Dead bodies with wounds to legs and arms.
- Blown-up vehicles on or near roads or paths.

Figure 6-1. Mine Sign

Figure 6-2. Perimeter Fence Marking a Minefield

Figure 6-3. Mine Sign Indicating Mined Area

- Mine debris, to include mine shipping boxes, shipping plugs, and safety pins.
- Unattended vehicles, trailers, or boxes along the side of the road. These indicators may represent an IED or booby trap threat. Be alert for electric wires, detonating cord, or a shock tube running down from these devices to the roadside. Cables or command detonation architectures are sometimes buried, so look for disturbed soil in lines running up to the road and away from the suspect area.
- Circular patches of new brickwork, plaster, mud or brick on walls along the side of roads or trails may indicate that IEDs or booby traps are hidden in the walls lining roads, footpaths, or thoroughfares.
- Routes, trails, and fields avoided by the locals. Stay out of overgrown fields and pastures next to cultivated and frequently used areas.

- Abandoned buildings, piles of wood, or building or farming materials not claimed by the locals.
- Trip wires or any low-hanging wires.
- Signs of digging in or near the road surface, to the side or shoulder of a road, or in the ground. These may indicate mine, booby trap, or IED emplacement. Digging may include solitary holes or a series of holes to support a particular explosive pattern at tactical or key locations.
- Battle positions, trenches, destroyed buildings. Assume that all are mined or booby-trapped.
- Small shiny metal plates, split lightweight bomb casings, and empty cluster bomb canisters are all indicators of cluster bomb strikes or scatterable mine attacks. Small parachutes or drogues from submunitions.
- Mine craters.
- Metallic devices on the road surface (used to confuse mine detector operators).
- Signs of concrete or asphalt removal on improved roads.
- Burned fields (Figure 6-4, page 6-8) indicating UN mine clearance operations (northern Iraq).
- Parked vehicles or bicycles without operators (possible booby trap).

IMPROVISED MARKINGS

Most original wooden minefield marking stakes emplaced by the Iraqi army or the UN have been removed and used by the local nationals for cooking fires. The local nationals began using improvised marking materials, including stones and rocks, to replace wooden stakes. The following is a list of improvised marking devices that serve as indicators that minefields or UXO is present.

Figure 6-4. Burned Fields

- Rows of light-colored or white-painted rocks. The rocks are usually in regular patterns and close together (Figure 6-5).

Figure 6-5. Stacked Rocks

- Rock piles or individual rocks that are painted red (Figure 6-6). These are UN, threat army, or local-faction danger area markers.
- Red lettering or marks painted on rock faces or building walls (Figure 6-6). UN demining

Figure 6-6. Painted Rocks

reference markers include start point signs denoted by "SP," reference point signs denoted by "RP," and bench mark signs denoted by "BP." Minefields will be close to these markers.

- Circles of stones surrounding objects (Figure 6-7). These are signs used by locals to mark individual mines and UXO. Where there is one mine or explosive hazard, there are usually more.

Figure 6-7. Rocks Laid in a Circle Marking a Mine

- Crossed sticks and collections of debris on routes and footpaths.
- Pieces of cloth and metal material attached to poles, sticks, and walls.

NATURAL INDICATORS

Once a mine is armed and buried, it is very difficult to replace the soil to the same density, pattern, or condition of the surrounding soil and vegetation. Soldiers must know how to recognize unusual ground or vegetation conditions that might indicate mine laying. Indicators include—

- Dead or injured animals with missing or damaged limbs (Figure 6-8). **NOTE: The animal may have walked several miles before dying.**
- Depressions in the ground (regular or odd spacing).
- Raised patches of earth (regular or odd spacing).
- Wilting or dead patches of vegetation.
- Potholes in the roadway.
- Circles of lush grass among thin grass (Figure 6-9, page 6-12).
- Available trees and bushes not collected for firewood.
- Overgrown fields, footpaths, and buildings.

Figure 6-8. Unexplained Dead and Injured Animals

Figure 6-9. Land Mine in Uncut Grass Between a Plowed Field and Pathway

Chapter 7

Extraction Drills

INTRODUCTION

Whether mounted or on foot, soldiers may suddenly discover they have inadvertently entered a minefield. On confirmation of observed indicators or a mine strike, all personnel must stop exactly where they are. Commanders must immediately gain full control of the situation. Leaders should be aware that in many reported cases of mine strikes, soldiers have immediately started to run away from the hazard or tried to escape the minefield on their own. This is a normal response, but it will put the rest of the patrol in extreme danger. Additionally, soldiers must be trained to overcome the natural urge to immediately move to a casualty, as this can lead to additional casualties. Regular training on mine strike immediate action drills will help prevent these reactions from soldiers. Once all vehicles or the dismounted patrol has halted, the leader must report his situation to his higher headquarters (HQ) and then determine whether self-extraction from the minefield is warranted or whether he can remain in place for an assisted extraction. If the leader determines that self-extraction from the minefield is necessary, he must fully develop a plan taking advantage of the mine strike extraction training standing operating procedures (SOPs) already developed by the unit. While individual techniques for minefield self-extraction are fairly simple, the command and control of soldiers, vehicles, and equipment is more demanding.

SAFE AREA

The leader must designate a safe area where soldiers must orient their extraction efforts. A safe area is one that is known not to contain any mines. This is usually a hard-surface road or hard trail known to be free of mines or unexploded ordnances (UXOs). This may include any area that is regularly transited across by pedestrians or vehicles, or areas that are cultivated and used for agricultural purposes. The following acronym is used to remember the sequence of events for extraction:

- **S**top and gain control of yourself and the patrol.
- **A**ssess the situation of both the mines and patrol individuals.
- **N**ote the situation for future reference.
- **D**raw back to the last known safe area.
- **I**nform higher HQ of the situation.

LOOK, FEEL, AND PROBE DRILL

The look, feel, and probe drill is probably the safest individual extraction technique for exiting a mined area.

- **Look.** Without moving your feet, look all around you to include looking forward and to the sides for trip wires. Then look closely around your feet for signs of fuzes and mine parts, disturbed ground, or slack trip wires.
- **Feel.** Use your trip wire feeler and feel for trip wires to your front left, front center, and front right from along the ground all the way to head height. Feel all the ground around your feet with your fingers using a slow sideways sweep and feeling for exposed mine fuze prongs and other mine or UXO parts.
- **Probe.** Using any rigid, sharp, long, thin instrument, probe the ground in a regular pattern at a 30-degree angle. The probe should go in at least 3 inches, with no more than 1¼- to

2-inch spacing. The next row of probing is to be 2 inches toward the direction of travel. Probing should be as gentle as possible to achieve the desired depth. If the probe hits a solid object, the soldier must investigate the obstacle to identify if it is a mine or another explosive device.

Soldiers are to stay as far apart as is tactically acceptable during probing or movement within a minefield. A 25-meter distance between soldiers will reduce the effects of shrapnel from an accidental mine detonation by another soldier.

PROBING TOOLS

Probing tools can be made of any material as long as they are rigid enough to push through the soil condition, long enough to penetrate at least 3 inches at a 30-degree angle, and small enough that a soldier can continue a probing drill for several hours (Figure 7-1, page 7-4). Ferrous, nonferrous, magnetic, and nonmagnetic metal tools (such as bayonets, screwdrivers, penknives, and issued titanium probes) are perfectly suitable for this task. It is better to use a solid, metallic probing tool than to try and achieve the same success with a wooden twig or ballpoint pen casing that is often advised. There are mines that are fuzed to detonate on a magnetic signature; however, they are extremely rare.

TRIP WIRE FEELER

A trip wire feeler should be stiff enough to be held straight out to the front but not so stiff as to hit a trip wire without you being able to feel it. A trip wire feeler should be 2 to 3 feet long. It can be made of a light wooden rod or stick, light gauge wire, plastic rods, or anything else that will allow you to be able to feel a trip wire without engaging it. See Figure 7-2, page 7-4, for examples.

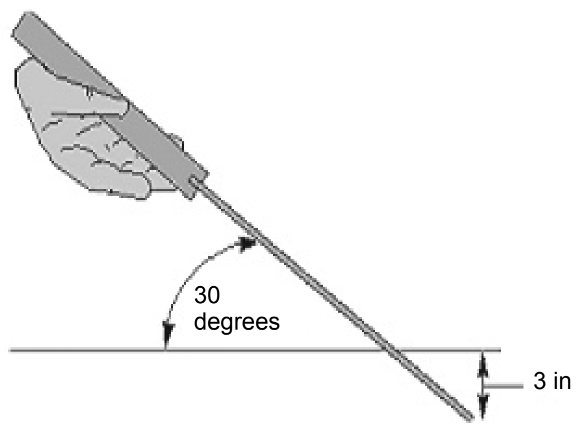


Figure 7-1. Probing Technique Using a Suitable Probe

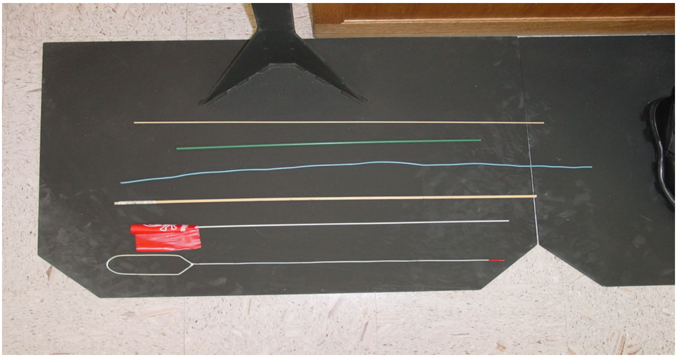


Figure 7-2. Trip Wire Feelers

ACTIONS (FINDING A MINE WITH A PROBE)

Most mines are plastic or metal-cased and give a distinct sound and feel when hit with a probe.

Excavation of the suspected object should start 3 inches back from the "hit." Using a bayonet or another excavating tool, dig down to the object depth and then slowly dig forward towards the side of the object. Digging action should be a side to side sweep rather than digging in a downward action.

If a mine is found, inform the commander. Do not dig around the mine—leave it as it is. Mark the perimeter of the suspected mine by placing a marker about 6 inches away from the explosive hazard itself, or use a mine bonnet. Continue probing in a new direction to continue the lane and avoid the suspected mine location.

MINEFIELD EXTRACTION (CONTACT WITH THE ENEMY)

Assault breaching of mine obstacles is covered in field manual (FM) 20-32 and unit SOPs. Commanders must assess the situation and direct soldiers to either continue the mission through the minefield or begin a minefield extraction while in contact. A mine risk assessment should be included in any formal estimates for combat missions.

MINEFIELD EXTRACTION (NO CONTACT WITH THE ENEMY)

The following tactics, techniques, and procedures (TTP) are relevant when patrols or soldiers not in contact with the enemy have mistakenly entered a minefield. These extraction drills are primarily for worst-case scenarios where metal detectors are not available and troops will have to rely on their own resources. The scenarios will cover extractions on foot, extractions where a casualty is involved, and extractions from a vehicle.

EXTRACTION ON FOOT

When footprints can be seen where a mine or trip wire has been detected and no casualties have occurred (Figure 7-3).

- Stop and immediately warn the rest of the patrol. Inform HQ of your situation. Help may be sent to you. If help is imminent, do not move. Wait until an extraction force arrives, and follow their directions.
- Consider directing each dismounted soldier to probe and clear an area around him large enough to accommodate himself and his equipment, if a long wait is expected.

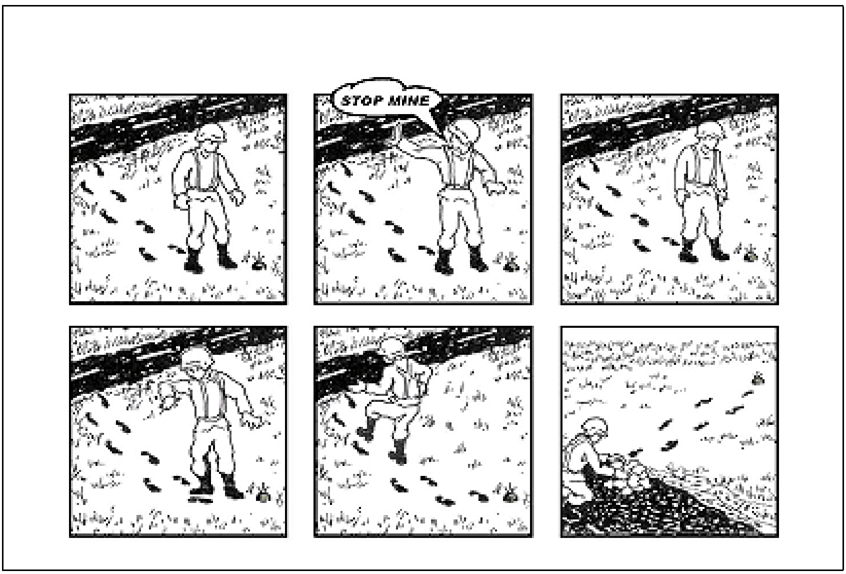


Figure 7-3. Footprints Seen (No Casualties)

If help is unavailable or communications with HQ is impossible, you must conduct your own extraction. Steps include the following:

- The commander or leader identifies the nearest or last-known safe area.
- The commander or leader instructs the soldier nearest the safe area (usually the last man of the patrol) to start following his footsteps back. Care must be taken to step exactly in the footprints already on the ground.
- Once the first soldier is more than 25 meters away from the trailing soldier, the second team member starts to follow his footprints back, moving toward the safe area.
- When the second soldier is 25 meters from the third soldier, the third soldier (when directed) moves toward the safe area and so on until all soldiers are extracted from the mined area. The commander must mark the mined area with any available materials, report the mined area location, and report how the area is marked to higher HQ.

When footprints cannot be seen where a mine or trip wire has been detected, no casualties have occurred, and your footprints cannot be easily identified (Figure 7-4, page 7-8)—

- Stop and warn the rest of the patrol.
- Inform HQ of your situation. Help may be available. If so, wait until the extraction force arrives and follow their directions. If there is a long wait, consider directing each dismounted soldier to probe and clear an area around him large enough to accommodate himself and his equipment.

If help is unavailable or communication with HQ is impossible, you must conduct your own extraction. Steps include the following:

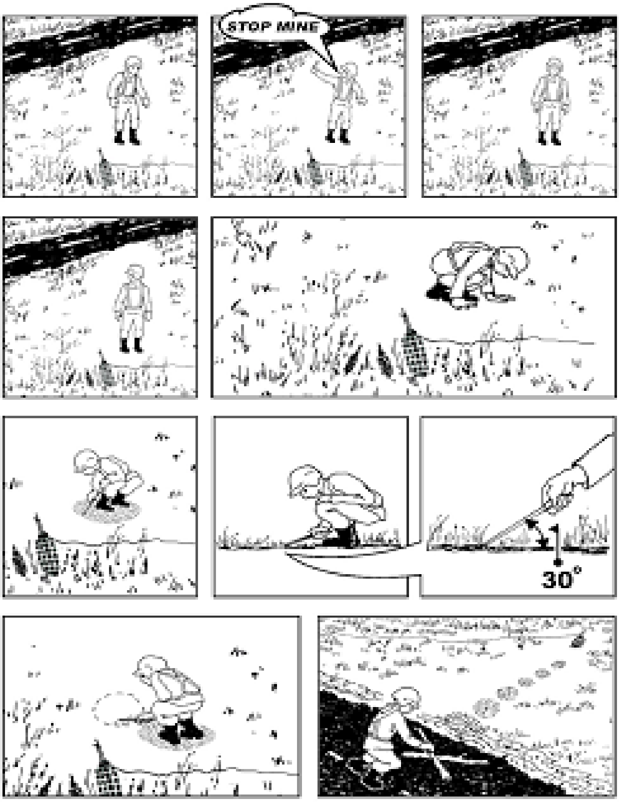


Figure 7-4. Footprints Not Identified

- The commander or leader identifies the nearest or last-known safe area and informs the team. The commander or leader must ensure security of the patrol. While some soldiers begin actions to develop a path out of the minefield, other soldiers must remain alert and protect the patrol.

- The commander or leader instructs all soldiers to clear an area around them large enough to accommodate their body and equipment. Starting from the standing position, soldiers begin to clear an area immediately around their feet using the look, feel, and probe drill and gradually moving from the standing to the kneeling and then to the prone position.
- The commander or leader directs the soldier nearest the safe area (usually the last man of the patrol) to start moving towards the safe area using the look, feel, and probe drill.
- The soldier closest to the designated safe area moves first and marks his path or clears a footprint area to guide the troops that follow.
- Once the first soldier is more than 25 meters away from the trailing soldier, the second soldier uses the look, feel, and probe drill and begins to clear a path from his position to the first soldier's cleared area. Each following soldier (in turn) probes a path to the starting point of the soldier in front of him, keeping back 25 meters from the soldier they are following.
- Once the second soldier is more than 25 meters from the third team member, the third team member (in the order of movement) commences using the look, feel, and probe drill toward the second soldier's position and so on until all patrol members are moving toward the safe area.
- Once an extraction mission is underway, time is of secondary importance to safety. If the extraction is going to take a long time, the leader considers resting those soldiers furthest away from the safe area, as these soldiers will move last. Leaders may direct each nonmoving, dismounted soldier to probe and clear an area around him large enough to accommodate

himself and his equipment using the look, feel, and probe drill.

Use of Radios in Minefields

In an emergency situation, the use of radio communications equipment in and around a minefield is acceptable. While there are certain mines that can be fused to detonate on a specific radio frequency (RF), these mines are extremely rare and are unlikely to be encountered. The lifesaving advantage of using a radio to call for help far outweighs the “potential” threat from RF sensitive mines.

Probing Path

There are two options to the type of lane created by probing to extract dismounted soldiers from a minefield. In both cases, it is recommended that a small area be cleared next to the soldier to put his equipment. This reduces the load and bulk on the probing soldier, enabling him to look, feel, and probe more efficiently and safely. However, security of the patrol must be taken under consideration. The commander or leader must designate a security element to provide local security during extraction operations.

Clearing Footprints or Connect-the-Dots Areas

If there are no casualties during a dismounted extraction exercise, the quickest technique is to clear individual large footprints or dot-sized areas for soldiers to step into (Figure 7-5). These areas should be about 18 inches in diameter to permit both feet to stand in the area. The gap between footprints should be no more than a man can comfortably reach forward and no more than 12 inches apart. Each footprint perimeter or center must be marked so following troops know where to step.

- **Advantages.** It minimizes the area required to be cleared or probed by the soldier.

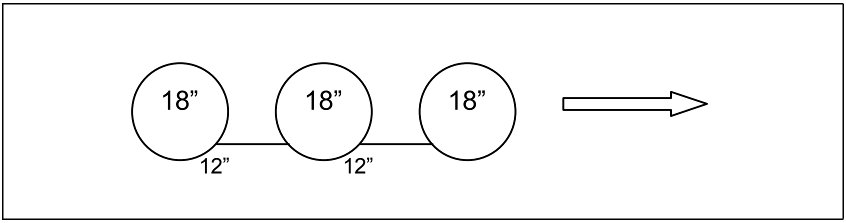


Figure 7-5. Footprints or Connect the Dots

- **Disadvantages.** The probing soldier cannot clear the area while in the prone position. This technique is not suitable for troops carrying wounded comrades or heavy equipment.

Clearing a Path

If a dismounted patrol must evacuate a casualty, then a cleared lane is recommended. Clearing a lane is time consuming, but will ease the difficulty of carrying the soldier out of the situation without exposing the litter party to the potential of stepping outside a cleared area. The path should be a minimum of 30 inches wide and marked with recognizable marking devices, including fluorescent paint, poker chips, or engineer tape (Figure 7-6). The path must extend beyond the casualty and back to the safe area. Either the centerline or the left and right limit of the path must be marked.

Figure 7-6. Clearing a Path

- **Advantages.** The soldier can probe from the prone position. This is a much safer position than the kneeling position. It reduces the soldier's profile from the enemy or a mine strike and allows him to rest. Troops carrying a casualty or heavy equipment can easily walk along the path.
- **Disadvantages.** It takes much more time to advance and is much more tiring on the soldier.

Path Clearance Drill with Metal Detectors

If a casualty occurs during mounted or dismounted operations and metal detectors are available, the following path clearance technique is recommended. A full cleared path will ease the difficulty of carrying the casualty out of danger and limit the risk to the rescuing soldiers. The commander selects the most direct and easiest route to the casualty and briefs the extraction team. Recommended path clearance techniques are as follows:

- The metal detector operator sweeps a 1.5-meter-wide path to the casualty and slightly beyond the injured soldier. The remainder of the patrol keeps back at least 25 meters from the mine detection crew.
- A detector operator or a designated soldier marks the left and right limit of the cleared path as the operator advances. The detector operator must keep the detector in light contact with the ground. The detector head sweeps across the path are to be parallel and must overlap by two-thirds of the search head. This will ensure full detection coverage of the path to the maximum depth.
- The detector crew must clear an area around the casualty, once they reach him, that is at least 1.5 meters wide in all directions. The detection crew must detect up to the casualty to ensure that he

is not lying on a mine. Beware of metal items, such as weapons and load-bearing equipment (LBE), on the casualty that could affect the metal detector operation.

The extraction team medic may approach and assist the casualty as soon as the path is cleared and marked and the casualty area is cleared. The team then renders first aid and extracts the casualty.

If a detection is made while clearing the path to the casualty, the location of the mine or explosive hazard is marked and the extraction team is alerted of its presence. The detector operator can investigate the suspected area, or a separate prober can move forward and investigate the detection to confirm the presence of a mine.

If a mine is found, clearly mark it and extend the path around the mine to avoid it.

Marking

All soldiers should carry an individual extraction kit as previously described in Chapter 4. The kit should contain up to 50 expedient mine markers. Markers must be wind resistant. Plastic poker chips or pieces of plastic lane marker tape pinned with nails work well. Check the unit SOP for standard items. Paths can be marked either along the centerline or at the edges (left/right limit of the cleared areas). Centerline marking uses less markers and shows personnel where their feet should go. If spray paint or chalk marker bottles are available, the outside edges can be easily marked.

Areas cleared using the footprint or dot method can be marked in the center or around the perimeter of the cleared location. The center marking uses fewer markers and shows where the foot should go.

Mines or suspicious objects must be clearly marked with markers either on top of or within 6 inches of the suspected mine or hazardous location, depending on the local SOP.

CASUALTY EXTRACTION DRILLS

Single Casualty in a Minefield

Entering a minefield to extract a fellow soldier is extremely hazardous and could result in additional casualties. Soldiers must resist the urge to race in and assist the casualty. Upon determining that extraction of a casualty is necessary, the following drills should be adopted:

- Establish communication with the casualty if he is conscious. Instruct him to remain still and administer self-help first aid. Reassure him that help is coming.
- Contact the closest higher HQ to give a situation report (SITREP). Request assistance for an immediate mine strike casualty extraction.
- Monitor the condition of the soldier and reassure him continuously. Prepare a safe area for the arrival of the extraction team.
- Keep HQ informed of the situation.
- Assist the extraction team, as required.

If the casualty is badly wounded and unconscious, the commander may determine that he cannot wait for an extraction team. Also, if communications with higher HQ fail, immediate extraction action may be required using available assets (Figure 7-7). Any extraction of this nature is extremely dangerous. Recommend adoption of the following:

- Identifying the shortest and easiest route to the casualty.
- Ensuring that nonessential personnel are in a safe area and that local security is maintained.

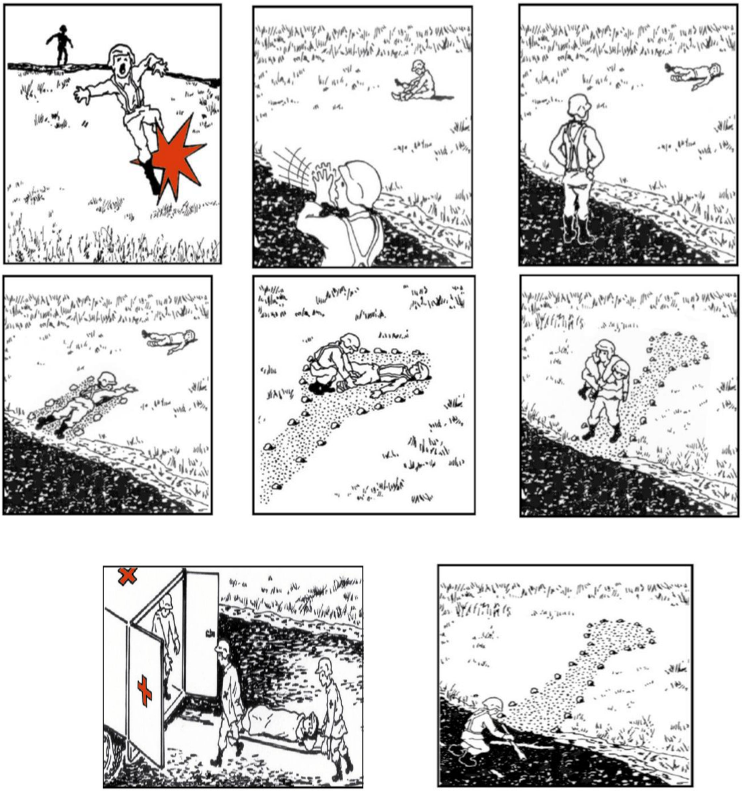


Figure 7-7. Path Clearance and Mine Strike Casualty Extraction

- Continuing to try and establish communications with the appropriate HQ and medical evacuation (MEDEVAC).
- Identifying an extraction team comprised of probers, markers, a litter team, and medical personnel.
- Working out to the casualty. The distance and time needed depends on the number of probers.

- Removing weapons, LBE, and any other equipment by the extraction team. The extraction team should continue to wear their helmets and Kevlar vests.
- Giving sufficient marking materials and probes to the probers.
- Continuing the clearing of a 30-inch-wide path using the look, feel, and probe drill from the prone position. This is done by the probers.
- Marking the path as they progress. This is done by the probers. No one else should be within 25 meters of the lead prober.
- Marking and avoiding any suspected mines found.
- Reassuring the casualty and informing him of the progress.
- Clearing a 30- to 48-inch area around the casualty to provide a safe working area for the medical and litter teams to work as soon as the casualty has been reached. Clearing up to and under the casualty in case he is lying on a mine.
- Completing the cleared path and exiting the minefield. This is done by the prober. Moving up the cleared path to the casualty. This is done by the medic and the litter team.
- Maintaining the minimum number of people in the minefield.
- Administering lifesaving immediate first aid. This is done by the medics.
- Carrying the casualty to the safe area for evacuation. This is done by the litter team.
- Continuing to stabilize the casualty while in the safe area. The medic does this.

Probing is extremely stressful and tedious. The senior leader must set a limit to the time a prober can effectively probe in the minefield as influenced by environmental conditions, experience of the prober, and difficulty of the terrain. To determine a reasonable probing time, the leader must consider mission, enemy, terrain, troops, and time available (METT-T) factors; weather conditions; the threat level; the unit 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 before relief is necessary.

VEHICLE OR CONVOY EXTRACTION

Personnel Extraction from a Vehicle Casualty

In the event of a vehicle mine strike or the crew determining or suspecting that they have entered a minefield based on visual presence of mines or mine indicators, use the following TTP:

- Stop immediately.
- Radio the situation to the appropriate higher HQ.
- Remain in the vehicle and await extraction if assistance is available.
- Extract the casualty, if there is no radio contact, from the rear of the vehicle and walk carefully following the visible vehicle tracks to the last-known safe area. Tire tracks can be followed (Figure 7-8, page 7-18). Tracked vehicle tracks may also be followed but care must be taken, as small antipersonnel (AP) mine fuzes have been known to be missed by the track pins and not detonated. These mines still pose a threat to personnel walking along the vehicle track marks.
- Ensure that the crews exit the vehicle using the look, feel, and probe drill, if there are no visible tire or track marks (Figure 7-9, page 7-18), and clear their way to a safe area.

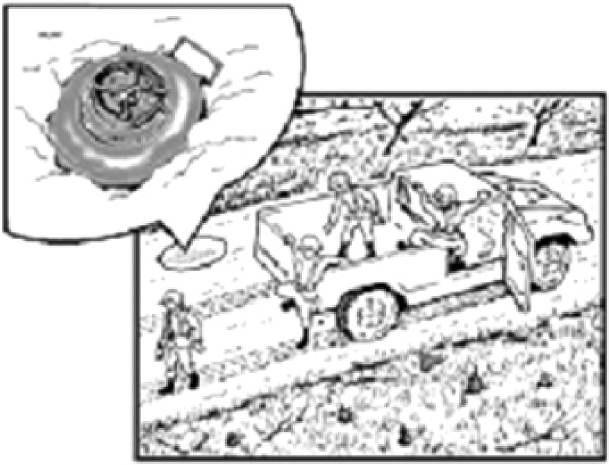


Figure 7-8. Tire Tracks Visible

Figure 7-9. Tire Tracks Not Visible

Immediate Action During a Mine Strike (Without Engineers) in a Convoy

All vehicles must stop immediately. Do not move off the road or toward the shoulders (herring bone), as this action could expose vehicles to mines. The convoy commander reports the situation to higher HQ. A SITREP is given along with a request for any medical, aviation, engineer, or maintenance support needed to execute the extraction from the area. Use the following TTP:

- Maintain vehicle spacing for security reasons and establish 360-degree weapons cover from vehicles.
- Restrict dismounted movement to the extraction of the personnel in the disabled vehicle. Dismounted soldiers must only walk in the tracks made by their vehicle; or they must use the look, feel, and probe drill.
- Ensure that METT-T dictates when the convoy can continue movement.
- Ensure that the soldiers in the last vehicle clear to a designated safe area. Soldiers in the following vehicles (deeper in the mined area) will clear paths from their vehicles to those vehicles closest to the safe area by walking in the track or tread path of their vehicle, by clearing new foot paths using a handheld metal detector, or by using the look, feel, and probe technique. If new footpaths are cleared, the left or right limit of the cleared path or the centerline of the cleared area must be clearly marked to facilitate movement of the soldiers behind them who will also use these cleared paths to exit the minefield.
- Use the dismounted casualty extraction drill. Soldiers in following vehicles will clear a footpath to the affected vehicle and will extract casualties in vehicles. Uninjured soldiers in the mine strike vehicle will immediately render first

aid to the injured soldiers. If possible and directed by the commander, uninjured soldiers in the mine strike vehicle may dismount using the look, feel, and probe technique and begin clearing a footpath toward the safe area.

NOTE: Remember that handheld metal detectors will alert when operated near a vehicle or other large body of metal, making it necessary to manually probe to a position away from the vehicle before placing the handheld mine detector in operation.

Immediate Actions During Mine Strikes With Engineers in a Convoy

Use the following TTP:

- Stop immediately (all vehicles).
- Report to higher HQ. (The convoy commander does this.)
- Halt all vehicle movement, and prevent soldiers from dismounting.
- Establish a 360-degree security from the vehicles.
- Direct clearance operations through the convoy commander. (The senior engineer does this.)
- Clear a footpath to the injured personnel, and begin first aid. (The mine sweep team does this.)
- Determine the method of MEDEVAC. (The convoy commander does this.) If necessary, the mine sweep team clears the landing zone (LZ).
- Locate and clearly mark all mines.
- Clear the wreckage, and repair the mine crater. (Engineers do this, if necessary.)
- Guide the vehicles around the mines. (Road guards do this.)
- Clear the mines after the convoy moves out of the area as permitted by the mission. (Engineers do this.)

- Report uncleared mines and the route status to higher HQ, adjacent units, and the military police (MP).
- Continue the mission.

Vehicle Extraction and Recovery from a Minefield

The following procedures proved effective in Bosnia for recovering mine strike vehicles from minefields:

- Clear a lane to the vehicle casualty. This is done by the engineers. The cleared lane should be wide enough to accommodate the recovery vehicle. (An M88 has a wider track base than most other tracked vehicles.)
- Clear a footpath to the disabled vehicle, and hook up a tow cable to it. This is done by a mine sweep team if the lane cannot be cleared all the way to the disabled vehicle to attach a tow bar. An M88 can run its cable out to 200 feet. Using a cable decreases the risk of the M88 also striking a mine while recovering the disabled vehicle.
- Pull the damaged vehicle out to the safe area by at least three vehicle lengths before switching to a tow bar. The recovery vehicle does this. **NOTE: If the disabled vehicle is on a curve, the recovery crew may have to bring the M88 or another armored vehicle up to the disabled vehicle and use a tow bar to recover it.**

The following TTP proved effective during operations in Bosnia in preparation for a mine strike incident:

- Affix tow cables to all vehicles at the front and rear, if possible. This allows recovery without touching the ground. Rear cables should be attached to lower mounts to prevent vehicle damage.
- Ensure that towing shackles are installed and complete. The leaders must do this during

preventive-maintenance checks and services (PMCS).

- Beware of the possibility of fire when towing a vehicle after a mine strike. The possibility of fire is much greater due to damage to the affected vehicle.

REPORTING MINES AND MINEFIELDS

If at all possible, avoid mines and minefields. If avoidance is not possible, take protective measures to reduce hazards to personnel and equipment. Regardless of the action taken, mines and minefields should be marked, recorded, and reported through command channels using the mine incident report (Figure 7-10).

MINE INCIDENT REPORT		
DATE: _______________ FROM:____________ THRU: ___________ TO: ___________ REFERENCE SIR#: _______________		
A. Incident DTG	A1. dd/time/zone/mm/yy	
B. Incident Location	B1. Map sheet/UTM/grid reference (8 digit)	Attach sketch as needed.
	B2. Location (road, field, building)	
	B3. Emplacement (buried, surface-laid, off route)	
C. Effects (to Supplement SIR)	C1. Casualties (name, rank, description of injuries)	
	C2. Vehicle damage (number, type, extent)	
D. Suspected Device	D1. Type of Mine (AT, AP, make, model)	
	D2. Type of booby trap (pull, release, pressure)	
	D3. Type of UXO (dropped, thrown, projected)	
	D4. Unknown (detail, color, shape, size)	
E. Circumstances	E1. Activity at the time of the incident	
	E2. Previous use of the route, area, and location	
	E3. Date of previous clearance and proofing	
	E4. Where the route, area, and location are monitored	
F. Recommendation	F1. Recommendation to prevent recurrence	
G. Miscellaneous	G1. Any other pertinent data	

Figure 7-10. Sample Mine Incident Report

Chapter 8

Mine Strike First Aid

NOTE: This chapter is not intended to serve as a substitute for emergency first aid procedures as outlined in Field Manual (FM) 4-25.11 and is provided as a first aid primer.

A study of the Soviet/Afghan war has proven extremely useful in addressing medical issues associated with mine strikes. Throughout the course of that war, 30 to 40 percent of trauma cases treated by Soviet medical personnel were caused by mine strikes. Necessarily, the Soviets adopted measures to improve force protection, gained a greater understanding of the effects of a mine strike on the body, improved casualty evacuation techniques, and implemented measures to plan for medical contingencies at the lowest level.

As noted earlier in Chapter 4, some simple mine countermeasures that increase mine strike survivability include—

- Training (refresher) in first aid.
- Training in mine awareness.
- Wearing flak jackets.
- Sandbagging the vehicle floors using fine aggregates because large particles become missiles.
- Riding on top of armored vehicles when the tactical situation permits.
- Leaving vehicle hatches cracked with the latch pin in place to permit dispersion of the concussive effects of a mine blast.

- Disseminating information through intelligence channels and/or the mine information coordination cell.

Injuries sustained during a mine strike are caused by the pressure wave of the primary blast, the penetrating and nonpenetrating wounds of the secondary blast, and the injuries associated with being thrown some distance. The combat medic or lifesaver must be aware of multiple wounds and combination wounds that usually result from a mine strike and must know how to thoroughly treat the patient. Additionally, treatment of shock becomes important, especially since 86.5 percent of Soviet mine strike victims went into shock. Fifteen percent of shock cases were irreversible, and the victim died in a short period of time.

Leaders must ensure that their units are thoroughly trained in first aid techniques as described in FM 4-25.11. Leaders must also ensure that additional combat lifesaver or medical support is provided for all countermine operations. They must anticipate that mine strike injuries will be severe and will require immediate medical attention to stabilize the victim. Combat medics or lifesavers must be thoroughly trained to apply tourniquets, initiate fluids, treat for shock, and locate and treat additional wounds. Leaders must rehearse the 9-line medical evacuation (MEDEVAC) request (Figure 8-1), and must understand the procedures to call for and guide rotary aircraft into a designated landing zone (LZ).

In the event of a mine strike, leaders, soldiers, and medical personnel must remain calm and resist the urge to rush to the victim. They should—

- Call for help. Arrange for mine clearance assistance and a MEDEVAC. Coordinate the construction of a landing zone (LZ), or designate an LZ known to be clear of obstacles and explosive hazards.

Line 1: Location. Grid coordinates of the LZ.

Line 2: Call Sign. Requesting unit.

Line 3: Precedence. Number of patients by precedence.

Urgent: Emergency to save life, limb, or eyesight.

Priority: Evacuation within 4 hours or patient will become urgent.

Routine: Patient is not serious.

Line 4: Special equipment required, such as stakes, a litter, a hoist, or a jungle penetrator.

Line 5: Number of patients by type of injury, wound, and illness. Give specific information regarding patient's injuries. Report serious bleeding along with blood type if known. Report allergies or special medical conditions of patients.

Line 6: Security of LZ or pickup zone (PZ). Use the following: no threat, potential threat (give description), and actual threat (give detailed description).

Line 7: Method of marking the pickup site, such as panels, smoke, strobe lights, vehicle lights, or star clusters.

Line 8: Nationality of patients. United States (US) military, allied military, civilian, and enemy.

Line 9: Description of hazards at LZ, such as wires, trees, dust, pedestrians, vehicular traffic, mine threat, unexploded ordnances (UXOs), and debris.

NOTE: Once a MEDEVAC is called, you must remain on the radio and maintain continuous communication with the MEDEVAC helicopter. You must provide any significant changes in the patient's condition or status, the situation or conditions at the pickup site, and any other information requested by the pilot.

MEDEVAC frequency:

MEDEVAC call sign:

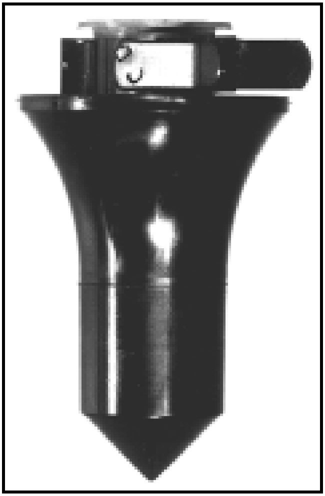
MEDEVAC mobile subscriber equipment (MSE):

Figure 8-1. MEDEVAC Request

- Warn the victim to not move if he is conscious. Assure the victim that help is on the way and actions are being taken to extract him.
- Administer first aid once the victim is in a safe (cleared) area. Train soldiers to evaluate casualties with this simple primer—ABC/CPR (airway, breathing, and circulation/ cardiopulmonary resuscitation.
- Stop the bleeding. Elevate the injured limb above the heart level. Apply pressure dressings to wounds, and try to stop the bleeding. In the event that a blast injury has amputated part of a limb, apply a tourniquet as close to the wound site as possible. Do not apply a tourniquet to any other type of wound unless the bleeding is uncontrollable. Use care if applying a tourniquet below the knee or elbow, because the use of an articulating joint greatly enhances the quality of life for an amputee with prosthetics. Use care when treating all bleeding sites.
- Treat the victim for shock by loosening restrictive clothing, elevating his legs, and keeping him warm. Train soldiers to evaluate casualties with this simple rhyme: "If the face is red, raise the head. If the face is pale, raise the tail." It may help soldiers treat victims of shock.
- Protect victims from the weather. Allow conscious victims who do not have stomach wounds to sip water or nonalcoholic beverages.
- Place unconscious victims in the recovery position (knees up and head turned).
- Identify an LZ or pickup point for the MEDEVAC vehicle.
- Keep headquarters (HQ) informed.

Chapter 9 - Mine Recognition

C3A1



C3A1 Antipersonnel Mine

The C3A1 is a blast/shape-charge antipersonnel mine. The C3A1 is nicknamed “ELSIE.” The C3A1’s primary lethal mechanism is a small, copper-lined, shaped-charge device with blast acting as a secondary mechanism. The mine is emplaced pointed end down until only the top portion of the mine is exposed. The mine will actuate when 7-12 kg force is applied. Upon activation, an explosive charge will detonate, sending a shape charge jet upward. The mine is also called the M25 and Type 67.

C3A1
Characteristics and Performance Data:

General:

Shape .... Conical
Height .... 90 mm
Diameter .... 30 mm
Total weight (kg) 0.095

Case:

Case Material .... Plastic
Color .... OD green or tan
Fuze wells 1
Detectability .... Difficult to detect

Explosive:

Main explosive charge type .... TNT
Main explosive charge weight .... 0.0076 kg

Fuze:

Fuze type .... Pressure
Fuze actuation (kg) .... 7 to 11

Lethal Mechanism:

Lethal mechanism category .... Shaped-charge

Features:

Antidisturbance .... Possible (however, no secondary fuze well or AD features)

M2

M2 Antipersonnel Mine

Minefields containing M2 mines may still exist in Iraqi territory. The M2 series of mines are bounding fragmentation mines. Mines in the series include the M2, M2A1, M2A3, M2A3B1, and the M2A4. All the mines are the same except for minor design improvements. The dual action fuze can operate either by pressure or tripwire. When the fuze is functioned, a charge at the bottom of the mine projects a 60-mm mortar shell into the air and starts a delay burn element. The completion of the delay element's burn initiates the fuze's explosive train that detonates the warhead's main explosive charge. Copies of the mine have been produced as the M/966 and the M2. Although considered obsolete in inventories, these mines may still be found in small numbers in other countries.

M2 Antipersonnel Mine
Characteristics and Performance Data:

General:

Shape..Cylindrical
Height.. 244 mm
Total weight (kg).. 2.948

Case:

Case Material..Metal
Color ....OD green
Fuze wells 1

Explosive:

Main explosive charge type .... Trotyl
Main explosive charge weight.. 0.154 kg
Max effective range.. 10 m

Fuze:

Fuze model M6A1
Fuze actuation (kg) .... 1.36 to 4.5
Fuze type ....Pressure

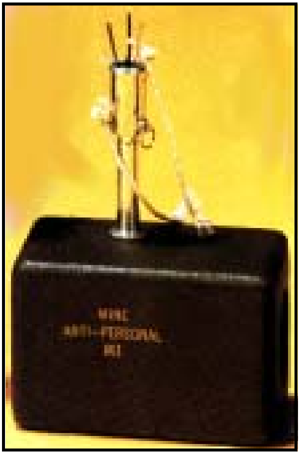
Lethal Mechanism:

Lethal mechanism category .... Bounding fragmentation

Features:

Antidisturbance .... Possible (however, no secondary fuse well or AD features)
Detectability .... Readily detectable due to metal case

M3



M3 Antipersonnel Mine

Minefields containing M3 mines may still exist in Iraqi territory. The M3 is an obsolete mine developed in the 1950s. It consists of a high-explosive charge housed in a heavy cast iron case. Normally it is emplaced on the surface or buried with just the fuze actuation element exposed. However, its effective radius can be increased if it is emplaced several feet off the ground. Its effective radius is considerably reduced when the mine is buried. The mine case has three fuze wells that permit booby-trapping or a variety of fuze arrangements.

M3 Antipersonnel Mine
Characteristics and Performance Data:

General:

Shape....................Rectangular
Height....................89 mm
Length....................137 mm
Width....................89 mm
Total weight (kg)....................4.0

Case:

Case Material....................Cast iron
Color....................OD green
Fuze wells....................3

Explosive:

Main explosive charge type....................TNT
Main explosive charge weight....................0.41 kg

Fuze:

Fuze model....................M7A1
Fuze type....................Tripwire
Fuze actuation (kg)....................1.4 to 4.5

Lethal Mechanism:

Lethal mechanism category....................Fragmentation

Features:

Antidisturbance....................Probable
Detectability....................Readily detectable due to metal case

Performance:

Max effective range....................4 m

M14

M14 Antipersonnel Mine

The M14 is a small, difficult-to-detect, plastic-bodied, blast mine with redundant safety features. The primary safety is a split ring clip that must be removed prior to emplacement; the second is a pressure plate that must be rotated from the safe position to the armed position. If this plate is not rotated, pressure cannot be applied to the Belleville spring that triggers the mine. The Belleville spring, fuze components, and safety features are contained in the upper portion of the mine. The lower portion contains 29 grams of Tetryl. The only metal in the mine is the steel striker tip, making the mine very difficult to detect. A direct copy is also produced, the MN-79; a similar copy is called the MD 82B.

M14
Characteristics and Performance Data:

General:

Shape..Cylindrical
Height...40 mm
Diameter ....56 mm
Total weight (kg)..0.099

Case:

Case Material...Plastic
Color ....OD green
Fuze wells 0

Explosive:

Main explosive charge type ....Tetryl
Main explosive charge weight...0.029 kg

Fuze:

Fuze model ....Integral
Fuze type ....Pressure
Fuze actuation ....9 to 16 kg

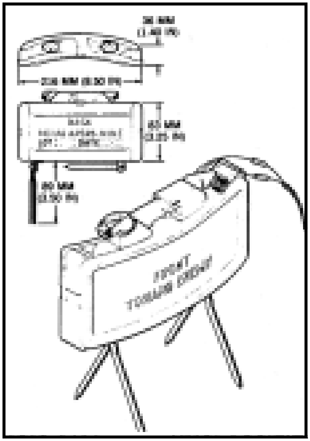
Lethal Mechanism:

Lethal mechanism category ....Blast

Features:

Antidisturbance .... Possible (however, no secondary fuze well or AD features)
Detectability ....Difficult to detect

M18A1



M18A1 Antipersonnel Mine

The M18A1 (nicknamed the CLAYMORE) is a plastic-bodied, directed, fragmentation mine with rows of ball bearings imbedded in a plastic matrix installed on the target facing side of the main explosive charge. The mine is emplaced on two pairs of folding scissors-like legs. The elevation/height of the fragment pattern can be adjusted by manipulating the articulated leg joints. A peep sight is located on the top center of the mine between the duel fuze wells. The duel fuze wells will accommodate a variety of fuzes, including tripwire and command detonation. This mine has been widely copied. Direct copies are produced as the M18A2 JGG, with similar copies as the Shrapnel Mine No. 2, K440, P5 Mark 1, and the MON-50.

M18A1
Characteristics and Performance Data:

General:

Shape..Rectangular
Height.. 83 mm
Length .... 216 mm
Width .... 35 mm
Total weight (kg 1.58

Case:

Case Material ....Fiberglass
Color ....OD green
Fuze wells 2

Explosive:

Main explosive charge type ....Plastic explosive
Main explosive charge weight... 0.682kg

Fuze:

Fuze model ....M57 firing device
Fuze type ....Command detonated

Lethal Mechanism:

Lethal mechanism category ....Directed fragmentation

Features:

Antidisturbance ....Possible (however, no secondary fuze well or AD features)
Detectability .... Visually detectable

Performance:

Max effective range.. 50 m

MON-50

MON-50 Antipersonnel Mine

The MON-50 is a copy of the M18A1 Claymore mine. The MON-50 has a plastic body with rows of imbedded fragments on the side facing the target. Two variants exist: one with steel ball bearing fragments and the other with cylindrical chopped steel rod fragments. The mine is emplaced on two pairs of folding scissors-like legs. The elevation/height of the fragment pattern can be adjusted by manipulating the articulated leg joints. A peep sight is located on the top center of the mine between two fuze wells. The fuze wells will accommodate a variety of fuzes, including tripwire and command detonation. Another version is known as the DM-51.

MON-50
Characteristics and Performance Data:

General:

Shape..Rectangular
Height.. 105 mm
Length .... 220 mm
Width .... 45 mm
Total weight (kg) 2.0

Case:

Case Material ....Plastic with imbedded fragments
Color .... Brown or OD green
Fuze wells 2

Explosive:

Main explosive charge type PVV-5A
Main explosive charge weight... 0.715 kg

Fuze:

Fuze model ....MN fuze
Fuze type ....Command detonated
Fuze actuation .... Command initiation

Lethal Mechanism:

Lethal mechanism category ....Directed fragmentation

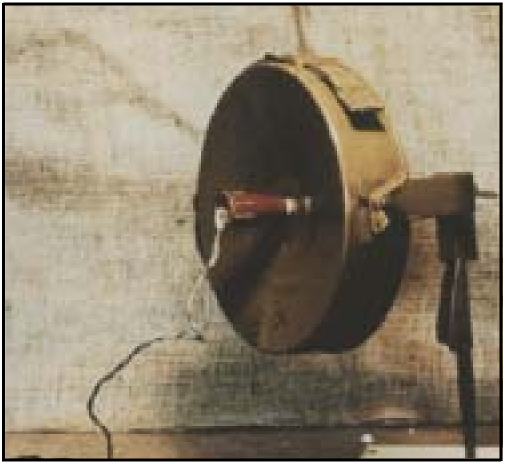
Features:

Antidisturbance ....Possible (however, no secondary fuze well or AD features)
Detectability .... Visually detectable

Performance:

Max effective range.. 50 m

MON-100



MON-100 Antipersonnel Mine

The MON-100 is a cylindrical directional fragmentation mine. It consists of a metallic case containing an explosive charge, steel fragments, and a metal stand. The 400 cylindrical steel fragments are embedded in a plastic matrix in front of the explosive. The mine can be attached to any fixed object or mounted on its own metal stake. The MON-100 can be functioned by tripwire, break-wire, or command detonation and has a lethal range of 100 meters. At 100 meters, 50% of the fragments will strike within 5 meters of the mine's aiming point. The MON-100 can be used singly or as part of an integrated explosive barrier. The mine is effective against dismounted infantry and lightly armored vehicles.

MON-100
Characteristics and Performance Data:

General:
Shape..Cylindrical
Height.. 80 mm
Diameter .... 220 mm
Total weight (kg) 5.0

Case:
Case Material.. Steel
Color ....OD green
Fuze wells 1

Explosive:
Main explosive charge type .... TNT
Main explosive charge weight... 1.790 kg

Fuze:
Fuze model ....EDP-R
Fuze type ....Command detonated
Fuze actuation .... Command or control initiated

Lethal Mechanism:
Lethal mechanism category ....Directed fragmentation

Features:
Antidisturbance .... Possible (however, no secondary fuze well or AD features)
Detectability .... Visually detectable

Performance:
Max effective range.. 100 m

MON-200

MON-200 Antipersonnel Mine

The MON-200 is a larger version of the MON-100 mine. It consists of a cylindrical metal case containing an explosive charge and 900 steel fragments, mounted on a metal stand. Like the MON-100, the cylindrical steel fragments are embedded in a plastic matrix in front of the explosive. The mine can be attached to any fixed object or mounted on its metal stand. The MON-200 can be initiated by tripwire, break-wire, or command detonation and has a lethal range of 200 meters. The MON-200 can be used singly or as part of an integrated explosive barrier. The mine is effective against dismounted infantry and lightly armored vehicles.

MON-200
Characteristics and Performance Data:

General:

Shape...Cylindrical
Height...130 mm
Diameter ....431 mm
Total weight (kg) 25.0

Case:

Case Material..Steel
Color ....OD green
Fuze wells 1

Explosive:

Main explosive charge type ....TNT
Main explosive charge weight...12.0 kg

Fuze:

Fuze model ....EDP-R
Fuze type ....Command detonated
Fuze actuation .... Command or control initiation

Lethal Mechanism:

Lethal mechanism category ....Directed fragmentation

Features:

Antidisturbance ....Possible
Detectability .... Visually detectable

Performance:

Max effective range...200 m

No. 4

No. 4 Antipersonnel Mine

The No. 4 is a pressure-initiated, blast, antipersonnel mine. The No. 4 is an updated plastic version of the wooden No. 3 “shu”-type mine. Downward pressure on the raised lid of the box forces the lid down, causing a notch in the side of the lid to release the striker-retaining pin from the fuze thus initiating the explosive train. The main explosive charge consists of a 188-gram cast block of TNT. Probing for small “shu” type mines with their low initiation thresholds is a very hazardous operation.

No. 4 Antipersonnel Mine Characteristics and Performance Data:

General:

Shape .... Rectangular
Height .... 50 mm
Length .... 135 mm
Width .... 65 mm
Total weight (kg) 0.348

Case:

Case Material .... Plastic
Color .... Green
Fuze wells 0

Explosive:

Main explosive charge type .... TNT
Main explosive charge weight .... 0.188 kg

Fuze:

Fuze type .... Pressure
Fuze actuation (kg) 8

Lethal Mechanism:

Lethal mechanism category .... Blast

Features:

Antidisturbance .... Possible (however, no secondary fuze well or AD features)
Detectability .... Readily detectable due to metallic content of fuze

P-25

P-25 Antipersonnel Mine

The P-25 is an old antipersonnel mine developed in the late 1970s. It consists of a cylindrical plastic casing containing the main charge and preformed steel fragments. The fuze is centrally located on the top of the mine. Two 15-meter trip wires can be attached to the fuze. The effective radius for the preformed fragments is 15 meters. This mine can be emplaced with only the fuze exposed or fixed to a stake.

P-25
Characteristics and Performance Data:

General:

Height... 180 mm

Diameter .... 75 mm

Total weight (kg)... 0.65

Case:

Case Material ....Plastic

Color ....OD green or tan

Explosive:

Main explosive charge weight... 0.18 kg

Fuze:

Fuze model .... Integral

Fuze type ....Tripwire

Fuze actuation 5

Lethal Mechanism:

Lethal mechanism category .... Fragmentation

Features:

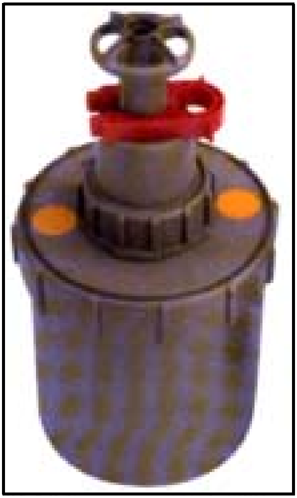
Antidisturbance .... Possible (however, no secondary fuze well or AD features)

Detectability .... Readily detectable due to metal case

Performance:

Min effective range.. 15 m

P-40



P-40 Antipersonnel Mine

The P-40 bounding fragmentation antipersonnel mine developed in the late 1970s. It consists of a cylindrical plastic casing produced in virtually any color. Within this outer casing is the bounding container with main explosive charge and preformed fragments. The mine is buried with just the fuze protruding above the ground. The fuze is centrally located on the top of the mine. Two 15-meter tripwires can be attached to the fuze. The effective radius for the preformed fragments is 15 meters.

P-40
Characteristics and Performance Data:

General:

Shape .... Cylindrical
Height .... 215 mm
Diameter .... 90 mm
Total weight (kg) 2.0

Case:

Case Material .... Plastic

Explosive:

Main explosive charge type .... Trotyl
Main explosive charge weight .... 0.480 kg

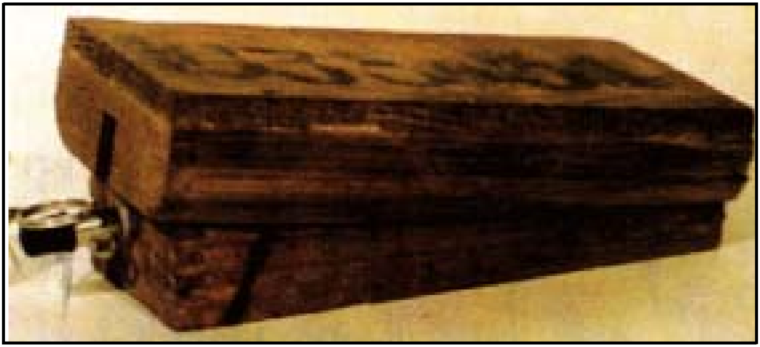
Fuze:

Fuze type .... Tripwire
Fuze actuation .... 7 to 13

Lethal Mechanism:

Lethal mechanism category .... Blast

PMD-6



PMD-6 Antipersonnel Mine

The PMD-6 is a wooden box or “shu” mine with a two-piece case. The lower section is a rectangular wooden box housing the main TNT charge, the MUV-type fuze, and the detonator. Downward pressure on the raised lid of the box forces the lid down, causing a notch in the side of the lid to release the striker-retaining pin from the fuze thus initiating the explosive train. Probing for small “shu” type mines with their low initiation thresholds is a very hazardous operation.

PMD-6
Characteristics and Performance Data:

General:

Shape....................Rectangular
Height....................64 mm
Length....................191 mm
Width....................89 mm
Total weight (kg)....................0.4

Case:

Case Material....................Wood
Color....................Natural wood
Fuze wells....................1

Explosive:

Main explosive charge type....................TNT
Main explosive charge weight....................0.2 kg

Fuze:

Fuze model....................MUV
Fuze type....................Pressure
(Although normally a tripwire fuze, the MUV is used as a pressure fuze in the PMD mines.)
Fuze actuation....................1 to 10

Lethal Mechanism:

Lethal mechanism category....................Blast

Features:

Antidisturbance.................... Possible (however, no secondary fuze well or AD features)
Detectability ....Readily detectable due to metallic content of fuze

PMN

PMN Antipersonnel Mine

The PMN antipersonnel mine consists of a bakelite lower body component, a plastic pressure plate, a black rubber pressure plate cover for waterproofing, a spring-loaded firing device, and the explosive components. Opposing openings on the side of the mine allow the user to insert the booster and detonator in one side and the cocked striker mechanism in the other. Both holes have thread plugs and gaskets. The PMN is possibly the most commonly encountered antipersonnel mine in the world.

PMN
Characteristics and Performance Data:

General:

Shape....................Cylindrical
Height....................56 mm
Diameter....................112 mm
Total weight (kg)....................0.55

Case:

Case Material....................Plastic, rubber, and metal
Color....................Black or brown
Fuze wells....................1

Explosive:

Main explosive charge type....................Trotyl
Main explosive charge weight....................0.2 kg

Fuze:

Fuze model....................Not integral but unnamed
Fuze type....................Pressure
Fuze actuation....................8 to 25

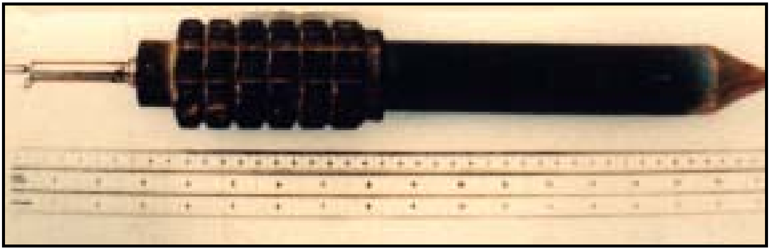
Lethal Mechanism:

Lethal mechanism category....................Blast

Features:

Antidisturbance....................Possible (however, no secondary fuse well or AD features)
Detectability....................Readily detectable due to metallic content of fuze

POMZ-2



POMZ-2 Antipersonnel Mine

The POMZ-2 is a fragmentation stake mine consisting of a serrated cylindrical cast-iron fragment sleeve, a 75-gram TNT charge, a MUV-type tripwire fuze, and wooden stake. The POMZ-2 is normally employed using vegetation as cover, the top of the mine approximately 30 cm above ground, and the tripwire attached to a fixed object. More than one mine can be attached to several tripwires, or several tripwires may be attached to one mine. The POMZ-2 differs from the POMZ-2M, its successor, in that it is heavier, has more serrations, and has a threaded fuze well.

POMZ-2
Characteristics and Performance Data:

General:

Shape....................Cylindrical
Height.................... 130 mm
Diameter .... 60 mm
Total weight (kg) .... 2.3 (Approximately)

Case:

Case Material....................Cast iron
Color ....OD green
Fuze wells 1

Explosive:

Main explosive charge type .... TNT
Main explosive charge weight.................... 0.075 kg

Fuze:

Fuze model ....MUV, MUV-2, MUV-3, MUV-4
Fuze type ....Tripwire
Fuze actuation .... 2 to 5

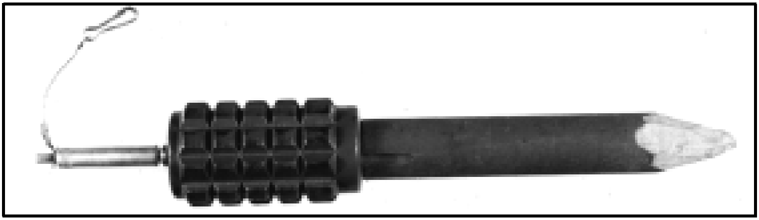
Lethal Mechanism:

Lethal mechanism category .... Fragmentation

Features:

Antidisturbance ....Possible (however, no secondary fuze well or AD features)
Detectability .... Visually detectable
Performance:
Max effective range.................... 4 m

POMZ-2M



POMZ-2M Antipersonnel Mine

The POMZ-2M is a fragmentation stake mine consisting of a serrated cylindrical cast-iron fragment sleeve, a 75-gram TNT charge, a MUV-type tripwire fuze, and wooden stake. The POMZ-2 is normally employed using vegetation as cover, the top of the mine approximately 30 cm above ground, and the tripwire attached to a fixed object. More than one mine can be attached to several tripwires, or several tripwires may be attached to one mine. The POMZ-2M differs from the POMZ-2, its predecessor, in that it is lighter, has fewer serrations, and the fuze well is threaded to improve its waterproofing.

POMZ-2M
Characteristics and Performance Data:

General:

Shape...Cylindrical
Height... 107 mm
Diameter .... 60 mm
Total weight (kg) 1.77

Case:

Case Material... Cast iron
Color .... OD green
Fuze wells 1

Explosive:

Main explosive charge type .... TNT
Main explosive charge weight... 0.075 kg

Fuze:

Fuze model ....MUV, MUV-2, MUV-3, MUV-4
Fuze type ....Tripwire
Fuze actuation 1

Lethal Mechanism:

Lethal mechanism category .... Fragmentation

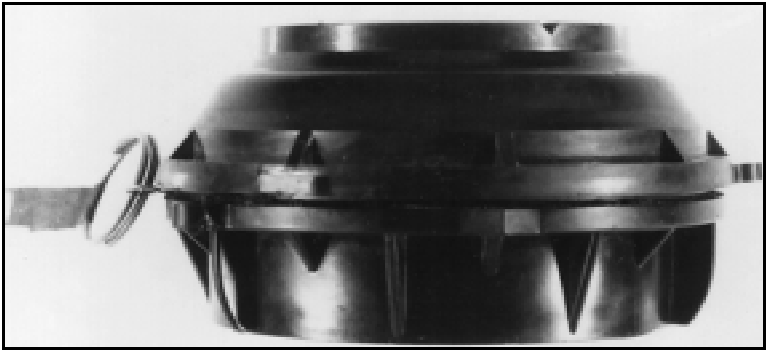
Features:

Antidisturbance ....Possible (however, no secondary fuse well or AD features)
Detectability .... Visually detectable

Performance:

Max effective range... 8 m

PPM-2



PPM-2 Antipersonnel Mine

The PPM-2 is a black, plastic-cased, antipersonnel blast mine consisting of a two-piece threaded mine case with rubber gasket, a piezoelectric initiation element, and a TNT main charge. The integral fuze is delay-armed, pressure-initiated, and electrically fired. Another version of the PPM-2 may incorporate a built-in anti-disturbance circuit. It will be identical to the normal variant except for a red arming pin. It is impossible to distinguish between the two versions in the armed condition.

PPM-2
Characteristics and Performance Data:

General:

Shape..Cylindrical
Height..63 mm
Diameter ....124.72 mm
Total weight (kg) 0.39

Case:

Case Material..Plastic
Color ....Black

Explosive:

Main explosive charge type ....TNT
Main explosive charge weight..0.13 kg

Fuze:

Fuze model ....Integral
Fuze type ....Pressure
Fuze actuation 12.5

Lethal Mechanism:

Lethal mechanism category ....Blast

Features:

Antidisturbance ....Possible (however, no secondary fuze well or AD features)
Detectability ....Readily detectable due to metallic content of fuze

PRB M409

PRB M409 Antipersonnel Mine

The PRB M409 is a plastic-bodied, blast antipersonnel mine. During transport, a safety plate with raised ridges protects the pressure membrane. The fuze is a double percussion type with two opposing steel firing pins. The strikers are held apart by a sliding bolt attached to the pressure plate. The bolt has an aperture holding two percussion caps. When the bolt is displaced, the strikers are released and detonate the percussion caps. The only metal components are firing pins and two aluminum primer caps. A copy of the PRB M409 is also produced as the M 411.

PRB M409
Characteristics and Performance Data:

General:

Shape..Cylindrical
Height.. 28 mm
Total weight (kg) 0.183

Case:

Case Material ....Plastic
Color .... Green or tan
Fuze wells 1

Explosive:

Main explosive charge type .... Trialene
Main explosive charge weight... 0.08 kg

Fuze:

Fuze model .... Integral
Fuze type ....Pressure
Fuze actuation .... 8 to 30

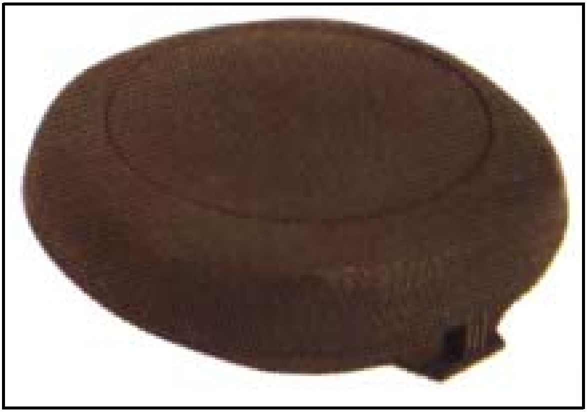
Lethal Mechanism:

Lethal mechanism category .... Blast

Features:

Antidisturbance .... Possible (however, no secondary fuze well or AD features)
Detectability ....Difficult to detect (Only 1 gram of metal is in the fuze assembly.)

SB-33



SB-33 Antipersonnel Mine

The SB-33 is scatterable, blast resistant, low-metallic content antipersonnel mine. The mine has a unique irregular shape to impede visual detection. The mine can be either hand emplaced or scattered using a SY-AT mine-scattering system. The pressure fuze employed in this mine is very resistant to explosive countermeasures. These systems have been consistently demonstrated as survivable against both fuel-air-explosive and bulk explosive counter-measures. An electronic version, the SB-33/AR, incorporates an anti-handling device to deter mine clearance. The EM-20 and the M412 are copies.

SB-33
Characteristics and Performance Data:

General:
Shape....................Irregular
Height....................32 mm
Diameter....................88 mm
Total weight (kg)....................0.14

Case:
Case Material....................Plastic
Color....................OD green or tan

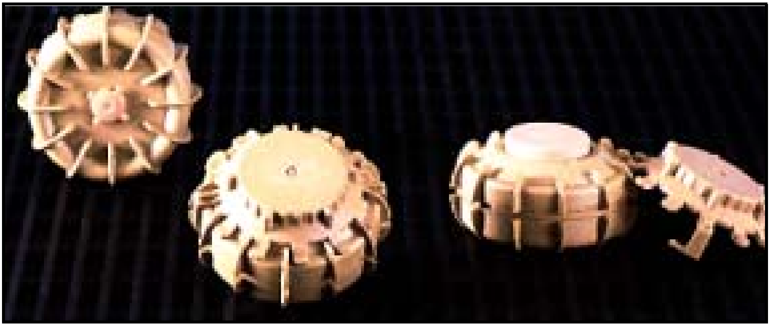
Explosive:
Main explosive charge type....................Trotyl
Main explosive charge weight....................0.035 kg

Fuze:
Fuze model....................Integral
Fuze type....................Pressure
Fuze actuation....................10 to 12

Lethal Mechanism:
Lethal mechanism category....................Blast

Features:
Antidisturbance....................Possible (however, no secondary fuze well or AD features)
Detectability....................Difficult to detect

TS/50



TS/50 Antipersonnel Mine

The TS/50 is a small, blast antipersonnel mine. It is a cylindrical mine designed to be scattered from helicopters but is usually emplaced by hand, either surface-laid or buried. The mine is blast resistant and is designed to defeat most explosive countermeasures including explosive line-charges and fuel-air-explosives.

TS/50
Characteristics and Performance Data:

General:

Shape..Cylindrical

Case:

Fuze wells 0

Fuze:

Fuze type ....Pressure

Fuze actuation (kg) 12.5

Fuze model .... Integral

Lethal Mechanism:

Lethal mechanism category .... Blast

Features:

Detectability ....Difficult to detect

Type 72

Type 72 Antipersonnel Mine

The Type 72 antipersonnel mine is a small, plastic-bodied, blast antipersonnel mine that has seen widespread use in Iraq. Two versions exist that incorporate anti-disturbance/booby-trap features; however, it is unlikely that those variants will be encountered in Iraq. The Type 72B utilizes a ball-in-cage mechanism to function solely as a booby-trap device. The Type 72C is intended to function both as an antipersonnel mine and as a booby-trap device. There have been reports that the Type 72C is very sensitive and can be detonated by the magnetic field generated by magnetic mine detectors.

Type 72
Characteristics and Performance Data:

General:

Shape....................Cylindrical
Height.................... 38.5 mm
Diameter .... 78.5 mm
Total weight (kg) 0.14

Case:

Case Material.................... Plastic and rubber
Color .... Green
Fuze wells 1
(detonator well, fuze is integral)

Explosive:

Main explosive charge type ....RDX/TNT
(RDX/TNT (50/50))
Main explosive charge weight.................... 0.051 kg

Fuze:

Fuze model .... Integral
Fuze type ....Pressure
Fuze actuation .... 5 to 7

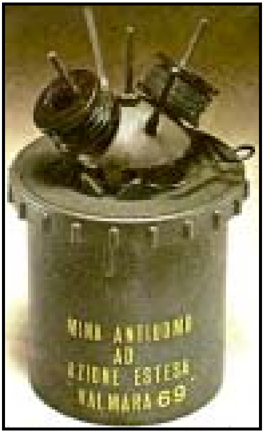
Lethal Mechanism:

Lethal mechanism category .... Blast

Features:

Antidisturbance .... Possible, especially if "look-alike" version is employed
Detectability ....Difficult to detect

Valmara 69



Valmara 69 Antipersonnel Mine

The Valmara 69 (Val 69), a successor to the Valmara 59 (Val 59), is a bounding fragmentation mine. The main difference between the two is the plastic outer body of the Val 69 verses the sheet steel outer body found on the Val 59. The two mines function the same, through direct pressure or by tension to an attached tripwire. When the fuze is functioned, the propelling charge is initiated, launching the inner case into the air. The main charge is then detonated at a height of 45 cm by the anchoring lanyard. The lethal radius of the mine is 27 meters. A similar version is produced as the No. 69 Mk1.

Valmara 69
Characteristics and Performance Data:

General:
Shape..........Cylindrical
Height.......... 205 mm
Diameter .... 130 mm
Total weight (kg) 3.3

Case:
Case Material..........Plastic
Color ....Variety of colors available
Fuze wells 1

Explosive:
Main explosive charge type ....RDX/TNT (2,4,6 TNT RDX)
Main explosive charge weight.......... 0.576 kg

Fuze:
Fuze type ....Pressure
Fuze actuation 10

Lethal Mechanism:
Lethal mechanism category .... Bounding fragmentation

Features:
Antidisturbance .... Probable (one or more fuze wells for booby trap purposes
Detectability ....Readily detectable

Performance:
Max effective range.......... 27 m

VS-50

VS-50 Antipersonnel Mine

The VS-50 is a small, cylindrical, plastic-cased, blast antipersonnel mine. The VS-50 was originally designed for helicopter emplacement; however, it is most often hand emplaced just below the surface. The mine is blast resistant and will defeat most explosive countermeasures, including explosive line-charges and fuel air explosives. The VS-50 is the predecessor to the VS-Mk 2 antipersonnel mine. The mine is also produced as the SPM-1 and the T/79.

VS-50 Antipersonnel Mine
Characteristics and Performance Data:

General:

Shape..........Cylindrical
Diameter .... 90 mm

Case:

Fuze wells 0

Fuze:

Fuze actuation (kg) 10
Fuze model .... Integral
Fuze type .... Pressure

Lethal Mechanism:

Lethal mechanism category .... Blast

Features:

Antidisturbance ....Possible, especially if "look-alike" version is employed
Detectability ....Difficult to detect

L9

L9 Antitank Mine

The L9 is also known as the barmine because of its distinctive shape. It is a relatively simple, pressure-activated, large, blast antitank mine. The standard fuze can be employed both as single and double impulse pressure fuze. The plastic body does limit the total metal content to fuze components. A copy of the L9 is made as the AT 3A.

L9 Antitank Mine
Characteristics and Performance Data:

General:

Shape .... Rectangular
Height .... 82 mm
Length .... 1200 mm
Width .... 108 mm
Total weight (kg) 10.4

Case:

Case material .... Plastic
Color .... Brown or OD green
Fuze wells 1

Explosive:

Main explosive charge type .... RDX/TNT

Fuze:

Fuze type .... Pressure
Fuze actuation (kg) 137

Lethal Mechanism:

Lethal mechanism category .... Blast

Features:

Antidisturbance .... Possible (however, no secondary fuze well or AD features)
Detectability .... Difficult to detect

Performance:

Main explosive charge weight .... 8.1 kg

M15

M15 Antitank Mine

The M15 is a heavy, metallic, antitank mine. A handle is attached to the bottom of the mine, and there are two secondary fuze wells, one on the bottom and one on the side. The mine is slightly larger in diameter than the M6A2 antitank mine. The M15 mine is taller to accommodate the larger explosive fill: 10.33 kg of COMP B compared to the 4.45 kg of TNT found in M6A2.

M15 Antitank Mine
Characteristics and Performance Data:

General:
Shape...Cylindrical
Height... 150 mm
Diameter .... 337 mm
Total weight (kg)... 14.27

Case:
Case Material...Metal
Color ....OD green
Fuze wells 3

Fuze:
Fuze model M603
Fuze type ....Pressure
Fuze actuation (kg) .... 159 to 340

Lethal Mechanism:
Lethal mechanism category .... Blast

Features:
Antidisturbance ....Probable (one or more fuze wells for booby trap purposes
Detectability .... Readily detectable due to metal case

Explosive:
Main explosive charge type .... Comp B
Main explosive charge weight.. 10.33 kg

MAT-76

MAT-76 Antitank Mine

The MAT-76 is a blast antitank mine made of cast Trotyl covered with a fiberglass resin protective coating. The fuze well accepts any fuze compatible with the TM-62 or TM-72 series mines. The MAT-76 does not have secondary fuze wells cast into the body, but the thin resin coating can be easily cut away, and an expedient well created in order to fit an anti-lift device. By the same token, the MAT-76 can be cut apart easily and the explosive used for improvised explosive devices. The very small metallic content of the MAT-76 fuze makes it difficult to detect.

MAT-76 Antitank Mine
Characteristics and Performance Data:

General:
Shape..Cylindrical
Diameter .... 320 mm
Total weight (kg)... 10.0
Case:
Case Material.. Resin
Color ....OD green
Fuze wells 1
Explosive:
Main explosive charge type .... Trotyl
Main explosive charge weight.. 9.35 kg
Fuze:
Fuze model P-62
Fuze type ....Pressure
Fuze actuation (kg) 200

Lethal Mechanism:

Lethal mechanism category .... Blast
Features:
Antidisturbance .... Possible (however, no secondary fuze well or AD features)
Detectability ....Difficult to detect

PRB M3

PRB M3 Antitank Mine

The PRB M3 consists of a square polyethylene case with a carrying handle located on one side. The mine body contains the main explosive charge, pressure-initiated fuze, and the pressure plate. The fuze fits in the fuze well in the center of the mine body and is covered by the pressure plate. The fuze functions when the pressure plate collapses. The PRB M3 is waterproof and may be used in shallow water. A variant, the PRB M3 A, is produced with two secondary fuze wells (one on the side and one under the mine) for booby-trap purposes.

PRB-M3
Characteristics and Performance Data:

General:
Shape...Cubic
Height.. 130 mm
Length .... 230 mm
Width... 230 mm
Total weight (kg) 6.8

Case:
Case Material..Plastic
Color ....OD green and tan
Fuze wells 10

Explosive:
Main explosive charge type ....RDX/TNT
(RDX/TNT (76/24))
Main explosive charge weight.. 6 kg

Fuze:
Fuze model M30
Fuze type ....Pressure
Fuze actuation 250

Lethal Mechanism:
Lethal mechanism category .... Blast

Features:
Antidisturbance ....Possible
(The PRB M3 has a variant with two secondary fuze wells for booby trap purposes.)
Detectability ....Difficult to detect
(Metallic content is approximately 1.0 grams; limited to spring, striker tip, and shear wire.)

PT Mi-Ba III

PT Mi-Ba III Antitank Mine

The PT Mi-Ba III blast antitank mine has a plastic body with no metallic content. When used with a non-metallic pressure fuze, the mine is extremely difficult to detect. Total metallic content is less than 2.46 grams. The mine is equipped with a plastic handle, which fits flush in the base of the bakelite body. Several Third World nations as well as terrorist groups use this mine.

PT Mi-Ba III Antitank Mine
Characteristics and Performance Data:

General:

Shape...Cylindrical
Height...107 mm
Diameter ....330 mm
Total weight (kg)..9.9

Case:

Case Material ....Plastic
Color ....Black or OD green
Fuze wells 1

Explosive:

Main explosive charge type ....TNT
Main explosive charge weight...7.230 kg

Fuze:

Fuze model RO-2
Fuze type ....Pressure
Fuze actuation (kg) 200

Lethal Mechanism:

Lethal mechanism category ....Blast

Features:

Antidisturbance ....Possible
Detectability ....Difficult to detect

SB-81

SB-81 Antitank Mine

The SB-81, a light, pressure-activated, blast, antitank mine. The mine can be emplaced either by hand or scattered from a helicopter-mounted delivery system. The SB-81 is very difficult to detect due to its plastic construction, with metallic content limited to fuze components. When emplaced by hand, several mines can be stacked to increase the effect of the mine. An electronic version, the SB-81/AR, which incorporates an electronic anti-disturbance and self-destruct/self-neutralization features is also available. The mine is also produced as the M453, YM-II, and the SB-81.

SB-81
Characteristics and Performance Data:

General:
Shape.......Cylindrical
Height....... 90 mm
Diameter .... 230 mm
Total weight (kg) 3.15

Case:
Case Material.......Plastic
Color ....OD green or tan
Fuze wells 1

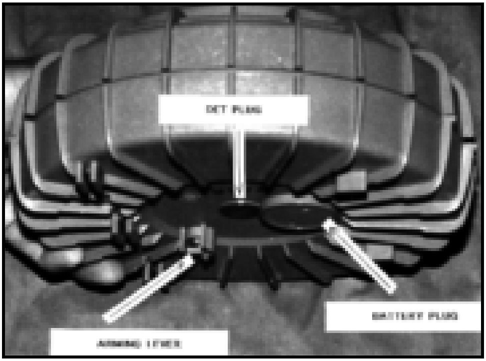
Explosive:
Main explosive charge type .... Comp B
Main explosive charge weight....... 1.85 kg

Fuze:
Fuze type ....Pressure
Fuze actuation 180

Lethal Mechanism:
Lethal mechanism category .... Blast

Features:
Antidisturbance ....Possible, especially if "look-alike" version is employed
Detectability ....Difficult to detect

SB-81/AR



SB-81/AR Antitank Mine

The SB-81/AR is the electronic version of the SB-81 blast antitank mine. The mine incorporates an electronic anti-disturbance and self-destruct/self-neutralization features. The mine can be emplaced either by hand or scattered from a helicopter-mounted delivery system.

SB-81/AR Antitank Mine
Characteristics and Performance Data:

General:

Shape .... Cylindrical
Height .... 90 mm
Diameter .... 232 mm
Total weight (kg) 3.2

Case:

Case Material .... Plastic
Color .... OD green or tan
Fuze wells 1

Explosive:

Main explosive charge type .... Trotyl
Main explosive charge weight .... 1.850 kg

Fuze:

Fuze type .... Pressure
Fuze actuation (kg) 180

Lethal Mechanism:

Lethal mechanism category .... Blast

Features:

Antidisturbance .... Yes
Detectability .... Readily detectable due to metallic content of fuze

TC/2.4

TC/2.4 Antitank Mine

The TC/2.4 is a conventional, pressure-fuzed, blast, antitank mine equipped with a handle mounted on the side of the case. Similar to other pneumatic pressure fuzes, the TC/2.4 is very resistant to blast type countermeasures. The TC/2.4 is very difficult to detect due to its plastic construction, with metallic content limited to only fuze components.

TC/2.4
Characteristics and Performance Data:

General:

Shape..Cylindrical
Height.. 108 mm
Diameter .... 204 mm
Total weight (kg) 3.3

Case:

Case Material..Plastic
Color .... Tan
Fuze wells 1

Explosive:

Main explosive charge type .... Comp B
Main explosive charge weight... 2.4 kg

Fuze:

Fuze type ....Pressure
Fuze actuation .... 180 to 310

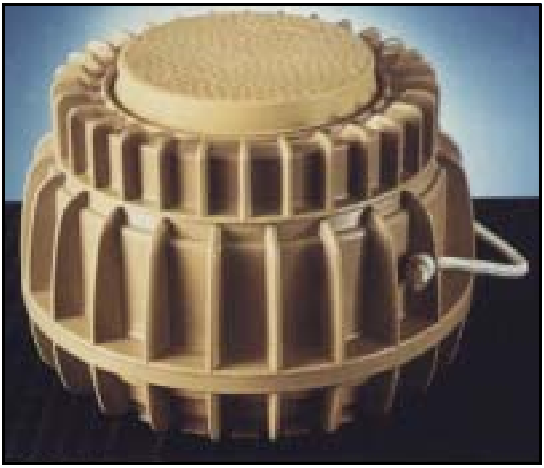
Lethal Mechanism:

Lethal mechanism category .... Blast

Features:

Antidisturbance .... Possible (however, no secondary fuze well or AD features)
Detectability ....Difficult to detect

TC/6



TC/6 and TCE/6 Antitank Mine

The TC/6 antitank mine has a blast-resistant pressure fuze that is very difficult to detect (less than 2.86 grams of metal). There is an “E” version that incorporates an electronics package primarily intended for remote activation/deactivation with a hand-held remote controller. This version is much easier to detect due to the electronics package. A copy of this mine is produced as the T.C. 6.

TC/6
Characteristics and Performance Data:

General:

Shape..Cylindrical

Case:

Fuze wells 2

Explosive:

Fuze:

Fuze model .... Integral

Fuze type ....Pressure

Fuze actuation 180

Lethal Mechanism:

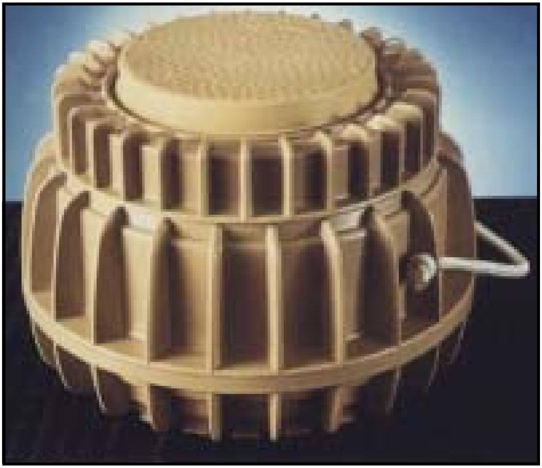
Lethal mechanism category .... Blast

Features:

Antidisturbance ..Possible, especially if "look-alike" version is employed

Detectability ....Difficult to detect

TCE/6



TC/6 and TCE/6 Antitank Mine

The TCE/6 antitank mine has an electronic, blast-resistant pressure fuze that incorporates an electronics package, primarily intended for remote activation/deactivation with a hand-held remote controller. Currently, this version does not include anti-lift/anti-disturbance/self-destruct features. The mine is identical in shape and size to the TC/6 antitank mines.

TC/6
Characteristics and Performance Data:

General:

Height.. 185 mm
Diameter .... 270 mm
Total weight (kg) 9.6

Case:

Case Material..Plastic
Color ....OD green or tan
Fuze wells 1

Explosive:

Main explosive charge type .... Comp B
Main explosive charge weight... 6.0 kg

Fuze:

Fuze type ....Pressure
Fuze actuation 180

Lethal Mechanism:

Lethal mechanism category .... Blast

Features:

Antidisturbance ....Probable
(There is a secondary fuze well on the bottom of the mine for booby trap purposes.)
Detectability ....Readily detectable due to metallic content of fuze

TM-46

TM-46 Antitank Mine

The TM-46 and TMN-46 are two antitank mines that differ only in that the TMN-46 has an additional fuze well on the bottom of the mine to allow for the inclusion of an anti-handling/anti-lift/booby-trap device. The TMN-46 is booby-trapped using a MUV-type pull fuze by connecting the pull pin to a fixed object (stake) under the mine. The mines consist of a sheet-metal body with carrying handle; main explosive charge, fuze(s), booster(s), a diaphragm to separate the pressure plate and explosive charge, and a side-mounted filler plug. With the safety pin removed, target pressure collapses the diaphragm. As the fuze housing is forced down, the striker spring is compressed. At a point, the retaining ball is released into a cavity between the striker housing and the fuze well. This frees the spring-driven striker that then impacts the detonator exploding the mine.

TM-46
Characteristics and Performance Data:

General:

Shape..Cylindrical
Height.. 108 mm
(With MVM fuze)
Diameter .... 305 mm
Total weight (kg) 8.6

Case:

Case Material ....Metal
Color ....OD green
Fuze wells 1

Explosive:

Main explosive charge type .... TNT
Main explosive charge weight.. 5.7 kg

Fuze:

Fuze model ....MVM
Fuze actuation 180
Fuze type ....Pressure

Lethal Mechanism:

Lethal mechanism category .... Blast

Features:

Antidisturbance .... Possible (however, no secondary fuze well or AD features)
Detectability .... Readily detectable due to metal case

TM-57

TM-57 Antitank Mine

There are at least two variants of the TM-57 antitank mine. One, assumed to be the earlier model, has two filler plugs on the bottom of its case for filling the main charge of TNT. The other has no filler holes on the bottom, which leads to the conclusion that the main charge is pressed TNT and is added during the manufacturing process. The side fuze well is a booby-trap well that will accommodate a MUV-type pull fuze. When the mine is emplaced, a cord connects the pull pin to a fixed buried object (stake) so that when the mine is lifted, the pull pin is removed.

TM-57
Characteristics and Performance Data:

General:
Shape..Cylindrical
Height.. 101.60 mm
Diameter .... 315.72 mm
Total weight (kg) 8.47

Case:
Case Material .... Steel
Color ....OD green
Fuze wells 2

Explosive:
Main explosive charge type .... TNT
Main explosive charge weight... 6.02 kg

Fuze:
Fuze type ....Pressure
Fuze actuation 200
Fuze model MVSH-57

Lethal Mechanism:
Lethal mechanism category .... Blast

Features:
Antidisturbance .... Probable (one or more fuze wells for boobytrap purposes
Detectability .... Readily detectable due to metal case

TM-62M

TM-62M Antitank Mine

The TM-62 series is a conventional blast antitank mine. It exists in four distinct versions: the TM-62M (metallic case), TM-62P (plastic case), TM-62B (caseless), and TM-62D (wooden case). All are circular except for the TM-62D, which is rectangular. The base of the TM-62M has six stability ridges radiating from its center. The wooden-cased TM-62D is probably available only in limited quantities.

TM-62M
Characteristics and Performance Data:

General:

Shape...Cylindrical
Height.. 101.85 mm
Diameter .... 320 mm
Total weight (kg) 8.5

Case:

Case Material...Metal
Color ....OD green
Fuze wells 1

Explosive:

Main explosive charge type .... Trotyl
Main explosive charge weight.. 7.0 kg

Fuze:

Fuze type ....Pressure
Fuze actuation 200
Fuze model ....MVN-62 or MVN-72

Lethal Mechanism:

Lethal mechanism category .... Blast

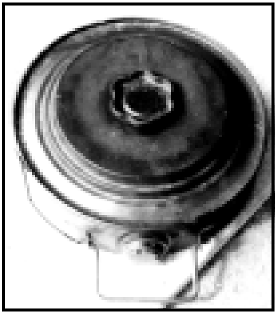
Features:

Antidisturbance .... Possible (however, no secondary fuze well or AD features)
Detectability .... Readily detectable due to metal case

Performance:

Penetration depth...27 mm RHAe

TMN-46



TMN-46 Antitank Mine

The TM-46 and TMN-46 are two antitank mines that differ only in that the TMN-46 has an additional fuze well on the bottom of the mine for inclusion of a booby-trap device. The TMN-46 is booby-trapped using a MUV-type pull fuze by connecting the pull pin to a fixed object (stake) under the mine. The mines are otherwise similar, consisting of a sheet-metal body with carrying handle; the main explosive charge, fuze(s), booster(s), a diaphragm to separate the pressure plate and explosive charge, and a side-mounted filler plug. The mines consist of a sheet-metal body with carrying handle, main explosive charge, fuze(s), booster(s), a diaphragm to separate the pressure plate and explosive charge, and a side-mounted filler plug. With the safety pin removed, target pressure collapses the diaphragm. As the fuze housing is forced down, the striker spring is compressed. At a point, the retaining ball is released into a cavity between the striker housing and the fuze well. This frees the spring-driven striker that then impacts the detonator, exploding the mine.

TMN-46
Characteristics and Performance Data:

General:
Shape...Cylindrical
Height.. 108 mm
(With MVM fuze)
Diameter .... 305 mm
Total weight (kg) 8.6

Case:
Case Material...Metal
Color ....OD green
Fuze wells 2

Explosive:
Main explosive charge type .... TNT
Main explosive charge weight... 5.7 kg

Fuze:
Fuze model ....MVM
Fuze actuation 180
Fuze type ....Pressure

Lethal Mechanism:
Lethal mechanism category .... Blast

Features:
Antidisturbance .... Probable (one or more fuze wells for boobytrap purposes)
Detectability .... Readily detectable due to metal case

Type 59

Type 59 Antitank Mine

The Type 59 consists of a sheet-metal body with carrying handle; the explosive chare, fuze(s), and boosters, a diaphragm to separate the pressure plate and explosive charge, and a side-mounted filler plug. The pressure plate is stepped to facilitate crushing, and a controlled actuation pressure results from this design. The two-pronged safety pin acts as a bridge, and a positive safety protecting the diaphragm. With the safety pin removed, target pressure collapses the diaphragm. As the fuze housing is forced down, the striker spring is compressed. At a point, the retaining ball is released into a cavity between the striker housing and the fuze well. This frees the spring-driven striker that then impacts the detonator, exploding the mine. The Type 59 antitank mine is a copy of TMN-46 AT mine.

Type 59
Characteristics and Performance Data:

General:

Shape....................Cylindrical
Height.................... 101.60 mm
Diameter .... 315.72 mm
Total weight (kg) 8.47

Case:

Case Material.................... Steel
Color ....OD green
Fuze wells.................... 2

Explosive:

Main explosive charge type .... TNT
(TGA 60/24/16)
Main explosive charge weight.................... 6.02 kg

Fuze:

Fuze type ....Pressure
Fuze actuation 200
Fuze model .... MUV type

Lethal Mechanism:

Lethal mechanism category.................... Blast

Features:

Antidisturbance .... Yes
(Probable, both the pressure board and the entire mine can be fitted with antihandling devices.)

Type 72 (CH Plastic)

Type 72 Antitank Mine

The Type 72 antitank mine is constructed of green plastic, is cylindrical, and features a pull-out handle at the base of the mine. The central fuze well lies within a raised pressure plate. Fuze functioning is simply a matter of deforming the pressure plate with a sufficiently long impulse to release a cocked striker. All three identified fuzes are blast resistant. A filler plug is located on the side of the mine body above the lifting handle. This is not a secondary fuze well. The following information is provided regarding the three known fuzes for this mine: Type 69, double-impulse pressure fuze (300-800 kg pressure); Type 72A, single-impulse pressure fuze (300-800 kg pressure); Type 81, single-impulse pressure fuze (400-800 kg pressure).

Type 72
Characteristics and Performance Data:

General:

Shape....................Cylindrical
Height.................... 100 mm
Diameter .... 270 mm
Total weight (kg) 6.5

Case:

Case Material....................Plastic
Color .... Green
Fuze wells 1

Explosive:

Main explosive charge type ....RDX/TNT
Main explosive charge weight.................... 5.4 kg

Fuze:

Fuze model .... Type 69
Fuze actuation .... 300 to 800
Fuze type ....Pressure

Lethal Mechanism:

Lethal mechanism category .... Blast

Features:

Antidisturbance .... Possible (however, no secondary fuze well or AD features)
Detectability ....Difficult to detect (Limited metallic content for the Type 69 and 72A fuzes)

VS-1.6

VS-1.6 Antitank Mine

The VS-1.6 is a first-generation scatterable antitank mine, equipped with a pressure fuze. The VS-1.6 antitank mine is described as resistant to all countermeasures. It has been consistently demonstrated as survivable against both fuel-air-explosive and bulk explosive countermeasures. A look-a-like version of this mine, the VS-1.6/ARAN, is equipped with an electronic anti-disturbance and self-destruct device.

VS-1.6
Characteristics and Performance Data:

General:
Shape...Cylindrical
Height...90.2 mm
Diameter ....220 mm
Total weight (kg) 2.98

Case:
Case Material...Plastic
Color ....OD green or tan
Fuze wells...1

Explosive:
Main explosive charge type ....RDX/TNT
Main explosive charge weight..1.705 kg

Fuze:
Fuze model ....VS-N
Fuze type ....Pressure
Fuze actuation 180

Lethal Mechanism:
Lethal mechanism category ....Blast

Features:
Antidisturbance ....Probable
(An antihandling device, the VS-AR4, can be fitted into the detonator plug on the bottom of the mine.)
Detectability ....Difficult to detect

VS-2.2

VS-2.2 Antitank Mine

The VS-2.2 is a cylindrical, plastic-bodied, blast, antitank mine equipped with a plastic carry handle. The centrally mounted VS-N pneumatic-type pressure fuze is very resistant to explosive countermea-sures. Additionally, the minimal metallic content of this mine renders it very difficult to detect. The blast effect of the VS-2.2 will destroy armored vehicle track and suspension assemblies, but it is unlikely to totally destroy heavy armored ground combat vehicles. It has limited effect against heavy armored vehicles.

VS-2.2
Characteristics and Performance Data:

General:
Height...117.6 mm
Diameter .... 240 mm
Total weight (kg) 3.54

Case:
Case Material..Plastic
Color ....OD green or tan
Fuze wells 1

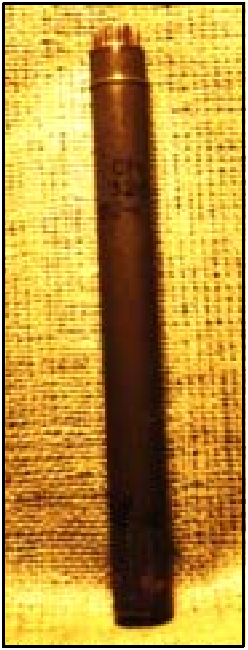
Explosive:
Main explosive charge type ....RDX/TNT
Main explosive charge weight.. 1.93 kg

Fuze:
Fuze model ....VS-N
Fuze type ....Pressure
Fuze actuation 180

Lethal Mechanism:
Lethal mechanism category .... Blast

Features:
Antidisturbance ....Probable
(An antihandling device, the VS-AR4, can be fitted into the detonator plug on the bottom of the mine.)
Detectability ....Difficult to detect

SM



SM Signal Mine

The SM signal mine launches pyrotechnic signal stars to a height of 5 to 25 meters. The bottom of the mine is painted white, green, or red to reflect the color of the signal stars within. The pyrotechnic effect lasts 10 to 12 seconds, and the audible signal lasts 8 to 10 seconds.

SM
Characteristics and Performance Data:

General:

Shape..Cylindrical
Height.. 278 mm
Diameter .... 25.0 mm
Total weight (kg)... 0.4

Case:

Case Material .... Steel
Color ....OD green
Fuze wells 1

Explosive:

Main explosive charge type ....Pyrotechnic compounds
Main explosive charge weight.. 0.256 kg

Fuze:

Fuze model ....MUV, MUV-2, MUV-3, MUV-4
Fuze type ....Tripwire

Lethal Mechanism:

Lethal mechanism category ....Visual alarm

Features:

Antidisturbance .... Possible (however, no secondary fuze well or AD features)
Detectability .... Visually detectable

VS-T

VS-T Illumination Mine

The VS-T combination illumination/alarm mine is designed to warn of intruders and to illuminate the area immediately surrounding the mine. The mine can be mounted on a stake or buried with the fuze exposed. The dual action fuze can operate either as a pressure or trip-wire fuze. The illuminating power is approximately 15 Lux at 57 meters for 40 seconds.

VS-T
Characteristics and Performance Data:

General:

Shape...Cylindrical
Height.. 220 mm
Diameter .... 70 mm
Total weight (kg) 470
Lethal mechanism category ....Visual alarm

Case:

Case Material ....Plastic
Color ....OD green or tan
Fuze wells 1
Detectability .... Visually detectable

Fuze:

Fuze type ....Pressure or Tripwire

Lethal Mechanism:

Lethal mechanism category ....Visual alarm

Features:

Antidisturbance .... Possible (however, no secondary fuze well or AD features)

Chapter 10

Booby Traps and Improvised Explosive Devices

Throughout the last 22 years, the Iraqi military has been involved in three major wars. During this period, Iraqi soldiers gained extensive knowledge and experience in the use of booby traps and improvised explosive devices (IEDs).

During the Gulf War, coalition forces encountered significant numbers of booby traps and IEDs. Most of these devices were located in numerous bunker complexes. It is logical to assume that our soldiers will again encounter these deadly explosive hazards.

In northern Iraq, the Iraqi military routinely booby-trapped 5-gallon cans of napalm to harass and intimidate the Kurdish population. Another common booby trap encountered involved daisy chaining the Valmara 69 antipersonnel (AP) fragmentation mine. Many of these hazards are still present today.

Leaders and personnel must know and understand these particular threats to avoid becoming casualties, protect the force, and maintain momentum. Booby traps and IEDs are similar to mines in that they are designed to kill or incapacitate personnel. They are also emplaced to avoid detection and improve effectiveness. Most are victim-activated, but some may involve remote or command detonation architectures. Iraq is a known sponsor of terrorism and has been closely identified with Hezbollah and, more recently, al-Queda. If a war or occupation of Iraq becomes necessary, we can expect booby traps to be used in the same manner as used in Israel to inflict casualties and provoke terror among United States (US) and coalition forces. US forces may encounter significant, sophisticated, and improvised devices. Booby traps, including command-detonated roadside bombs and car bombs, may also be faced.

The use of booby traps is limited only by the imagination of the adversary. Booby traps are victim-activated devices intended to create casualties and terror and may or may not be found in areas of tactical significance. Booby traps—

- Are usually explosive in nature.
- Are usually activated when an unsuspecting person disturbs an apparently harmless object or performs a presumably safe act; for example, souvenir hunting.
- Are designed to kill or incapacitate.
- Cause unexpected random casualties and damage.
- Create an attitude of uncertainty and suspicion, in effect lowering morale and inducing a degree of caution that restricts or slows movement.
- Threaten force protection.
- Assume that all mines are booby-trapped.

Improvised devices are characterized by varying employment techniques. In most of the techniques shown below, an unexploded ordnance (UXO) can easily be engineered to replace a mine or explosive device using one of the several following techniques:

- **Coupling.** Coupling is a method of linking one mine or explosive device to another, usually with detonating cord. When the first device is detonated, it also detonates the linked explosive. This technique is often used to defeat countermine equipment, such as mine rollers (Figure 10-1).
- **Rolling.** The roller will pass over the initial, unfuzed device and set off the second fuzed device. This in turn detonates the overpassed

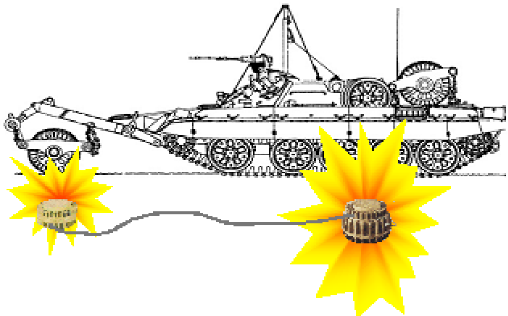


Figure 10-1. Coupling of Mines

device underneath the clearing vehicle. When the linked devices are directional fragmentation mines, they can create a large, lethal engagement area.

- **Boosting.** Buried mines, UXOs, or other explosive devices are stacked on top of one another. The device buried deepest from the surface is fuzed. Fuzing only the deepest ordnance helps mask no- and low-metal explosive hazards placed near the surface. This reduces the probability of detection by metal detectors, and it increases the force of the blast.
- **Sensitizing antitank (AT) mines.** On some nonmetallic AT mines, the pressure plate is cracked and the spring is removed to reduce the pressure required to initiate the mine. Similarly, the pressure plate can be removed from metallic AT mines to create the same effect. A pressure-fuzed AP mine can be placed on the top of an AT

mine, thus creating a very large AP mine as an alternative method.

- **Daisy chaining.** AP mines may be used in daisy chains linked with other explosive hazards. Enemy forces may link the mines together with trip wire or detonating cord. When the initial mine is detonated, the other mines may detonate. This may also create large, lethal engagement areas.

FIRING DEVICES

In low-intensity, stability and support operations and counterterrorism conflicts, there may be high incidences of improvised devices and booby traps. It is impossible to provide a complete list of firing devices (FDs) and improvised demolition materiel that can be used. Most improvised traps are variations of those described below.

- **Improvised electric FDs.** An electric FD requires a current to pass between two contacts. The ways in which this can be achieved are unlimited. Booby traps/IEDs utilizing electrical components are limited by having to use a power source. In most cases, the power source will be a battery. The life of this type of booby trap is limited to the life of the battery. Examples of simple FDs that can be manufactured using basic materiels, household items, or appliances are shown in Figure 10-2.

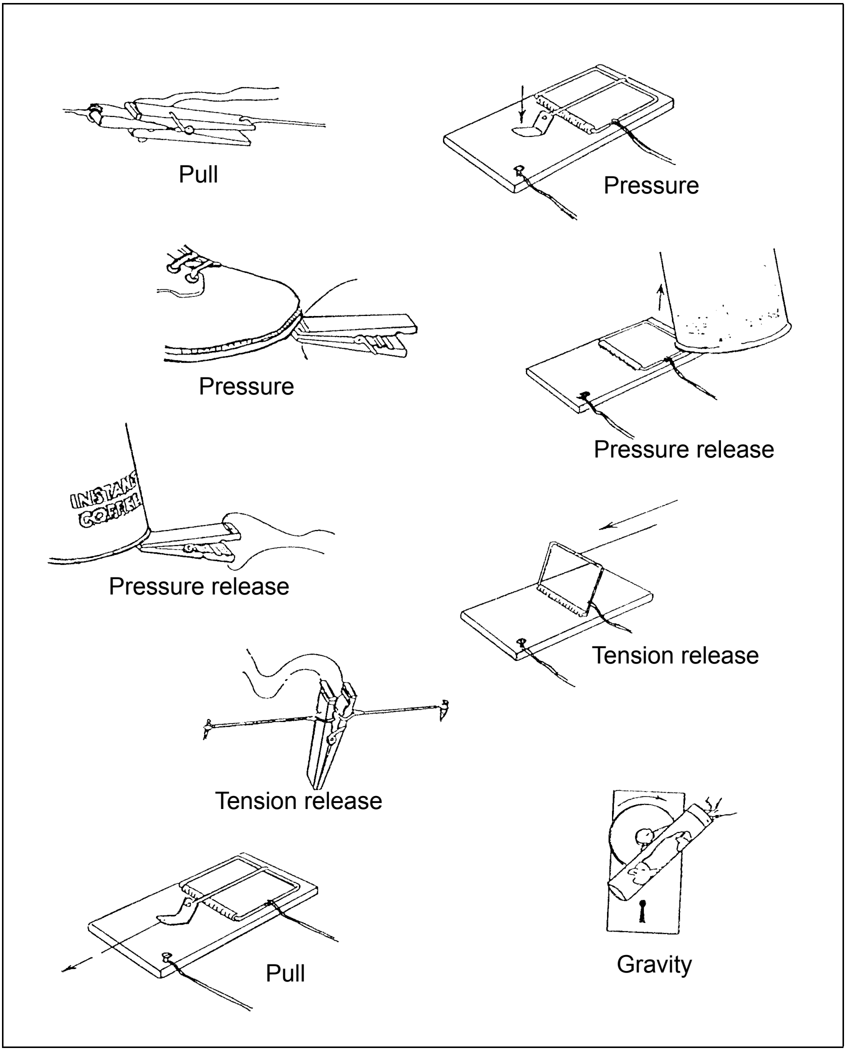


Figure 10-2. Improvised Electrical FDs

- **Nonelectric FDs.** Most nonelectric FDs are based on pressure, pressure release, or trip wire actuation. Improvised FDs are usually of the shear pin or pin removal type. Examples of these are shown in Figures 10-3 and 10-4.

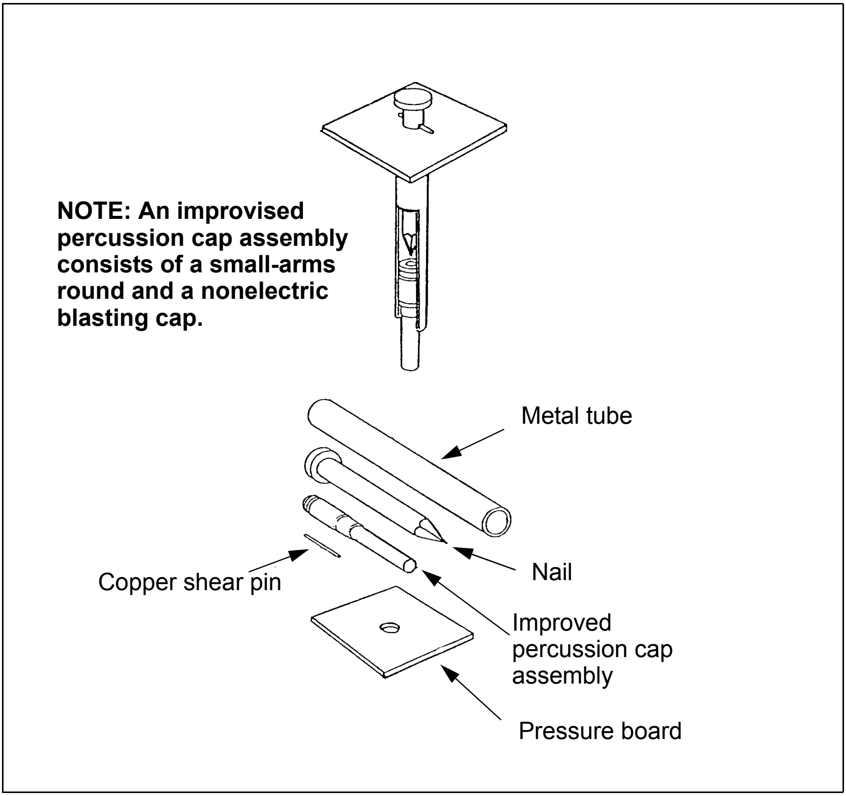


Figure 10-3. Improvised Nonelectric FD

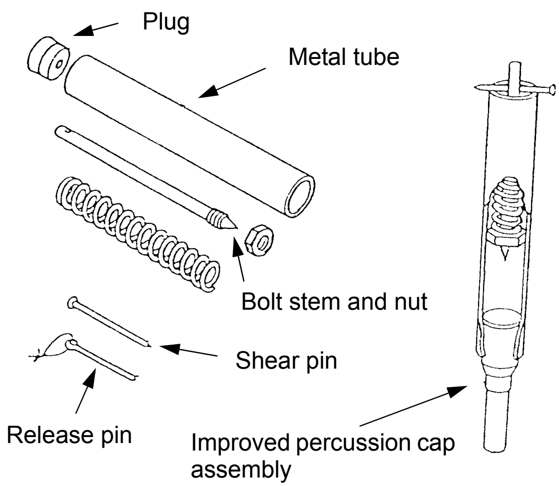


Figure 10-4. Improvised Nonelectric FD (Spring-Operated)

BOOBY TRAP INDICATORS

By definition, booby traps are disguised or well-hidden, victim-activated devices. The initiating object is going to be fairly obvious, as it is the object that the enemy hopes a soldier will interfere with in order to set off the trap. Booby traps rely on an unwary or distracted soldier touching or pulling a physical object (such as a war souvenir) or provide a too-easy access or simple solution to a problem (such as leaving only one door open in an otherwise secure building). (See Figure 10-5, page 10-8, for possible booby trap and mine locations.)

In an operational environment where booby traps have been used, soldiers must be trained to constantly question why things are positioned where they are or why the enemy might have left obvious routes open. The enemy will watch reactions and procedures executed when moving through an area. They will be looking for

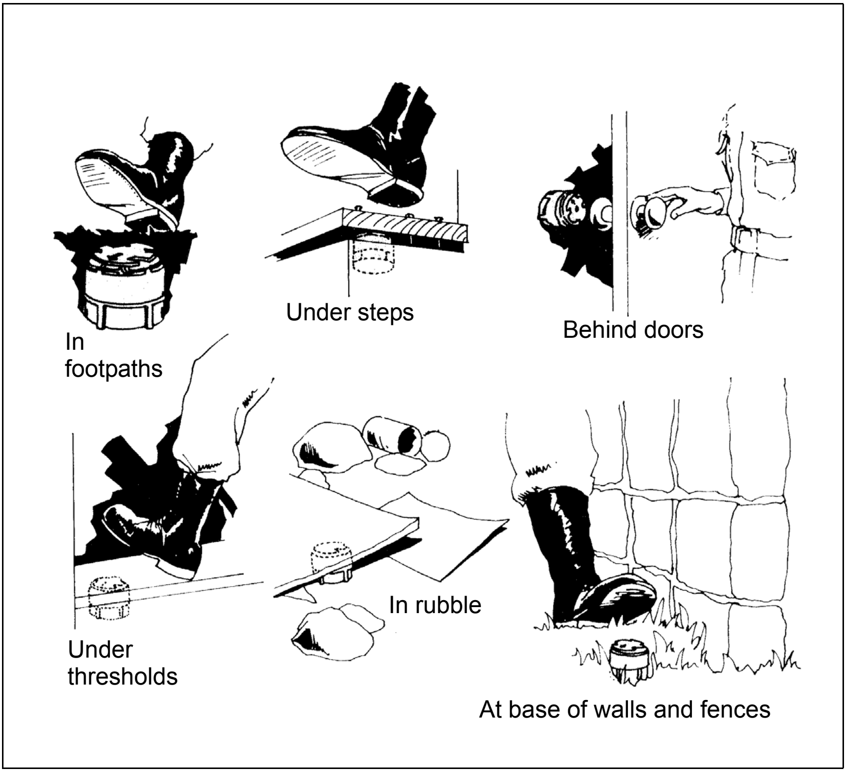


Figure 10-5. Possible Booby Trap and Mine Locations

our natural behavior and weaknesses in our drills. For example, in Vietnam, the Vietcong (VC) noticed soldiers liked to kick empty soda cans that were lying on the ground. It was not long before the US troops found that the VC were leaving explosive devices in empty cans lying alongside regular patrol routes. The devices were activated when the cans were kicked.

Many of the booby trap indicators mirror those of mines. These include areas where the locals do not enter, such as abandoned buildings and attractive items that are usually left alone. Others include the following:

- Electrical wires, batteries, booby traps, and store items (clothes pegs, mouse traps, steel tubes, and springs).
- Isolated boxes and containers along routes.
- Abandoned vehicles, military equipment, weapons, uniforms, and papers.
- Trip wires, string, and cables.
- Disturbed soil and sand.
- Dust.
- Footprint trails that stop suddenly.

Buildings are excellent sites for booby trap warfare. If unsecured buildings have to be entered and occupied, assume that they are booby-trapped. Likely targets are restrictive areas like doorways, windows, and areas of approach that are typically used. These are likely targets because people will have to move through them. These areas are likely to be booby-trapped. Teams must develop alternate ways of entering the building where the enemy is unlikely to have set traps.

Once inside, hallways, interior doorways, staircases, and floors provide restricted access and are again prime sites. Any remaining furniture or household objects will have to be cleared prior to use.

The search and clearance of buildings, caves, abandoned vehicles, or any suspect area is a specialized skill that requires expert knowledge of booby trap types and functions. The clearance procedures are also highly complex, requiring skilled soldiers and specialized equipment and training. The task of booby trap clearance and disposal is an explosive ordnance disposal (EOD) mission. If booby traps are located, EOD personnel should be tasked for clearance and disposal support.

In all cases, the minimum number of soldiers with the largest tactically acceptable spacing should be engaged in clearance operations to reduce collateral casualties. If operations require troops to enter suspect buildings without EOD support, the guidelines outlined below should be adopted.

GUIDELINES FOR CLEARING BUILDINGS

The clearance of buildings requires meticulous planning and control to ensure that all personnel are operating safely and that all areas of the building are covered. Command and control of the approach, selection and execution of the initial entry, and the subsequent search procedures must be absolute. No one else may enter the building until it is declared clear. Recording the progress into the building is vital to ensure that all areas are properly covered.

While a clearance team might comprise several soldiers, only the minimum should be engaged in actual search and clearance operations at any one time. This is usually one person. As a general rule, two walls or two floors are the minimum distance between parties.

EXTERIOR RECONNAISSANCE AND ENTRY

Assume that the area surrounding the target building is booby-trapped or mined (see Figures 10-6 and 10-7). Sweep the approach route as if it were a minefield. Mark this lane clearly. Carry out a reconnaissance to determine the point of entry, and clear the way to it. When selecting the point of entry, consider the following:

- **Doorways.** Never consider doorways to be safe. If the door is fully open, check for trip wires or pressure FDs in the doorway floor. If a house is built on a concrete slab, it is not likely to have a pressure FD in the floor.
- **Windows.** Windows are excellent locations for booby traps. Pay particular attention to the ground outside and the floor inside because they are classic sites for pressure FDs. Use the

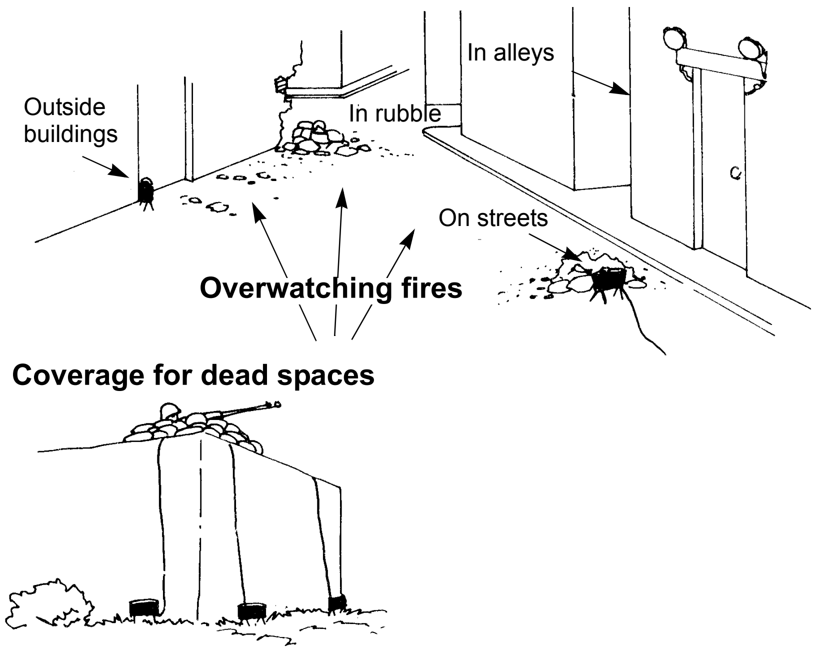


Figure 10-6. Likely Mine/Booby Trap Locations Outside Buildings

Figure 10-7. Trip Wire-Activated Stake, Mine Hidden in a Mud Wall

following procedures if access must be gained through a window:

- Pull the window if it is unlocked and can be moved. If it is locked, use a small charge or a heavy object to break the glass.
- Select a stationary window that cannot be opened versus a window that can be opened. The window that can be opened is more likely to contain a booby trap.
- Deal with blinds and curtains in a manner similar to procedures used for windows.
- Use a mirror to examine inside the window frame before entering the building.

• **Mouse holes.** If you decide not to enter the structure through a door or a window, use explosives to make a mouse hole in the wall, roof, or floor. This offers a remote, safe method of creating an access point, but it can also detonate nearby traps. Exercise caution if entering through the roof of a two-story building, because it is far more difficult to clear booby traps when going down steps than it is when going up them.

All search actions/investigations should be executed remotely. Remote investigation of a suspected booby trap/IED area is achieved using lengths of rope, pulleys, hooks, and anchors. These techniques generally require available equipment, but they must be rehearsed prior to execution. Additional considerations for booby trap/IED investigation include the following:

• Open doors with falling weights and bungee cords from at least 50 meters away, behind cover, by pulling the rope or cable.

• Remotely drop heavy weights (50 pounds minimum) onto the floor, and drag it back to provide floor clearance.

- Carefully attach pulling ropes to all moveable objects, such as chairs and furniture, and pull from outside.
- Check for trip wires from the floor to above head height.
- Wait for at least 1 minute after each positive action to allow for time delay fuzing or slow initiation systems.

The sequence of search should follow a set procedure to ensure that items and areas are not missed. The following is a suggested sequence:

Step 1. Doors/entry points.

Step 2. Trip wires.

Step 3. Floors.

Step 4. Furniture/moveable objects.

Step 5. Fittings/fixed furniture (drawers, cupboards, fireplaces).

Step 6. Switches.

Step 7. Walls and windows.

Step 8. Ceilings.

Make a record of each action. Clearly mark all rooms with paint, chalk, a marker, or a pen. Leave all doors, windows, and drawers open after they are cleared.

CLEARING INSTALLATIONS AND FACILITIES

Clearing by hand is necessary in installations and facilities (such as fuel dumps, ammunition dumps, and electric substations) where an explosion could result in the loss of resources. In other situations, the importance of the item 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. You should seek a specialist's advice, if available, when clearing booby traps in industrial areas and unfamiliar locations.

Chapter 11

Unexploded Ordnance

INTRODUCTION

Unexploded ordnance (UXO) saturation has become a characteristic of the modern battlefield—a characteristic that threatens mobility and force protection. United States (US) Army personnel have been killed or injured by UXO in virtually every modern conflict or contingency operation in which the US has participated.

NOTE: More US personnel were killed by UXO in Desert Storm than by Iraqi ground fire. These losses can be attributed primarily to unfamiliarity with UXO countermeasures and avoidance procedures.

Every individual participating in an operation should be able to recognize and react safely to UXO hazards. To this end, leaders must train their personnel to conduct operations in UXO-contaminated environments. Commanders must consider the impact of UXO during the development of combat estimates and take appropriate countermeasures during mission execution.

UXO is defined as explosive ordnance that has been primed, fuzed, armed, or otherwise prepared for action. It can be fired, dropped, projected, launched, or placed. The failure of the weapon to explode may be due to malfunction, design, or another cause.

THE IMPACT OF UNEXPLODED ORDNANCE ON GROUND MOBILITY

UXO inhibits mobility by—

- Restricting terrain use and reducing momentum.
- Increasing force protection and safety risks to combat, combat support, and combat service support (CSS) elements.
- Requiring the dedication of resources to clear and mark UXO areas and the lanes through them.
- Impacting combat power due to potential losses of personnel and equipment to UXO encounters.

RENDERING UNEXPLODED ORDNANCE SAFE

Only EOD personnel may render UXO safe. All soldiers are to report UXO through the chain of command to get EOD assistance. Soldiers must be trained in basic UXO identification to assist in threat analysis and UXO reporting. UXO is categorized into the following four groups:

- Placed (mines).
- Projected (artillery shells, mortar rounds, and rockets).
- Thrown (grenades).
- Dropped (aircraft bombs).

Field Manual (FM) 21-16 provides detailed illustrations and identifying characteristics of the four categories of UXO.

ORDNANCE TERMS FOR THE FORMER UNION OF SOVIET SOCIALIST REPUBLICS/RUSSIA

Refer to Tables 11-1 through 11-10, pages 11-3 through 11-16, for ordnance terms for the former Union of Soviet Socialist Republics (USSR)/Russia.

Table 11-1. Ammunition Filler Codes

Marking	Meaning
А	Amatol (100% Ammonium Nitrate)
А-40	Amatol (40% Ammonium Nitrate, 60% TNT)
АТ-40	Amatol (40% Ammonium Nitrate, 60% TNT Pressed)
А-80	Amatol (80% Ammonium Nitrate, 20% TNT)
АТ-90	Amatol (90% Ammonium Nitrate, 10% TNT)
АТФ 40	TNT (40% Ammonium Nitrate, 60% TNT Pressed)
А-IX-1	RDX 94%, Wax 6%
А-IX-2	RDX 73%, Aluminum 23%, Wax 4%
А-IX-20	RDX 78%, Aluminum 19%, Wax 3%
А-IX-П	RDX with unknown suffix "Ï=P"
ДБ	Dinitrobenzol
ДБТ	Dinitrobenzene and TNT
Г	Hexogen (cyclonite, RDX)
ГАИ-30	RDX 30%
З	Incendiary
М	Picric Acid
МС	TNT, Aluminum, RDX
К-1	TNT 70%, Dinitrobenzene 30%
К-2	TNT 80%, Dinitrobenzene 20%
ОКТОГЕН	HMX
ОКФОЛ	HMX 95%, wax 5% (normal composition)
ОКТОЛ	HMX and TNT
ОЛ	HMX 95%, wax 5% (normal composition)
ПВВ-5А	Plastic Explosive

Table 11-1. Ammunition Filler Codes (Continued)

Marking	Meaning
Т	Trotyl (TNT)
Т-80	TNT 70%, RDX 30%
ТГ	TNT and RDX
ТГ-30	TNT 30%, Hexogen (RDX) 70%
ТГ-50	TNT 50%, Hexogen (RDX) 50%
ТГАФ-5	TNT 40%, RDX 40%, Aluminum 20%
ТГАГ-5	TNT 60%, RDX 20%, Aluminum 15%, Wax 5%
ТД-42	TNT 42%, Dinitronapthalene 58%
ТД-50	TNT 50%, Dinitronapthalene 50%
ТДУ	TNT with spotting charge
ТС	TNT sulfite
Ш	Schneiderite (Ammonium Nitrate 88%, Napthalene 12%)
ШТ	Schneiderite and TNT
Р-4	White and Yellow Phosphorus
Р-5	Mustard gas (H)
РС	Lewisite gas (L)
РЮ	Phosgene gas (CG)
Р-15	Adamsite gas (DM)
Р-2	Hydrogen Cyanide gas (AC)
Р-35	Sarin gas (GB)
Р-43	Lewisite gas (L)
Р-55	Soman gas (GD)
Р-74	Mustard gas (H)
РК-7	Mustard/Lewisite mixture (H+L)

Table 11-2. General Ordnance Markings

Cyrillic	English	Meaning
А	A	Propaganda or fragmentation
Б	B	Armor-Piercing
З	Z	Incendiary
Р	R	Tracer
БР	BR	Armor-Piercing, Tracer
БЗ	BZ	Armor-Piercing, Incendiary
БЗА	BZA	Armor-Piercing, Incendiary (improved)
БЗР	BZR	Armor-Piercing, Incendiary Tracer
БМ	BM	Armor-Piercing Discarding Sabot (fin or Spin Stabilized)
БП	BP	HEAT Spin Stabilized
БК	BK	HEAT Fin Stabilized
Д	D	Smoke
ДЦ	DTs	Target Marker Smoke
О	O	Fragmentation (Oskolochno)
Ф	F	High Explosive (Fugaasnymi)
ОФ	OF	Fragmentation, High Explosive
Г	G	Concrete-Piercing
ОГ	OG	Fragmentation (launched grenades)
ОФР	OFP	Fragmentation, High Explosive, Tracer
ОФЗТ	OFZT	Fragmentation, High Explosive, Incendiary, Tracer
ОР	OR	Fragmentation, Tracer
ОЗ	OZ	Fragmentation, Incendiary
ОХ	OKh	Fragmentation, Gas

Table 11-2. General Ordnance Markings (Continued)

Cyrillic	English	Meaning
ПБР	PBR	Armor-Piercing, Target Practice
ПГ	PG	HEAT (launched grenades)
ПУ	PU	Target Practice
РПО	RPO	Infantry Flame Weapon
С	S	Illumination
СП	SP	Solid Shot, Armor-Piercing
Ш	Sh	Shrapnel
Щ	Shch	Canister
Х	Kh	Gas
ИНЕРТ	INERT	Inert
МАКЕТ	MAKET	Model
ОСКОЛ	OSKOL	Fragmentation
ПРАКТ	PRACT	Practice

Table 11-3. Projectile Suffixes

Cyrillic	English	Meaning
А	A	Cast Iron
Б	B	Improved Projectile (Mostly AP Types)
Д	D	Improved Projectile (Mostly AP Types)
ДУ	DU	Improved Projectile (Mostly Frag Types)
Ж	Zh	Sintered Iron Rotating Band
К	K	Improved Projectile (Mostly AP Types)
М	M	Usually HEAT Projectile (Copper Liner)
Н	H	Improved Projectile (Mostly Frag)
П	P	Usually Improved HVAP Projectile
ПК	PK	Usually Improved HVAP Projectile
С	S	Improved HEAT Projectile
СП	SP	Improved AP Projectile
У	U	Usually Improved AP Projectile
УМ	UM	Improved HEAT Projectile

Table 11-4. Projectile Weight Classification USSR/Russia

Symbol	Meaning
ЛГ	Greater than 3% below standard
----	2.33% to 3% below standard
---	1.66% to 2.33% below standard
--	1% to 1.66% below standard
-	0.33% to 1% below standard
Н	0.33% below to 0.33% above standard
+	0.33% to 1% above standard
++	1% to 1.66% above standard
+++	1.66% to 2.33% above standard
++++	2.33% to 3% above standard
ТЖ	Greater than 3% above standard

Table 11-5. Nomenclature Caliber Relationships for USSR/Russian Projectiles

1st and 2nd Digit of Nomenclature	Caliber
13	25
16	37
24	45
27	57
28	57
34	76
35	85
36	100
41	107
42	122
46	107
47	122
48	130
50	152
52	152
53	152
54	152
57	180
62	203
67	280
83	82
84	107
84	120

EXAMPLE: OF-412=Fragmentation, High Explosive, 100mm

Table 11-6. Model Markings for USSR/Russian Mines

Cyrillic	English	Meaning
Б	B	Large or Paper
В	V	Fuze
Д	D	Wooden
Э	E	Electrical
З	Z	Obstacle
К	K	Shaped Charge
М	M	Mine, Metal, or Improved
Н	N	Anti-Handling, Tread Operated, or Directional
О	O	Fragmentation or Obstacle
П	P	Anti-Personnel or Plastic
С	S	Self Destruct or Booby-Trap
Т	T	Anti-Tank
У	U	Training
Ф	F	Explosive, FAE, or Dropped
Х	Kh	Chemical
Ч	Ch	Clockwork or Timer
Ш	Sh	Tilt Rod
Я	Ya	Box (Old Designation) or Anchored
Р	R	Water

Table 11-7. Typical USSR/Russian Mine Markings

Cyrillic	English	Meaning
МВЗ	MVZ	Mine Fuze Pressure Operated
ЯМ	YaM	Anti-Tank Mine Wooden (Old Designation
МПМ	MPM	Mine-Bullet-Improved
ЭХЗ	EkhZ	Electric Chemical Fuze
ЧЗ	ChZ	Clockwork/Timer Fuze
МВЧ	MVCh	Clockwork Mine Fuze
УВ	UV	Pull Fuze
МВШ	MVSh	Mine Fuze Tilt-Rod
ОЗМ	OZM	Fragmentation Obstacle Mine
ТМД-Б	TMD-B	Anti-Tank Wooden Cased
ЗТ	ZT	Time Fuze Igniter
ТМК	MUV	Mine Fuze Pull
ТМК	TMK	Anti-Tank Mine With Shaped Charge
ПМД	PMD	Anti-Personnel Mine Wooden Cased
ПОМЗ	POMZ	Anti-Personnel Mine Obstacle
ПМН	PMN	Anti-Personnel Mine Tread Operated
ВПФ	VPF	All Ways Acting Fuze
ТМБ	TMB	Anti-Tank Mine Paper Cased
ТМ	TM	Anti-Tank Mine
МВ	MV	Mine Fuze Pressure Operated
МВМ	MVM	Mine Fuze Improved
МВН	MVN	Mine Fuze Magnetic Influence
ТМН	TMN	Anti-Tank Mine With Anti-Handling Fuze
МОН	MON	Mine Fragmentation Directional

Table 11-8. Typical USSR/Russian Bomb Markings

Cyrillic	English	Meaning
ФАБ	FAB	General Purpose, High Explosive
ОФАБ	OFAB	General Purpose, Frag-HE
БРАБ	BRAB	Semi-Armor Piercing
БЕТАБ	BETAB	Armor Piercing
ПТАБ	PTAB	Anti-Tank
МАБ	MAB	Light-Case Blast
АО	AO	Fragmentation
ЗАБ	ZAB	Incendiary
РРАБ	RRAB	Container (Cluster)
ХАБ	KhAB or ChAB	Chemical
КРАБ	KRAB	Toxic Smoke
ДАБ	DAB	Incendiary Smoke
ОДАБ	ODAB	Fuel Air Explosive
ФОТАБ	FOTAB	Photo Flash
АНАБ	ANAB	Marker Float
АБ	AB	Propoganda
ДС	DS	Rocket Assisted
АОХ	AOKh or AOCh	Frag-Chemical
САБ	SAB	Flare
АГИТАБ	AGITAB	Leaflet

Table 11-9. Russian and English Conversion Chart

Russian	English	Russian	English	Russian	English
А а	A a	Л л	L l	Ц ц	Ts ts
Б б	B b	М м	M m	Ч ч	Ch ch
В в	V v	Н н	N n	Ш ш	Sc sh
Г г	G g	О о	O o	Щ щ	Shch shch
Д д	D d	П п	P p	Ъ ъ	(") (")
Е е	Ye, E ye, e[1]	Р р	R r	Ы ы	Y y
Ж ж	Zh zh	С с	S s	Ь ь	(') (')
З з	Z z	Т т	T t	Э э	E e
И и	I i	У у	U u	Ю ю	Yu yu
Й й	Y y	Ф ф	F f	Я я	Ya ya
К к	K k	Х х	Kh kh		

[1]ye initially, after vowels, and after ъ, ь; e elsewhere. When written as ё in Russian, translate as yë or ë. Use of diacritical marks is preferred, but such marks may be omitted when expediency dictates.

Table 11-10. Foreign Projectile Markings In Cyrillic

Аматол	Amatol
Боевой	Live
Боевые припасы	Ammunition
Бомба	Bomb
Бронебойный	Armor-piercing
Взведенный	Armed
Взрыв	Explosion; burst
Взрыватель	Fuze
Радиовзрыватель	Proximity fuze
Взрывчатое вещество (ВВ)	Explosive
Головное зарядное отделение	Warhead
Граната	Grenade; shell
Детонатор	Detonator
Дистанционная трубка	Time fuze
Дымовой	Smoke (adj)
Зажигательный	Incendiary
Зажигательный пристрелочный	Incendiary ranging
Замедление	Delay

Table 11-10. Foreign Projectile Markings In Cyrillic (Continued)

Запальник	Igniter
Кумулятивный бронепрожигающий	High-explosive antitank
Кумулятивный заряд	Shaped charge
Кумулятивный снаряд	Shaped-charge projectile
Марка	Mark; stamp; model
Мгновенный	Instantaneous
Мина	Mortar projectile; mine
Миномет	Mortar
Наконечник	Cap
Незаряженный	Inert; empty
Неконтактный взрывателъ	Proximity fuze
Окончательно снаряженный (ок. сн., ок. снар.)	Fuzed
Опасно ВВ	Danger! Explosives
Осветительный	Illuminating
Осветительный снаряд	Flare; illuminating shell; star shell
Осколочный (оск., оско.)	Fragmentation; antipersonnel
Подрывной	Demolition

Table 11-10. Foreign Projectile Markings In Cyrillic (Continued)

Предохранитель	Safety
Противопехотный	Antipersonnel
Противотанковый	Antitank
Ракета	Rocket
Ракетный снаряд	Rocket projectile
Снаряд	Projectile; shell
Тетрил	Tetryl
Тетритол	Tetrytol
Тринитротолуол	Trinitrotoluene
Тритонал	Tritonal
Тротил	Trinitrotoluene; trotyl
Трубка	Fuze; tube; pipe
Ударный	Impact (adj)
Усилитель детонатора	Booster
Фосфор	Phosphorus
Фугасный	High explosive
Химический	Chemical; gas
Циклонит	Cyclonite
Чувствительный	Sensitive

ORDNANCE RECOGNITION

Refer to Tables 11-11 through 11-13, pages 11-17 through 11-28, and Figure 11-1, pages 11-29 and 11-30, for ordnance markings.

Table 11-11. Arabic Ordnance Markings

0	٠
1	١
2	٢ / ٢
3	٣ / ٣
4	٤
5	٥
6	٦
7	٧
8	٨
9	٩
10	١٠
11	١١
20	٢٠
antiaircraft	مضاد للطائرات (م/ط)
antipersonnel	مضاد للأشخاص (م/أ)
antitank	مضاد للدبابات (م/د)
armor-piercing	ثاقب المدرع (ث/م)، ثاقب (ث)
bomb (aircraft)	قنبلة (قن)
bomb (mortar)	بمبة
delay	تعويق
electrical	كهربائية، كهربائي
explosive	انفجار

Table 11-11. Arabic Ordnance Markings (Continued)

fuze	طابة ، صمامة
base fuze	صمامة القاعدة
fuze cap	غطاء الصمامة
delay fuze	صمامة تعويق
electrical fuze	صمامة كهربائية
base fuze	صمامة مصادمة
instantaneous fuze	صمامة فورية ، طابة لحظية
mechanical-time fuze	صمامة آلية زمنية
point fuze	صمامة الرأس
quick fuze	صمامة سريعة
safety fuze	طابة الامن
time fuze	طابة زمنية
grenade	قنبلة
handgrenade	قنبلة يدوية
high explosive	شديد الانفجار (ش/ف)، متفجرة
illumination	مضيئة
impact	مصادمة
incendiary	حارق
inert	خامد
instantaneous	لحظية
mine	لغم
model	نموذج ، طراز
mortar	هاون (ها)

Table 11-11. Arabic Ordnance Markings (Continued)

projectile	قنبلة . مقذوف . قذيفة
illumination projectile	مقذوف مضيئة
AP projectile	مقذوف ثاقب المدرع
concrete-piercing	مقذوف ثاقب خرسانة
HE projectile	مقذوف شديد الانفجار
HEAT projectile	مقذوف ذات حشوة جوفاء قذيفة مجوفة
incendiary projectile	مقذوف حارق
practice projectile	مقذوف تمرين
smoke projectile	مقذوف دخان
tracer projectile	مقذوف بكاشف
rocket	صاروخ
smoke	دخان
tracer	كاشف . خطاطة
type	طراز . نوع
year	عام . سنة

Table 11-12. Chinese Ordnance Markings

一	1
二	2
三	3
四	4
五	5
六	6
七	7
八	8
九	9
十	10
十	11
一百 or 百	100
杀	Antipersonnel

Table 11-12. Chinese Ordnance Markings (Continued)

杀爆变钢	Antipersonnel HE fragmentation
彈底信管	Base-detonating fuze
黑火葯	Black-powder
延	Delayed Action (fire)
炸藥	Explosive
輕放	Fragile (no rough handling)
杀爆	Fragmentation
信管	Fuze
破壞藥	High explosive
曳破	High Explosive Antitank (HEAT)
碰炸信管	Impact fuze
燒夷彈	Incendiary shell
	Black incendiary (thermite)
瞬發信管	Instantaneous fuze
迫擊炮彈	Mortar shell
瞬	Nondelay
彈頭信管	Point-detonating fuze
彈頭 or 彈丸 or 炮彈	Projectile
火箭	Rocket
破	Shaped charge
短時延期信管	Short-delay fuze
煙藥彈	Smoke shell
定時信管	Time fuze
梯恩梯/茶褐火藥	TNT
式	Type

Table 11-13. Common Ordnance Markings

AlphaNumeric Markings	Country
9M	USSR
AA	USSR
AK	NETHERLANDS
AMA	DENMARK
AMC	FRANCE
APX	FRANCE
ARF	ITALY
ARGES	AUSTRIA
ARS	FRANCE
AS	FRANCE
AS	USSR
ASS	FRANCE
AT	USSR
ATM	NORTH KOREA
AZDM	GERMANY (FEDERAL REPUBLIC POST WWII)
AZZ	GERMANY (FEDERAL REPUBLIC POST WWII)
BAE	UNITED KINGDOM
BCK	GERMANY (FEDERAL REPUBLIC POST WWII)
BCK	GERMANY (PRE WWII)
BK	USSR
BL	FRANCE
BMP	BELGIUM
BPD	ITALY
BR	SPAIN
BR	USSR
BRP	SPAIN
BT	FRANCE
C	CANADA

Table 11-13. Common Ordnance Markings (Continued)

AlphaNumeric Markings	Country
CAA	CHINA
CIS	SINGAPORE
CSA	CHINA
CSS	CHINA
CSSC	CHINA
DM	GERMANY (FEDERAL REPUBLIC POST WWII)
DM	GERMANY (FEDERAL REPUBLIC POST WWII)
DYNAMITE NOBEL	GERMANY (FEDERAL REPUBLIC POST WWII)
EAB	FRANCE
ECIA	SPAIN
ECN	FRANCE
ECP	FRANCE
EF	SINGAPORE
EHD	BELGIUM
EM	CHINA
ET	CHINA
ET	USSR
EURO	NETHERLANDS
EVR	CZECHOSLOVAKIA
F	CHILE
F	SWEDEN
F	USSR
FAB	USSR
FB	CHILE
FB	ITALY
FERRANTI	UNITED KINGDOM
FFR	SWEDEN
FFV	SWEDEN
FL	NETHERLANDS
FMK	ARGENTINA

Table 11-13. Common Ordnance Markings (Continued)

AlphaNumeric Markings	Country
FN	BELGIUM
FROG	USSR
FrSv	CZECHOSLOVAKIA
FUI	FRANCE
GIAT	FRANCE
H	FRANCE
HBS	UNITED KINGDOM
HP	AUSTRIA
IMB	UNITED KINGDOM
IMI	ISRAEL
JNS	NETHERLANDS
KAAKAA	EGYPT
KB	YUGOSLAVIA
KV/YU	YUGOSLAVIA
KY/KU	YUGOSLAVIA
L	UNITED KINGDOM
LOS	GERMANY (FEDERAL REPUBLIC POST WWII)
LU	FRANCE
LUL	FRANCE
M	BELGIUM
M	CHILE
M	ISRAEL
M	ITALY
M	SOUTH AFRICA
M	SPAIN
M	SWEDEN
M	SWEDEN
M	SWEDEN
M	SWEDEN
M	YUGOSLAVIA
M.Md1	FRANCE

Table 11-13. Common Ordnance Markings (Continued)

AlphaNumeric Markings	Country
MA	BELGIUM
MA	NETHERLANDS
MAUSER	GERMANY (FEDERAL REPUBLIC POST WWII)
MCR	BELGIUM
MDH	VIETNAM
MK	FRANCE
MK	ISRAEL
MK	ITALY
MK	PAKISTAN
MK	SWEDEN
MK	UNITED KINGDOM
MKE	TURKEY
MKS	ISRAEL
MKS	UNITED KINGDOM
MLE	FRANCE
MN	ITALY
MOD	TURKEY
MODEL	AUSTRIA
MODEL	BELGIUM
MODEL	EGYPT
MODEL	FRANCE
MODEL	FRANCE
MODEL	GERMANY (FEDERAL REPUBLIC POST WWII)
MODEL	ITALY
MODEL	SPAIN
MODEL	SWEDEN
MODEL	SWITZERLAND
MP	CHINA
MPA	BELGIUM
MR	FRANCE
MVA	SWEDEN

Table 11-13. Common Ordnance Markings (Continued)

AlphaNumeric Markings	Country
MZ	CZECHOSLOVAKIA
NASR	EGYPT
NICO	GERMANY (FEDERAL REPUBLIC POST WWII)
NICO	GERMANY (PRE WWII)
NO.	AUSTRIA
NO.	ISRAEL
NO.	UNITED KINGDOM
NR	BELGIUM
NR	NETHERLANDS
NWN	NETHERLANDS
NZ	CZECHOSLOVAKIA
O	USSR
OF	CZECHOSLOVAKIA
OF	USSR
OZM	USSR
OZT	CZECHOSLOVAKIA
P	ITALY
P	PAKISTAN
PBR	BELGIUM
PDB	SPAIN
PDM	BULGARIA
PDM	USSR
PI	GERMANY (FEDERAL REPUBLIC POST WWII)
PI	GERMANY (PRE WWII)
P-ISV	CZECHOSLOVAKIA
PL	CHINA
PMA	CZECHOSLOVAKIA
PMA	YUGOSLAVIA
PMP	GERMANY (PEOPLES REPUBLIC POST WWII)
PO	SPAIN
POM	YUGOSLAVIA

Table 11-13. Common Ordnance Markings (Continued)

AlphaNumeric Markings	Country
PP	CZECHOSLOVAKIA
PPD	NORWAY
PP-MI	CZECHOSLOVAKIA
PRB	BELGIUM
PRB	NETHERLANDS
PROM	YUGOSLAVIA
PS	SOUTH KOREA
PSM	BULGARIA
PSV	CZECHOSLOVAKIA
PT	CZECHOSLOVAKIA
PT-MI	CZECHOSLOVAKIA
R77	PHILIPPINES
RBK	USSR
RBS	SWEDEN
RHEIMENTALL	GERMANY (FEDERAL REPUBLIC POST WWII)
RKV	SWITZERLAND
RKVDIR	SWITZERLAND
RMS	FRANCE
RO	CZECHOSLOVAKIA
RTE	FRANCE
RYN	FRANCE
S	ITALY
S	SINGAPORE
S	USSR
SA	USSR
SAE	FRANCE
SC	FRANCE
SET	USSR
SM	FRANCE
SNILA	ITALY
SOL	ISRAEL

Table 11-13. Common Ordnance Markings (Continued)

AlphaNumeric Markings	Country
SPRA	UNITED KINGDOM
SS	FRANCE
SS	USSR
TAAS	ISRAEL
TAM	FINLAND
TECTEL	SOUTH AFRICA
TMA	CZECHOSLOVAKIA
TMA	YUGOSLAVIA
TYPE	CHINA
TYPE	DENMARK
TYPE	FRANCE
TYPE	GERMANY (FEDERAL REPUBLIC POST WWII)
TYPE	GERMANY (PRE WWII)
TYPE	JAPAN
UMR	YUGOSLAVIA
UPM	YUGOSLAVIA
UT	YUGOSLAVIA
UTI	YUGOSLAVIA
UTM	YUGOSLAVIA
UTU	YUGOSLAVIA
V	FRANCE
V	USSR
VS	ITALY
W	SPAIN
WALLOP	UNITED KINGDOM
YAM	USSR
ZAB	USSR

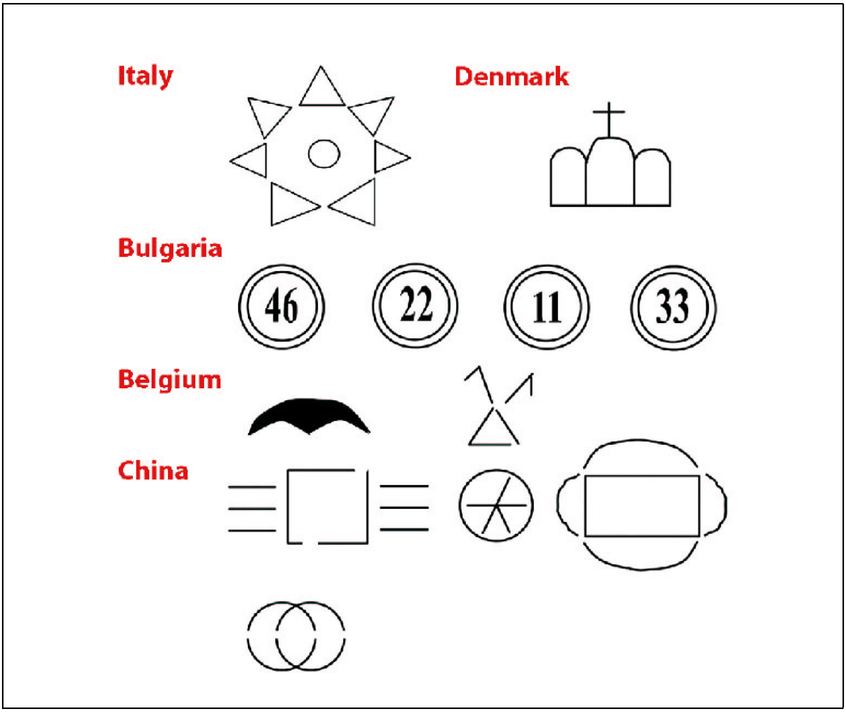


Figure 11-1. Common Ordnance Symbols and Markings

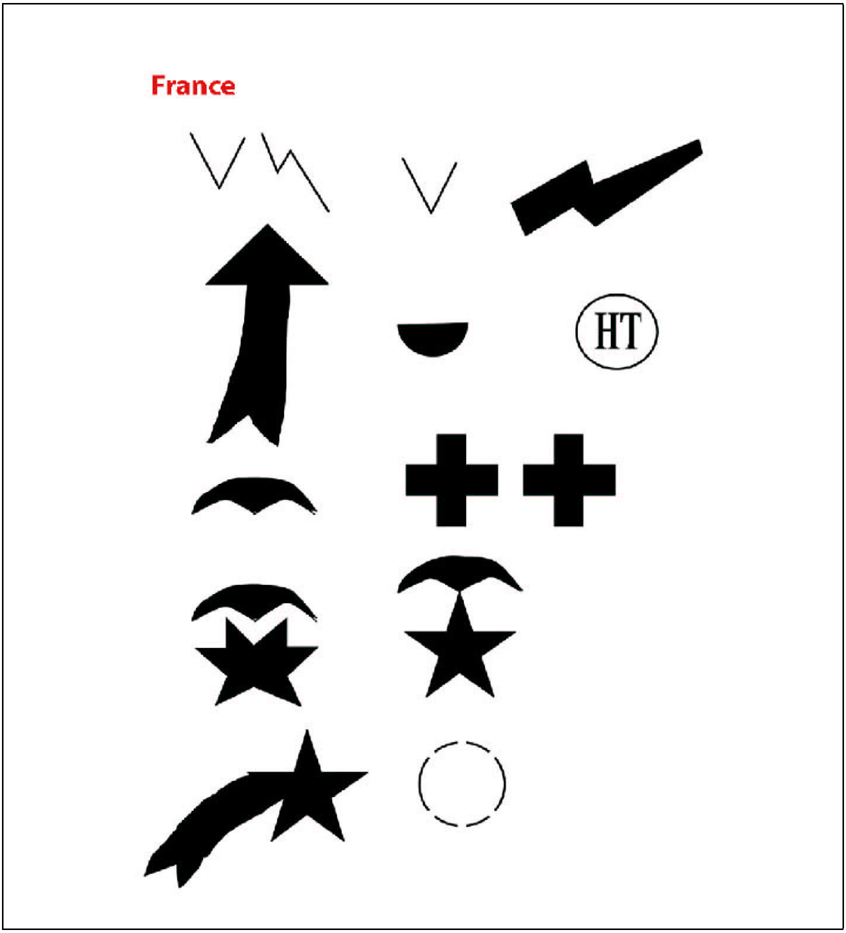
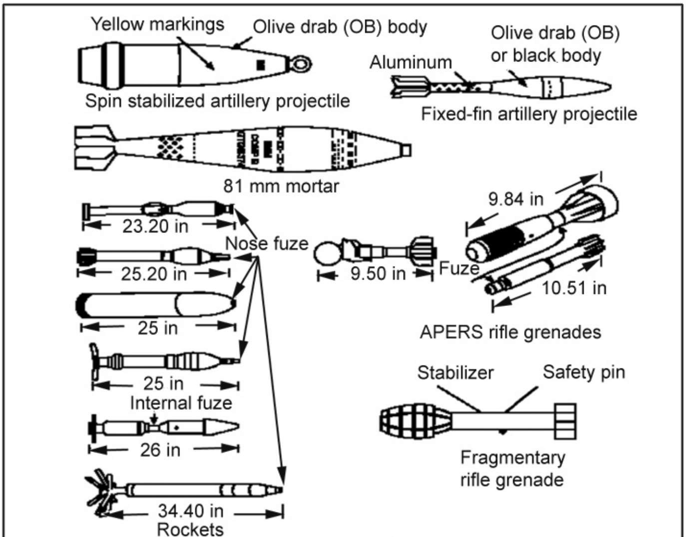


Figure 11-1. Common Ordnance Symbols and Markings (Continued)

PROJECTED ORDNANCE

Projected ordnance is fired from a gun tub or launcher. Refer to Figures 11-2 through 11-8, pages 11-31 through 11-34, for specifications and examples of projected ordnance.



Type	Length	Diameter	Remarks/ weapon contents
Projectiles	2 in to 4 ft	2 in to 16 in	HE, Chem, Illum, submunition
Mortar Shells	Varies	5 in to 10in	HE, Chem, WP, Illum
Rockets	18 in and up	11/2 and up	Self propelled projectile, no std shape
Guided Missiles	Varies	Varies	Missile with guidance system
Rifle Grenades	Varies	Varies	Similar to mortar but fired from rifle

Figure 11-2. Projected Ordnance

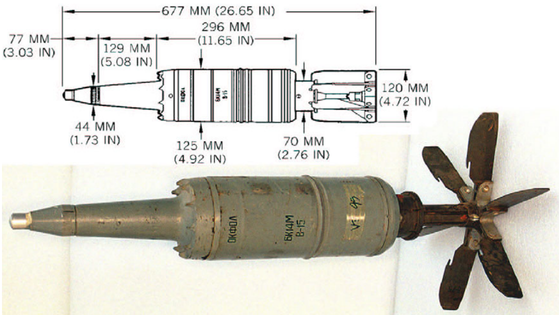


Figure 11-3. USSR Projectile, 125-mm, HEAT-T, BK-14M

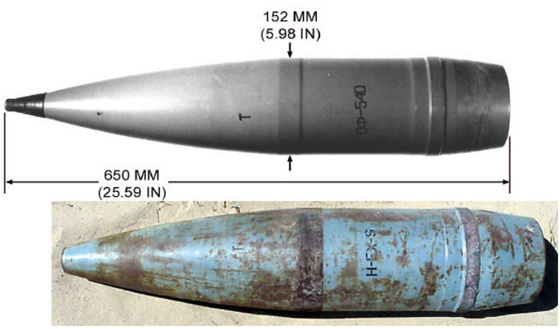


Figure 11-4. USSR Projectile, 152-mm, FRAG/HE, Model OF-540

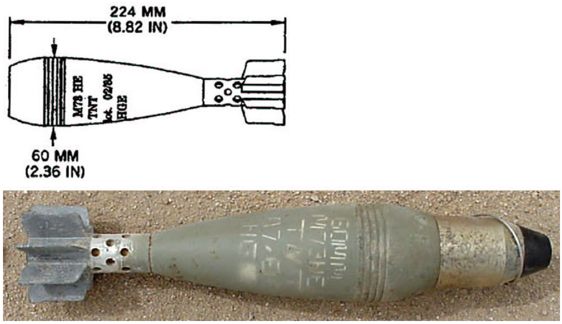


Figure 11-5. Iraqi Mortar, 60-mm, HE, M-73

Figure 11-6. USSR Rocket, 57-mm, HE, S-5M

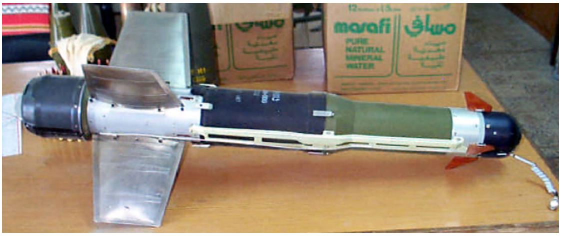


Figure 11-7. USSR Guided Missile, Surface-to-Surface, AT-5

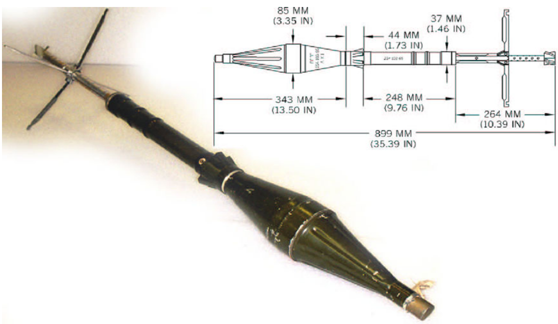
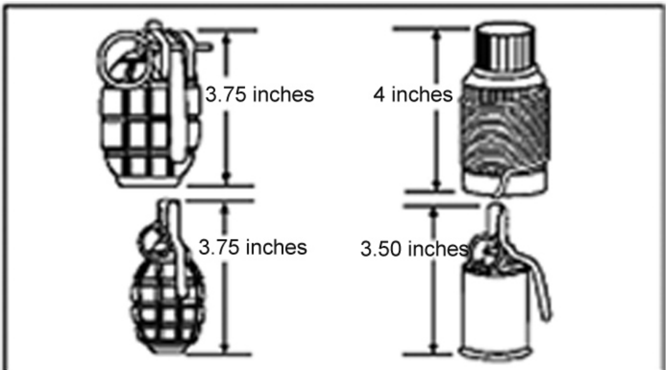


Figure 11-8. USSR Grenade, HEAT-T, Rocket-Propelled, Model PG-7G

THROWN ORDNANCE

Thrown ordnance is thrown by personnel. Refer to Figures 11-9 through 11-13, pages 11-35 through 11-37, for specifications and examples of thrown ordnance.



Hand grenades	Classifications include, fragmentation, offensive, antitank, smoke, and illum. May have chemical or incendiary contents.

Figure 11-9. Thrown Ordnance

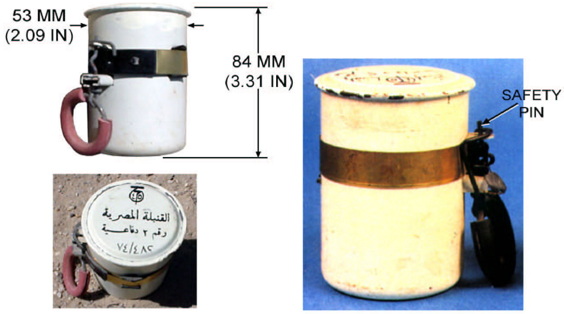


Figure 11-10. Egyptian Grenade, Hand, Fragmentation #2

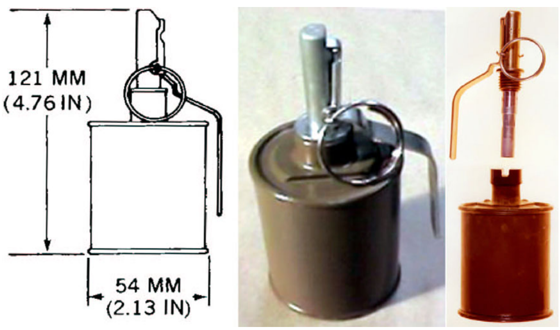


Figure 11-11. USSR Grenade, Hand, Defensive, RG-42

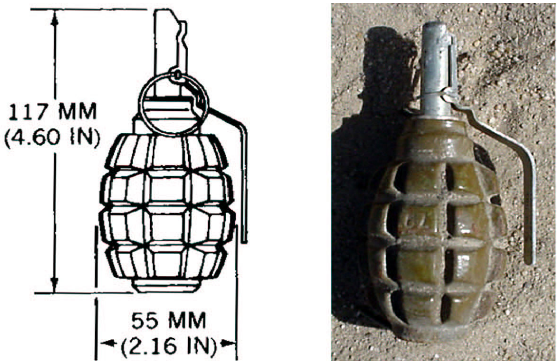


Figure 11-12. USSR Grenade, Hand, Defensive, F-1

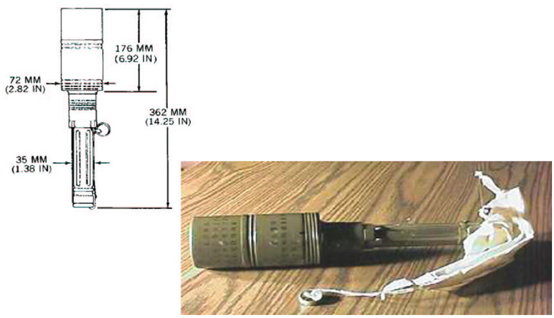


Figure 11-13. USSR Grenades, Hand, Heat, RKG-3, RKG-3M, and RKG-3T

PLACED ORDNANCE

Placed ordnance is emplaced by personnel. Refer to Figure 11-14 and Chapter 9 for specifications and examples of placed ordnance.

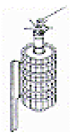
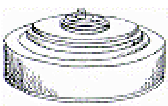
Type	Remarks
AP Mine 	Generally small, with various shapes and sizes. May be plastic, metal, or wood. May have attached trip wires.
AT Mine 	Larger than an AP mine, with various shapes and sizes. May be plastic, wood, or metal. May have antihandling devices.

Figure 11-14. Placed Ordnance

DROPPED ORDNANCE

Dropped ordnance is dropped from aircraft. Refer to Figures 11-15 through 11-25, pages 11-39 through 11-44, for specifications and examples of dropped ordnance.

Type	Remarks
Bomb	Small to very large (2 to 10 feet), with metal casing, tail fins, lugs, and fuzes. May contain HE, chemical, or other hazardous materials.
Dispenser	Looks similar to bombs but may have holes or ports. Do not approach. May be scattered.
Submunition	Small bomblets, grenades, or mines. Very sensitive.

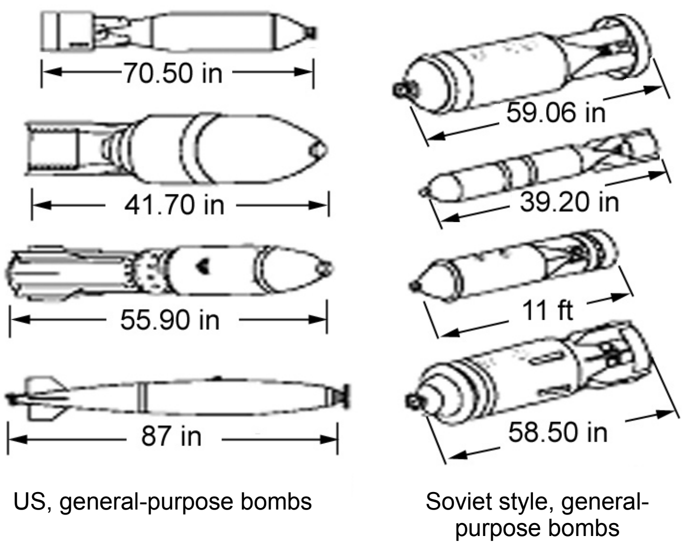


Figure 11-15. Dropped Ordnance

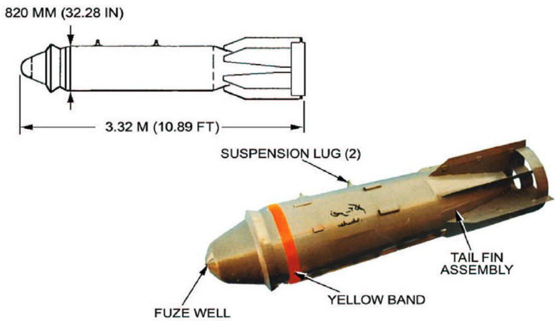


Figure 11-16. Iraqi Bomb, 3000 KG, GP, NASR-3,000

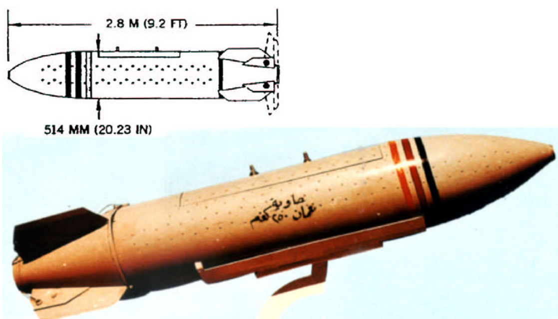


Figure 11-17. Dispenser, Iraqi Bomb, Cluster, 250 KG, NAAMAN-250 Submunitions

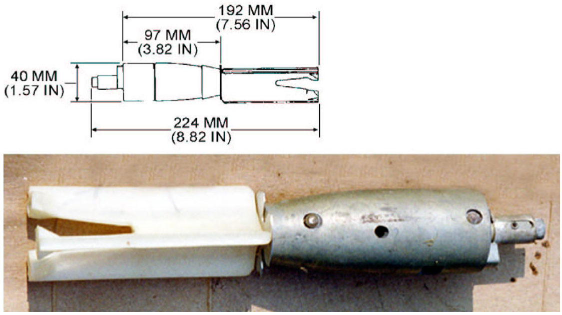


Figure 11-18. US Bomb Unit, Antipersonnel, HEAT, BLU-77/B

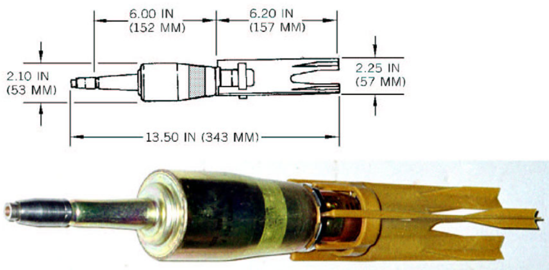


Figure 11-19. US Bomb, HEAT/Fragmentation, MK 118 MODS 0 & 1

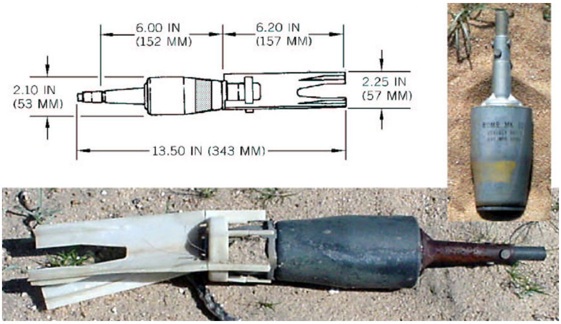


Figure 11-20. US Bomb, HEAT/Fragmentation, VECP Modified

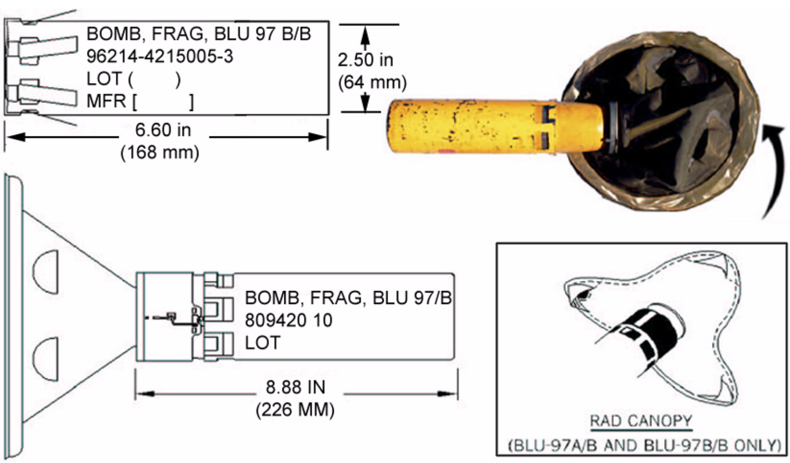


Figure 11-21. US Bomb Units, HEAT/Fragmentation, BLU-97/B, BLU-97 A/B, and BLU-97B/B

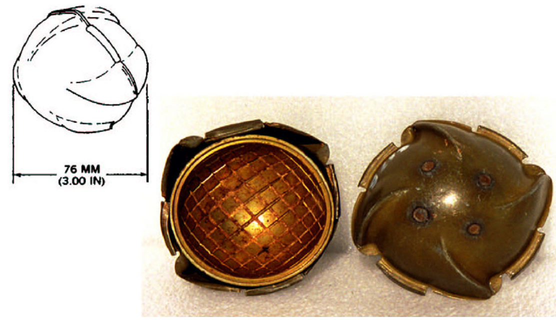


Figure 11-22. US Bomb Units, BLU-63/B, BLU-63A/B, BLU-86/B, and BLU-86A/B

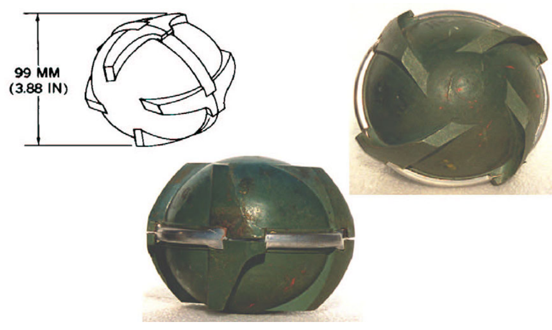


Figure 11-23. US Bomb Unit, Fragmentation, BLU-61A/B

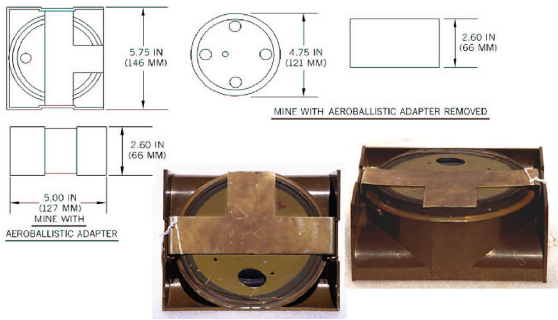


Figure 11-24. US Land Mine, Antipersonnel, BLU-92/B Air-Delivered, Scatterable Mine (Gator)

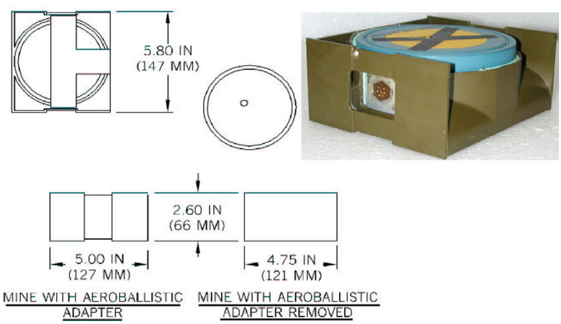


Figure 11-25. US Land Mine, AT/AV, BLU-91/B (Gator)

REPORTING UNEXPLODED ORDNANCE

The UXO spot report is a timely, detailed, two-way reporting system. It clearly identifies the location of the UXO hazard and briefly describes the hazard, the priority for clearing, and the unit(s) affected. The UXO spot report is the first echelon report that is sent when an observer detects an UXO. Units can use the report to request help in handling an UXO hazard if the unit cannot reduce the hazard by using protective works or moving away from the UXO. The report also helps the tactical commander set clearance priorities based on the situation. The report consists of nine lines and is sent by the fastest means available. EOD forces use the spot report to help sequence their response to all UXO incidents within the area of operation (AO). Refer to Figure 11-26 for an example of the nine-line report.

1. Date-time group (DTG) that the UXO was discovered.
2. Reporting unit or activity and the UXO location (grid coordinates).
3. Contact method (how the EOD team can contact the reporting unit).
4. Discovering unit point of contact (POC), mobile subscriber equipment (MSE), or defense switching network (DSN) phone number and the unit frequency or call sign.
5. Type of UXO (dropped, projected, throw, or placed) and the number of items discovered.
6. Hazards caused by the item (such as possible chemical threat, limits travel on key route).
7. Resources threatened. Report any equipment, facilities, or other assets threatened by the presence of item(s).
8. Impact on the mission. Your current situation and how the presence of the UXO affects your status.
9. Protective measures. Describe measures taken to protect personnel and equipment (marking the area, informing local civilians).

Figure 11-26. Sample Nine-Line Report Format

PROTECTIVE MEASURES

There are three methods to protect personnel and equipment from the threat posed by UXO—evacuate, isolate, and barricade (or any combination of the three).

EVACUATE

When possible, evacuation of all personnel and equipment is the best protective measure. When necessary, only mission-essential personnel and equipment are to remain within the threat area. Personnel and equipment remaining within this area must be protected from the UXO with barricades. Personnel must wear their helmets and Kevlar vests. Minimum evacuation distances are shown in Table 11-14.

Table 11-14. Minimum Evacuation Distances

Estimated Explosive Weight (pounds)	Evacuation Distances (meters)
30 or less	310
40	350
50	375
100	475
200	600
400	725
500	800

ISOLATE

Sometimes for mission-related, operational, or other reasons, evacuation of personnel and equipment is not possible or it is not possible to leave a particular area. In these situations, isolate the assets from the UXO by establishing a safe area and limiting exposure.

BARRICADE

A barricade provides limited protection by blocking blast and fragmentation from an explosion. Barricades may suppress thermal and shock wave effects and deflect or absorb fragmentation and overpressure hazards. Natural terrain features can provide adequate frontal and overhead protection, if deemed suitable by qualified engineers and EOD soldiers. If natural features are judged inadequate, construct artificial barriers.

When building barricades, personnel must wear protective equipment. Depending on the size of the UXO, build suppressive barricades around the UXO to protect the entire area or build protective barricades alongside nonevacuated personnel or equipment. Yield sizes of UXOs include—

- **Small.** For UXO less than 3 inches in diameter, a double-wall thickness of sandbags should surround the area of the UXO. Stack the sandbags to at least three high.
- **Medium.** This UXO is generally 3 to 7 inches in diameter. Construct a wall 4 or 5 layers deep to a height of at least 5 feet around the UXO.
- **Large.** UXO over 7 inches in diameter is generally too large to build an effective barricade around. In these cases, barricade the equipment and personnel activity areas as described in FM 21-16.

LESSONS LEARNED FROM DESERT STORM

The large-scale use of dual-purpose, improved, conventional munitions (DPICMs) and cluster bomblet units (CBUs) resulted in UXO on an unprecedented level. The magnitude of the UXO problem exceeded the ability of the EOD community to handle it. Kuwait and Iraq were littered by friendly UXO. CBUs (BLU-97) comprised the majority of this ordnance. Engineer units were forced to destroy much of this ordnance in the course of breaching operations and main supply route (MSR) development. Many engineer units were unfamiliar with the ordnance identification and characteristics and the peculiar destruction techniques to destroy this ordnance in place. Because of this inexperience, engineer units suffered many wounded or killed personnel. Engineer units about to undertake UXO destruction missions require special training to identify, collect, and destroy ordnance. When possible, engineers should undertake these missions with the help of EOD technicians, who will provide technical assistance.

Chapter 12

Intelligence Gathering

In any operation where enemy obstacles interfere with friendly maneuvers or threaten force protection, obstacle intelligence (OBSTINTEL) becomes priority intelligence requirements (PIR). Finding enemy obstacles or seeing enemy obstacle activity validates and refines the Intelligence Officer's (US Army) (S2) picture of the battlefield. OBSTINTEL helps determine enemy intentions, plans, and strengths.

When collecting OBSTINTEL, reconnaissance is a combined arms activity that includes engineers. Reconnaissance teams should gather the following OBSTINTEL information during their patrols:

- **Minefield and ordnance locations.** Plot the perimeter location of minefields, unexploded ordnance (UXO), or other explosive hazards on a large-scale map, and refer to recognizable landmarks. Use Global Positioning System (GPS) coordinates when available.
- **A perimeter description.** Describe how the perimeter is fenced. If it is unfenced, describe how it is marked. If it is unmarked, note how the hazard was recognized.
- **Nuisance mines.** If you discover a nuisance mine forward of the minefield outer edge, there may be others. Assembly areas (AAs) may also be mined.
- **Types of mines.** Indicate whether mines are antitank (AT), antipersonnel (AP), a combination of AT and AP, or scatterable. Include the fuzing details (such as single impulse, double impulse, or self-destruct) if

known. Record mine details, including the circumference, color, markings, and condition if possible. Do not touch or approach explosive hazards.

- **Details of any other devices.** Describe booby traps, antihandling devices, trip wires, flares, or visible command detonation wires.
- **The laying method.** Indicate whether mines are buried or surface-laid.
- **The density and the pattern.** Include the mine spacing and the number of mine rows. Estimate the mine density based on this information.
- **The minefield depth.** Provide the distance between strips or rows, and describe any lane markers.
- **Safe lanes and gaps.** Plot the location of suspected safe lanes and gaps and describe their markings.
- **Ground conditions.** Include information on general ground conditions. Note the soil conditions and how the soil or terrain may affect the use of handheld mine detectors and mechanical or explosive breaching equipment.
- **Other obstacles.** Plot the location and the construction of other obstacles.
- **Enemy defenses.** Describe the enemy's location and size. Include the location of enemy direct-fire weapons.

Chapter 13

Mine Detection Equipment and Lane Clearing Techniques

METAL DETECTORS

Currently, the only technology employed by the United States (US) Army for mine detection is metal detection. This technology aims to detect the metal content of a mine. This might be the casing, fuzes, trip wires, springs, detonators, or mine assembly items. In low-metal mines, the amount of metal is very small—a few grams—and it might represent just the tip of the firing pin. This small amount of metal is extremely difficult to detect with the current range of metal detectors.

The position of the mine in the ground will also affect its detectability. Most antipersonnel (AP) blast mines are buried between 1 and 2 inches beneath the surface. This means that the metallic content of the mine is within 2 to 3 inches of the surface, depending on the depth of the mine. The farther from the surface, the more difficult the metal components are to detect. The orientation of the metal components within the structure of the mine will affect the detectability. Horizontal metal elements are more readily detected than those in an upright position.

The basic principle of present day metal detection systems is current induction and electromagnetic field detection. Metal detector heads are comprised of two elements—an electromagnetic pulse (EMP) generator and a magnetic field detector. The EMP generator emits a pulse into the ground. As the transmitted wave travels through the soil, it momentarily induces an electric current in any metallic objects it passes. The induced current then gives off its own momentary electromagnetic field. The magnetic field detector detects this new field and sounds an alarm (Figures 13-1 and 13-2).

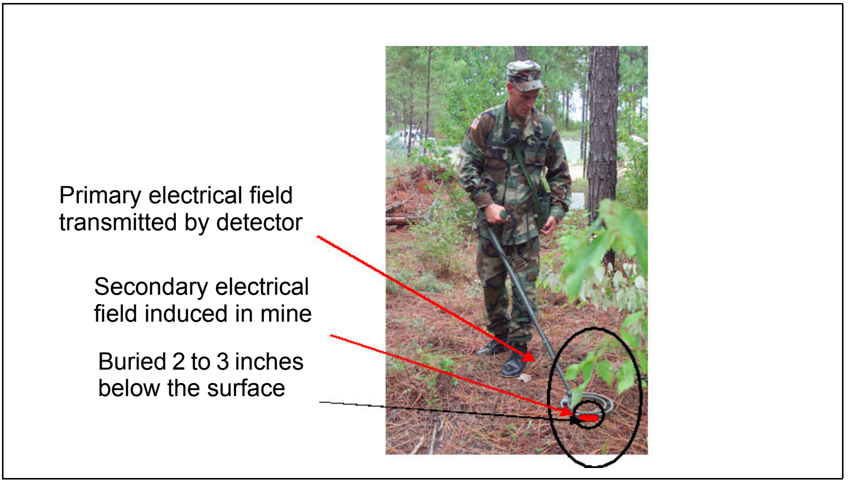


Figure 13-1. Induced Field Reaches the Receiving Coil, Machine Detection

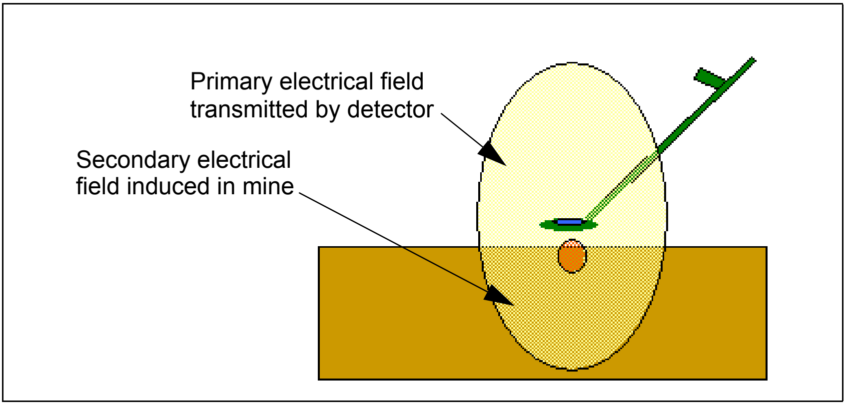


Figure 13-2. Induced Field Fails to Reach the Receiving Coil When the Detector Head is Too Far Above the Ground

Soil with a high metallic content (usually red iron oxide soils or high-mineralized/laterite soils) interferes with this process and can give false alarms. Soil with metal debris (such as battlefields with shrapnel or bullets) will also confuse operators, as the detector will pick up every piece of metal. In some areas, this might lead to several hundred hits per real mine. This becomes very tedious and can lead to complacency. Leaders must constantly check detector operators to ensure that they do not become complacent, because complacency kills.

Modern metal detectors are now able to reduce the effect of high metallic soils by calibrating the background return signal against a metal-free soil sample. This balancing allows the device to cancel out the natural metallic signal of the soil and pick out the return signal from metal debris or mines. This is generally achieved through a technology called multiperiod sensing (MPS). The Army-issued metal detector—the AN/PSS-12—does not have this ground-balancing feature.

In areas of Iraq, the soils are saturated with shrapnel and have a high metal content. The AN/PSS-12 has difficulty discriminating between the metallic soil return and a piece of metal (a mine).

There are limited numbers of the F1A4 metal detector issued to various units deploying to Iraq. This high-technology detector utilizes MPS and is tuned and adjusted to the soil conditions. While the technology and equipment setup procedure is slightly different, the basic operation of the metal detector is very similar to the AN/PSS-12. The F1A4 represents a significant increase in metal (mine) detection capability.

METAL DETECTOR USE

The efficiency of metal detection relies on two key elements—

- Equipment that is set up correctly and “tuned” to the local soil conditions.

- Operator familiarity with the operation procedures of the detector.

NOTE: These apply to the AN/PSS-12 and the F1A4.

METAL DETECTOR USER TIPS

Equipment Storage/Maintenance

- Store metal detectors in dry, low-humidity, and temperature-controlled environments.
- Remove batteries for storage.
- Keep detectors in their protective case during storage and while traveling.
- Clean detectors of dust, dirt, and contaminants prior to storage.
- Do not store detectors next to large electrical/ magnetic sources or equipment. This will interfere with and possibly affect the delicate electronics within the detectors.

Equipment Setup

- Always test batteries prior to use to ensure that they are fresh. Batteries sitting in storage containers for extended periods of time will sometimes become dead or weak.
- Do not force elements together. Many components are fragile and are not easily replaced once broken.
- Set up the equipment away from large metal sources.

Equipment Testing

- Operators must remove all metal objects, such as watches, rings, load-bearing equipment (LBE), and weapons (if the tactical situation allows).

- The testing sequence must follow the operator's guide.
- Complete the air testing prior to ground balancing (only for the F1A4).
- Once detectors are properly ground-balanced or calibrated, test the detector against realistic mine simulants/inert real mines of the type you expect to find in the minefield. The test pieces provided with the detectors work exceptionally well in replicating low-metal mine simulants. Ensure that test mines are in metal-free soil from the clearance area and buried at the expected depth.
- Ensure that ground testing is done in a guaranteed metal-free test area very near the clearance site.

Operator Skills

- Operators should use the same detector on each mission when possible. Familiarity with a specific detector is crucial to competent and confident clearance.
- Operators must be trained using accurate and relevant mine targets. Understanding and recognizing specific mine alarm signals from the detector are essential.
- The detector head and heel must remain in light contact with the ground at all times. This will provide maximum ground penetration.
- The sweep speed should not exceed 1 foot per second.
- Operators must look ahead for trip wires and protruding mine fuzes prior to sweeping with the detector.
- Operators must be practiced and remain confident when investigating a detector hit to confirm or deny the presence of a mine.

- Land mine detection is stressful. Operator efficiency depends on the climate, the mine/ metal hit density, and the ground conditions. The greater the number of hits, the more stressful land mine detection becomes.

REAR AREA LANE CLEARING TECHNIQUES/AREA CLEARANCE

PROCEDURES

- All clearance operations must start from a cleared and confirmed safe lane, at least 2 meters wide, to allow extraction team access.
- Lanes/operators must be at least 25 meters apart.
- Lanes should be at least 1 meter wide. A 1-meter wooden stick will help regulate the lane width (Figure 13-3).
- Marking the cleared area is crucial. The operator will use tape/string and pegs to mark progress. This must be extremely accurate, as an error of 2 inches will miss a mine.
- Lanes should not extend into the minefield for more than 25 meters during clearance operations. If they extend any further, command, control, and potential extraction tasks become unmanageable.
- In high-density/high-risk minefields where there is not a threat of enemy contact and adequate time is available, consider using the following clearance procedures:
  - Place two 1-meter sticks across the beginning of the lane as a guide (Figure 13-4).
  - Look forward, down, and to the sides for evidence of trip wires or mines.

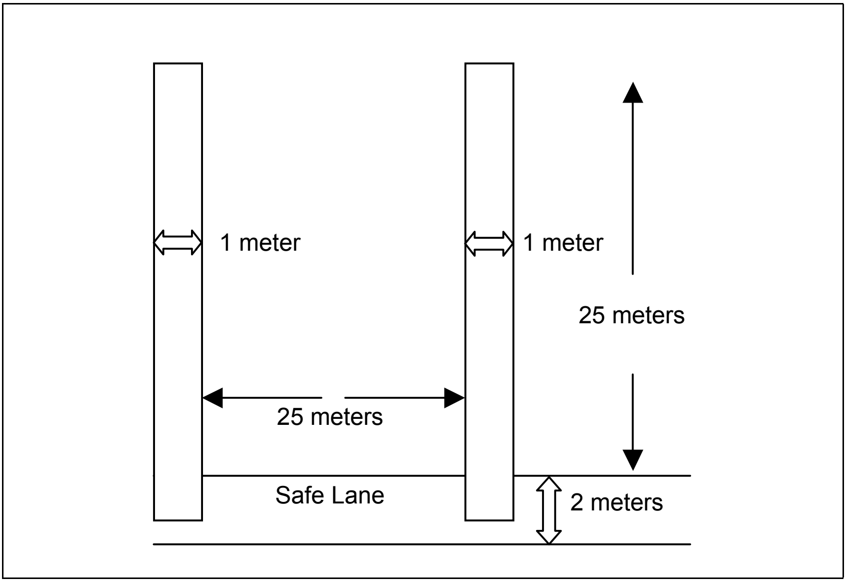


Figure 13-3. Safe Lane Width

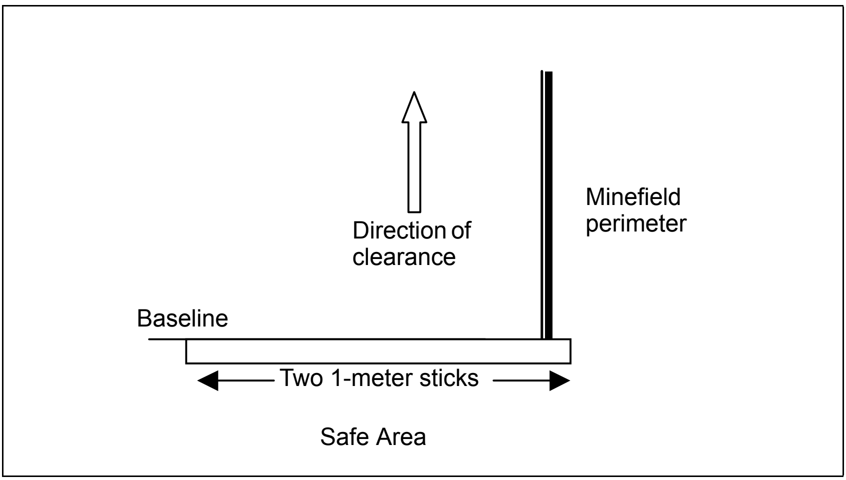


Figure 13-4. Alternate Lane Clearing Technique, Example 1

- Use a trip wire feeler to the left forward, the center forward, and the right forward.
- Cut down excessive vegetation to ground level in small increments. Watch for trip wires.
- Feel for mine fuzes across the lane with your fingertips.
- Move one of the 1-meter sticks forward to the limit of the searched area (Figure 13-5).

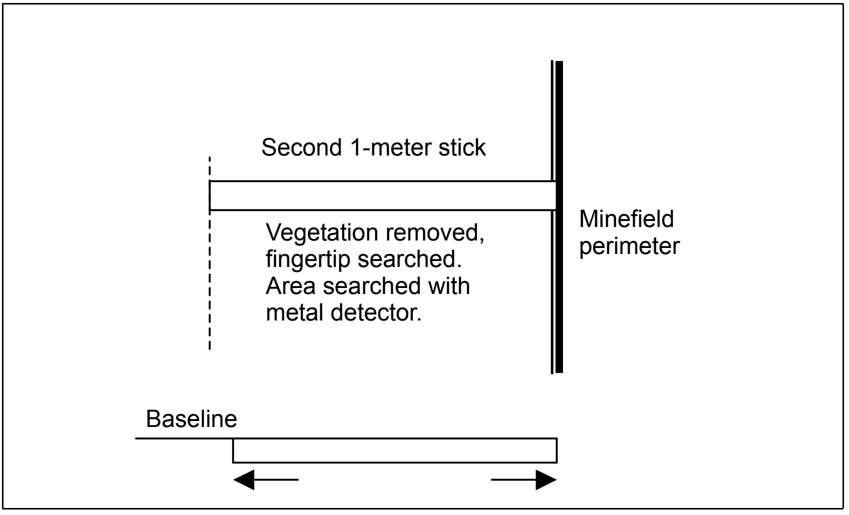


Figure 13-5. Alternate Lane Clearing Technique, Example 2

- Sweep the cleared area between the marker sticks with a metal detector.
- If clear, move the rear stick to the front stick and start the process again (Figure 13-6).

NOTE: Lane clearance is likely to advance 1 foot at a time using this method.

- Consider using the two-man drill. One operates the metal detector, and the other prepares. When not working, the team member moves to

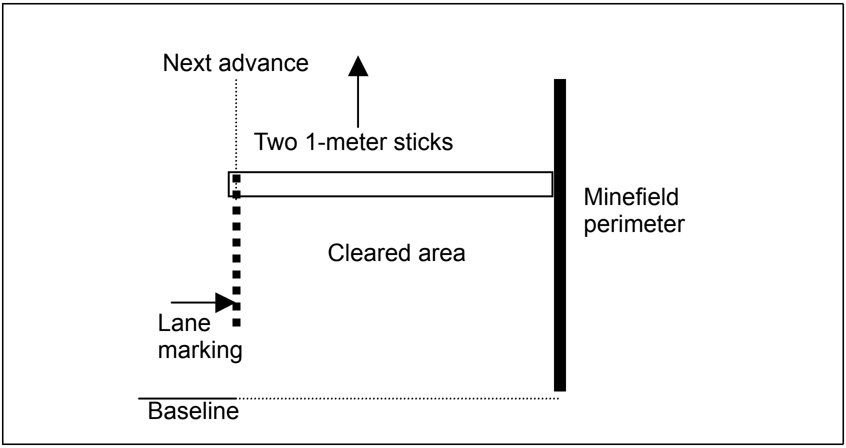


Figure 13-6. Alternate Lane Clearing Technique, Example 3

and then beyond the safe area until the other member finishes his task and moves to and beyond the safe area. The personnel then swap positions.

- If a mine is found, blow in place (BIP) as the tactical situation dictates. Every BIP operation requires personnel to withdraw to a calculated safe area, depending on the ordnance size and type. BIP operations are time-consuming. If mines are found when clearing lanes in minefields, mark them and exit the lane. Close the lane, and start the next lane. When detection/marking operations are complete, blow all of the mines in one shot as dictated by the tactical scenario. Blowing mines all at once is more efficient and safer than multiple shots in a single day.
- Assume that all detections are a mine or a UXO until confirmed otherwise. Begin probing and excavating/clearing at least 3 inches in front of the target. Excavate the soil with a digging tool, using a side-to-side stroke. Do not dig directly

downward, because this could inadvertently function, and detonate, the suspected ordnance. Instead, dig at an angle (30 to 45 degrees) and to a depth of 4 to 6 inches in front of the mine. Then, continue excavating toward the target. Confirm that the target is a mine or a UXO, and then mark it.

The exact recording of the mined/cleared areas is essential to ensure the full and complete safety of personnel. Marking minefields and clearance progression is critical.

AN/PSS-12 SPECIFIC TIPS

- Water and high-moisture levels affect electronics. If the ground surface is moist, place a thin film of petroleum jelly over the detector head and a plastic bag on top of it.
- The maximum detection depth for low-metal mines is 2 to 3 inches. The head and heal of the detector must remain lightly in contact with the ground at all times. Failure to do so will result in the detector not penetrating the ground deeply enough and significantly increases the likelihood of missing low-metal mines. If the detector head is held 2 to 4 inches above the ground, it is very likely to miss low-metal mines within 1 to 2 inches of the ground's surface.
- The detector must be calibrated using the phasing block or test piece buried in the ground, with the metal end of the test piece in the downward position. The operator must recheck the calibration of the detector every 1 to 2 meters of forward movement. Ensure that this is done in a safe area that is free of metal objects or clutter. Ensure that the detector is calibrated in the same type of soil in which the mine detection will take place.

- When searching for mines with the detector head underwater, ensure that the calibration is done underwater. Operation of the detector head underwater will require a calibration setting different from use above water. The detector will operate with the head underwater as well as or better than it does on the ground. The metal detection signals remain the same underwater. When using the detector near or in water, the operator must ensure that the electronics unit remains above water at all times.
- The AN/PSS-12 mine detector does not ground balance/tune. Sensitivity is set and determined by the operator.
- Use fresh batteries (load-tested) every day to get maximum performance. Batteries that remain in storage containers for extended periods of time will often become dead or weak. Frequent fluctuations in the calibration setting may be an indication of low batteries. Degraded performance may occur well before the low-battery light comes on.
- Use metal detectors for mine detection only. Do not attach any objects to the head of the detector for trip wire detection.

SAFETY OF USE MESSAGE (SOUM02-001)

It has been determined that the users of the AN/PSS-12 mine detecting set have not been properly calibrating the detector. Additionally, it is critical that personnel use proper sweeping techniques and proper positioning of the detector head, which is necessary to detect mines. Failure to properly calibrate or use the proper sweeping techniques and positioning of the detector head will result in most low-metal mines not being detected. This can lead to serious injury or death to the user from stepping on missed mines.

WARNINGS

1. It is common practice for low-metal mines to be placed within the footprint area (or shadow) of high-metal mines. The large footprints of high-metal mines may mask signals from low-metal mines within the footprint. Always assume that there are low-metal mines within this footprint area.

2. The search head should never be swept where its path cannot be visually cleared first. If trip wires are a threat, other techniques to detect trip wires should be used before sweeping the detector. Always be aware of the potential for booby traps and UXO.

3. The search head path should be straight or only slightly arched. Operators who sweep in a circular motion or use a severe arc tend to miss areas. The ends of the sweep tend to be too high above the ground and can cause missed mines.

4. Low batteries may reduce detector performance well before the indicator light comes on. If you need to make more frequent or larger sensitivity adjustments to maintain a constant sensitivity setting, discard all batteries and replace them with new ones.

F1A4 SPECIFIC TIPS

- The ground-balancing exercise must be done on prescreened, metal-free soil from the ground in which the minefield clearance will be executed. Conduct the ground-balancing exercise by raising and lowering the head of the detector 1 to 4 inches above the ground in the same type of soil where the mine search will take place. Each complete up-and-down movement should take 3 to 4 seconds. If these procedures are not followed, the superior detection properties of the F1A4 are nullified.

- Once it is ground-balanced, check the detector against target-inert mines in the same type of soil used in the area of search.
- The plastic joints and some of the electronic couplers are delicate. Handle them carefully, especially in cold weather, as the plastic will break more easily.
- The detector will maintain maximum sensitivity until the battery-low light comes on.
- The detection depth for low-metal mines is 2 to 3 inches. Keep the detector head as close as possible to the ground at all times without making contact with the ground. The F1A4 detection area under the detector head is triangular, so there is a requirement to overlap sweeps by two-thirds of the halo head to ensure complete coverage.
- In comparison with the AN/PSS-12, the F1A4 detector alerts closer to the edge of the suspected target.
- While sweeping the coil, keep it parallel and at a constant height from the ground at all times. Be aware of any tendency to raise the coil at the ends of each sweep, as this will reduce the detection depth.

Chapter 14

Mine Clearing and Proofing Assets

MINE CLEARING/ARMOR PROTECTION KIT

The mine clearing/armor protection (MCAP) kit (Figure 14-1) includes all the necessary armor protection to protect the operator and critical operating components during mine excavation. The kits are bolted and pinned to a bulldozer and the existing frame assemblies of track type tractors and hydraulic excavators. Mine clearing rakes can be adapted to the system as needed. Both a light-soil and a heavy-soil blade are available.

Figure 14-1. Mine Clearing/Armor Protection Attached to a Dozer

CAPABILITY

The MCAP kit provides operators of D7G dozers protection from 7.62-millimeter, armor-piercing ammunition and antipersonnel (AP) mine blast fragmentation. Mine clearing rakes can be attached to existing bulldozer blades, creating a 12-foot-wide path and a soil penetration depth of 12 to 18 inches.

OPERATIONAL CONSIDERATIONS

- Effective in clearing large areas, especially when equipped with a mine rake.
- Effective in clearing rough terrain.
- Mechanically reliable.
- Limited by soil type. Two different blade kits have been developed and put in the field. One is excellent for sand, but poor in cohesive soils, and the other has stronger tines that allow penetration of clay type soils.
- Able to withstand multiple AP blasts. However, the enclosed cab intensifies the blast so operators may need to be replaced due to the percussion effects.
- Somewhat arduous to install and limits the use of the dozer for other than clearing operations.
- The addition of this kit causes the interior operating space to become extremely warm.
- The armor plating severely restricts the operator's vision. During clearing operations, a ground guide must be positioned at a safe distance to guide the operator and observe the spoil for unearthed mines.
- Creates a berm that may or may not contain mines.
- When fully equipped, the MCAP can only be transported by a C17 or larger aircraft.
- Severe consequences if an antitank (AT) mine is detonated.

MINIFLAIL SYSTEM

The miniflail system (Figure 14-2) consists of a self-powered, John Deere™ 375 skid steer chassis subsystem, a countermine rotating flail subsystem, a remote control operating subsystem, and a transportation subsystem. The miniflail system incorporates both a radio frequency (RF) remote and a 75-foot backup cable link. An overall weight of 2,250 pounds without tracks and 2,460 pounds with tracks enables the system to be sling load-deployed by the UH-1H helicopter into remote areas.

Figure 14-2. Miniflail

CAPABILITY

The miniflail system is designed to clear surface-laid and buried AP mines. It is not effective against blast-hardened, AP mines; dud cluster munitions; irregular force, improvised explosive devices (IEDs); and AP booby traps from a 400-foot standoff distance. The miniflail can clear a 1- by 1,000-meter path in one hour.

OPERATIONAL CONSIDERATIONS

- The remote control unit is operated on line of sight.
- An AT mine will destroy the unit.
- The small size of the miniflail makes it ideal for clearing in tight areas around buildings and trails. It is not designed for large clearing or breaching missions.
- The flail has limited effectiveness on hard, rocky ground.
- The flail should be turned gradually, or it could stall or miss mines.
- When conducting a clearing operation, extreme care must be given to ensure that the flail passes overlap each other or a mine may be missed.
- When operating in summer type conditions, the hydraulic system tends to overheat. The recommended operation time is 1 hour before stopping to let it cool down.
- Two personnel should operate the flail, one to operate the remote control and one to ground guide. This is especially important during a recovery operation because the operator cannot see in front of the flail.
- During an extraction operation, keep the flail 50 meters from personnel in a covered vehicle and 100 meters from personnel in the open.
- Proof the lane with some other means.
- When towing the flail with a high-mobility, multipurpose, wheeled vehicle (HMMWV), do not exceed 40 miles per hour on paved roads.
- The trailer is not designed for cross-country travel.
- Operate at more than 1.7 miles per hour, or there may be skip zones (areas where the flail did not hit every square inch).

- Watch the machine for hopping during operation. If this occurs, reduce the speed or mines may be missed.
- Can be operated on slopes up to 40 percent forwards or sideways.
- Chains can be reversed to sweep surface-laid mines and unexploded ordnances (UXOs).
- Not effective against blast-hardened AP mines.

BODY ARMOR SET, INDIVIDUAL, COUNTERMINE

The body armor set, individual, countermine (BASIC) (Figure 14-3) provides increased survivability for soldiers from blast and fragments.

Figure 14-3. Body Armored Set, Individual, Countermine

OPERATIONAL CONSIDERATIONS

- The BASIC is heavy and extremely hot when worn in warmer weather. Increase fluid intake when wearing this equipment for extended periods. Recommended work schedules are located in Table 14-1.

Table 14-1. Recommended Work Schedules

Temperature (F)	Relative Humidity	Water Intake Per Hour (quart)*	Hourly Work/Rest Schedule Minutes	Maximum Work Time in 24-Hour Cycle Minutes
77	Low-High	3/4	40/20	160
77-90	Low-Moderate (74.5%)	3/4	40/20	160
77-90	High (>75%)	1	30/30	120
90-100	Low-High	1	30/30	120
100-105	Low-Moderate (74.5%)	1	30/30	120
100-105	High (>75%)	1	20/40	80
105-108	Low-High	1	20/40	80
108-110	Low (50%)	1	20/40	80
108-110	Moderate-High (>50.5%)	1.5	10/50	40
>110	Low-High	1.5	NFW**	NFW**

*Individual requirements will vary by ±0.25 quart.

**No further work. Stop mine clearing operations, and remove BASIC.

- The BASIC may restrict movement.
- The BASIC becomes cold throughout the entire mass when stored in cold locations. Wearing these cold-soaked items will transfer the cold

directly to the body. The cold clothing will rob the body of heat at a very rapid rate. Only prewarming the suit will reduce the safety risk of cold-soak injuries.

- Since the overboot is worn over the standard combat boot, the increased height and thickness of the heel and sole can contribute to instability while walking on uneven surfaces. Use caution to avoid twisting ankles or tripping.
- The ballistic cover and face shield add weight to the helmet. The assembly shifts the balance point forward. A high risk of injury to the neck may be expected when the soldier is subjected to conditions that cause him to be jolted or if he undergoes sudden acceleration, such as running, jumping, tripping, or riding over rough roads.
- Soldiers who are candidates for countermine operations must perform a neck-conditioning exercise program to strengthen and toughen their neck muscles before using the head assembly.
- For maximum protection against AP mines, the BASIC must be worn with the interceptor body armor or the personnel armored system, ground troops (PASGT) vest.

MINE CLEARING LINE CHARGE

The mine clearing line charge (MICLIC) is a rocket-projected, explosive line charge that provides an in-stride breaching capability for maneuver forces. The MICLIC system consists of an M353 3 1/2-ton or an M200A1 2 1/2-ton trailer (or M200 tracked trailer) chassis, a launcher assembly, an M58A3/4 line charge, and a 5-inch MK22 Mod 4 rocket. The MICLIC system also mounts on the armored vehicle-launched bridge (AVLB) (after removing the bridge) and becomes the armored vehicle-launched MICLIC (AVLM) (Figure 14-4). The line charge contains 840 kilograms of C-4 explosive at a spacing of 5 pounds per linear foot.

Figure 14-4. Armored Vehicle Launched-Mine Clearing Line Charge

CAPABILITIES

The MICLIC is a single shot, mine clearance system capable of clearing a path 14 meters wide (7 meters on the left and right of the linear charge) and 100 meters long through a minefield. It is effective against single-impulse, pressure type, non-blast-hardened AT mines and mechanically activated AT mines. The MICLIC creates an overpressure, which causes pressure type fuzes to function. Mines not detonated by the overpressure of the linear detonation charge will usually be uncovered or blown from the ground.

LESSONS LEARNED FROM DESERT STORM

MICLIC misfires occurred often during the in-country train up for the ground war, with units experiencing failure rates as high as 50 percent. Firing circuits continually malfunctioned, requiring each MICLIC to be dismantled and checked before firing.

The current arming method, the arming wire weave (AWW), significantly increased the reliability of the charge. Since the AWW was instituted, it has undergone a multitude of tests and refinements—the results of which continue to support this method of arming the fuze. Soldier training on the MICLIC is vital to its successful employment. If the MICLIC precombat check (PCC)/precombat inspection (PCI) procedures are followed, the reliability of the MICLIC will be greatly increased. The number one reason for MICLIC malfunctions is inadequate soldier training.

OPERATIONAL CONSIDERATIONS

Historically, MICLIC misfires are common and are likely to occur unless the entire system is checked prior to employment. Thorough operator training on this system (before use) is critical. The National Training Center (NTC) verified that the MICLIC PCC/PCI procedures listed below should be followed.

- The fuze assembly should be completely exposed and inspected during preparation of the MICLIC for employment.
- When transporting the MICLIC to its firing site, ensure that the system is not shaken or bounced around excessively.
- When pulling the trailer-mounted MICLIC, the following speeds should be followed:

  Rough broken terrain0-5 miles per hour
  Flat rough terrain0-10 miles per hour
  Smooth off-road0-15 miles per hour
  Secondary roads0-25 miles per hour

- Operators should conduct preventive-maintenance checks and services (PMCS) using TM 9-1375-215-13&P. Lube the MICLIC according to the lube chart.
- When the MICLIC is going to sit for several days, remove the W3, W5, and W6 cables and the control box and put them in the storage box. If left exposed to heat and cold, the cannon wires can separate from the cannon plug.
- When mounting the MICLIC onto the AVLM, fabricate the U-bolts using 3/4-inch medium carbon steel rod (automated integrated survey instruments [AISI] 1040-1045). The instructions for this modification are in TM 9-1375-215-13&P. Use six 1-inch beveled washers (National Stock Number [NSN] 5310-01-284-6395), eight 3/4-inch beveled washers (NSN 5310-01-317-0480), and eight 5/8-inch beveled washers (NSN 5310-01-373-6951).
- When preparing to fire, remove the pins from the lock holes and the bungee cords. Raise the launcher angle to 47 degrees, plus or minus 2 degrees.
- When storing the MICLIC for extended periods, do not leave the pump pressurized. This will quickly damage the pump.
- The MICLIC system should be kept covered (poncho or tarp) until it is to be used. Rain will wash away the lubricants and rust the launcher rails.
- Slight errors in the narrow specifications regarding elevation of the rocket arm may be the primary cause for cable breakage.
- TM 9-1375-215-13&P states that under combat conditions, you may attempt to detonate a linear demolition charge with weapon fire from the towing vehicle's gun or from the covering vehicle's gun.

ANTIPERSONNEL OBSTACLE BREACHING SYSTEM

The AP obstacle breaching system (APOBS) (Figure 14-5) is a rocket-propelled, 45-meter line charge with 108 special-purpose fragmentation munitions linked to a detonating cord. The rocket can be initiated by a delay mode (using a delay igniter) or a command mode (using an electric initiator and a blasting machine). Mines and wire are neutralized by high-velocity fragments and blast overpressure from the munitions on the line charge.

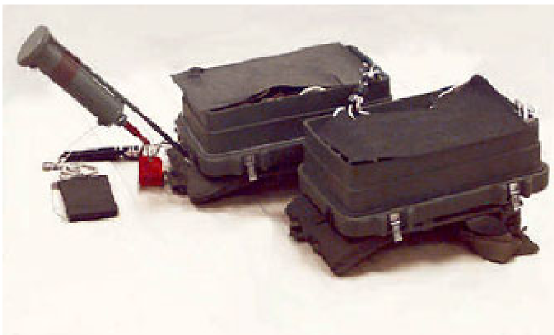


Figure 14-5. Antipersonnel Obstacle Breaching System

CAPABILITY

APOBS is a two-man, portable system that is capable of breaching a footpath through complex wire obstacles and AP mines from a 35-meter standoff position. The total system weight is 125 pounds (about 63 pounds per soldier). The system clears a path approximately 0.6 to 1 meter wide by 45 meters long. It is effective against AP land mines and complex and simple wire obstacles.

OPERATIONAL CONSIDERATIONS

- Effectiveness may be degraded on snow-covered ground.
- Cannot be deployed in an area where trees, power lines, or other overhead objects would interfere with the flight of the rocket or line charge over the obstacle (72-foot maximum trajectory height).
- Operates in ambient temperatures from 120° F to -25° F.
- Storage range is 160° F to -40° F.
- Deploys within 30 to 120 seconds.
- Has delay and command firing modes.
- Safe distance from the line charge detonation is 50 meters from the launch point and 75 meters from the deployed grenades in the prone position. For a covered position, the safe distance is 25 meters.
- The firing team has 23 seconds (maximum) to reach the safe distance before line charge detonation.
- The use of APOBS during sequential breaching operations requires skill to ensure that the line charges are overlapped so that the entire lane is cleared.
- During the deployment of APOBS on uneven or hilly terrain, consider the slope. Firing uphill, the system may fall short; firing downhill, the system may overshoot the target.

MINE ROLLER SET

The mine roller (Figure 14-6) is mounted on the front of an M1 Abrams tank. The rollers clear a path 44 inches wide in front of each tank track and the dog-bone-and-chain assembly clears tilt rod mines. An improved dog bone assembly (IDA) between the rollers will clear magnetic-influenced, fuzed mines. The mine roller is primarily used as a detector, but it can also be used to neutralize single-impulse, pressure-fuzed mines. Armor units are authorized one mine roller per tank company and/or four per battalion.

Figure 14-6. Mine Roller

CAPABILITY

The roller detonates mines by exerting pressure against the mine pressure plate or tilt rod actuator. Each roller bank weighs 5 tons. The IDA neutralizes magnetic-influenced, fuzed mines by projecting a magnetic field that prematurely activates the mine.

OPERATIONAL CONSIDERATIONS

- The roller's effectiveness is degraded when operating in excess of 10 miles per hour.
- The roller's operational utility is limited in extremely soft soil or extremely muddy conditions.

- The rollers leave an 88-inch swath between them that can contain pressure-fuzed mines. Follow-on vehicles of a different wheel base width are subject to mine detonations.
- While breaching a minefield or moving through rough terrain, avoid having the main gun positioned over the mine rollers. Failure to do so may result in damage to equipment.
- When clearing mines, avoid sharp turns and side slopes that will result in the tank track leaving the cleared path. Perform minefield breaching in the straightest line possible.
- If terrain conditions are encountered such that the rollers are 12 inches below the plane of the tank treads, the pivot-limiting chains at the rear of the rollers will support the weight of the rollers; therefore, mine clearing will not be effective. This condition can be encountered immediately over the top of a sharp rise and at abrupt depressions. If possible, avoid areas where the rollers will be lifted clear of the surface when clearing mines.
- The mine roller will operate successfully in wet and muddy conditions; however, 4- to 6-inch-deep mud will impair the ability of the wheels to rotate.
- The expected useful life of a roller will depend on the explosive weight and the number of mines encountered. Each push beam/roller assembly is capable of withstanding a minimum of two detonations from AT mines, each containing up to 22 pounds of high explosive. Immediately after breaching a minefield, as conditions allow, make visual checks of rollers and/or be aware of possible damage as noted by operating characteristics of the tank that may prevent and/or hinder the progress.

- When possible, avoid wooded areas that can damage the dog bone chain connected between the rollers. Do not use the rollers and/or push beam as a dozer or a ram.
- When crossing a ditch, shell hole, or trench, approach the obstruction as squarely as possible. Avoid ditches, shell holes, or trenches that have a vertical wall on the enemy side.

MINE CLEARING BLADE

The mine clearing blade (Figure 14-7, page 14-16) is effective against most mine types, regardless of fuzing. The mine clearing blade clears mines by extracting them from the ground and casting them aside. The IDA prematurely detonates tilt rod-fuzed mines by exerting pressure against the tilt rod fuze. If so equipped, the IDA neutralizes magnetic-influenced, fuzed mines by projecting a magnetic field that prematurely activates the mine. The mine clearing blade can be raised into a travel mode or lowered into a plowing mode via controls within the driver's compartment.

CAPABILITY

The mine clearing blade is mounted on the front of an M1 Abrams tank. The blades clear a path at least 42-inches wide in front of each track and a dog-bone-and-chain assembly clears tilt rod mines between the blades. An IDA between the blades will clear magnetic-influenced, fuzed mines as well. The blade is primarily used to provide a cleared path through mined areas for others to follow.

OPERATIONAL CONSIDERATIONS

- The effectiveness degrades when operating in excess of 10 miles per hour.
- It cannot be operated on hard-surface roads.

Figure 14-7. Mine Clearing Blade

- Its operational utility may be limited by frozen ground or deep snow.
- The mine plow can be lowered while the tank is moving at speeds up to 8 to 10 miles per hour. However, use caution when lowering the blade while moving because it can cause damage to the blade and injury to the crew.
- The travel lock spindle usually shears when the blade drops or hits something while the vehicle is moving at high speeds. When the spindle shears off, the downward motion of the blade causes the rest of the spindle to bend or break the bracket in which it is mounted. For some reason, the spindles on the left travel lock break considerably more often than the ones on the right. In every case, the bracket breaks through

the bolt holes. The only way to fix the bracket is to replace the entire push beam. This is a very time-consuming operation, which can be avoided if caution is used when driving with the blade.

- When operating laterally on a slope, always drop the uphill plow first.
- The blades will plow through concertina wire effectively, but the wire will often cut the nylon lifting straps, so avoid wire if possible. To prevent damage to the straps, some units bolt wire catchers (similar to those on the old M151 bumper) on the moldboard in front of the straps.
- At the conclusion of plowing, back the tank approximately 2 meters to clear the blade from the spoil prior to lifting. Otherwise, the additional weight of the spoil may break the lifting straps.
- The most common problems with the motor are that the armature brushes burn out or one of several electrical relays malfunctions. The only authorized repair for burned out brushes is to have a direct support (DS) level mechanic replace the entire motor. The German-made motors often take several months to come in after ordering. A technique used by NTC contract mechanics is to file the brushes from an old M-1 or M-2/3 starter down to size and place them in the lifting motor. This reduces the downtime from several months to 3 or 4 hours.
- When planning movement or maneuver routes, keep the rate of movement to a speed that the plow tanks can safely negotiate.
- The plow tanks should be positioned on the right side of the unit formation if possible. Drivers of plow tanks cannot see to the right side of the tank, because the power cable enters the tank through the right periscope opening. This makes

it difficult for the driver to maintain formation and interval.

- The moldboard extensions should be attached to the ends of the moldboards before plowing. The extensions push the spoil and mines clear of the lane so that they do not roll back down under the plow tank's tracks.
- The travel-lock hitch pins must be in the travel lock until it is actually time to drop the plow. This prevents the travel lock from disengaging prematurely and dropping the blade.
- A second plow should not be used to clear the center of the lane because it will simply push mines into the area cleared by the first plow.
- Any dismounts moving through a breach made by a mine clearing blade should expect to encounter some pressure-fuzed AP mines missed by the device.

ABRAMS PANTHER

The Abrams Panther (Figure 14-8) requirement emanates from a United States Army, Europe (USAREUR) operational needs statement identifying a requirement for an Abrams-based vehicle to perform mine detection and proofing operations in the Bosnia and Kosovo theaters. The Abrams Panther system is designed for remote and manned operation. It replaces the aging M60-based Panther system. The Abrams Panther is based on an M1IP chassis with the turret removed. The system incorporates a ballistic cover in place of the turret, a commander's hatch, and a machine gun mount. The vehicle is equipped with a series of line-replaceable units (LRUs) referred to as the Standardized Robotic System (SRS) kit, allowing for unmanned navigation through a minefield via wireless teleoperation. The vehicle is equipped with floor plates, stowage space, and a commander's seat to support the two-man crew during manned operations. It has crew protection and mobility characteristics that are similar to the IPM1 tank.

Figure 14-8. Abrams Panther

CAPABILITY

Teleoperated from a remote vehicle, the Panther is built on an M60 or M1 chassis pushing track-width rollers. It provides protection against single-impulse, pressure-fuzed mines. Protection can be enhanced against tilt rod, centerline, and magnetic-influenced mines using the IDA.

OPERATIONAL CONSIDERATIONS

- A Panther with mine rollers should be used as route or area proofing only.
- The remote control is a line-of-sight control.
- The Panther can be controlled from the tank/track commander (T/C) or troop hatch of an M113. The crew should be unbuttoned and have a 200- to 300-meter standoff.

- For recovery purposes, a tow cable should be installed on the panther when beginning a proofing mission.
- The roller's effectiveness degrades when operating in excess of 10 miles per hour.
- The roller's operational utility is also limited in extremely soft soil or extremely muddy conditions.
- The rollers leave an 88-inch swath between rollers that can contain pressure-fuzed mines. Follow-on vehicles of a different wheel base width are subject to mine detonations.
- When clearing mines, avoid sharp turns and side slopes that will result in the tank track leaving the cleared path. Perform minefield breaching in the straightest line possible.
- If terrain conditions are encountered such that the rollers are 12 inches below the plane of the tank treads, the pivot-limiting chains at the rear of the rollers will support the weight of the rollers; and therefore, mine clearing will not be effective. This condition can be encountered immediately over the top of a sharp rise and at abrupt depressions. If possible, avoid areas where the rollers will be lifted clear of the surface when clearing mines.
- The mine roller will operate successfully in wet and muddy conditions, however, 4- to 6-inch deep mud will impair the ability of the wheels to rotate.
- The expected useful life of a roller will depend on the explosive weight and number of mines encountered. Each push beam/roller assembly is capable of withstanding a minimum of two detonations from AT mines, each containing up to 22 pounds of high explosive. Immediately after breaching a minefield, as conditions allow, make visual checks of rollers and/or be aware of

possible damage as noted by operating characteristics of the tank that may prevent and/or hinder the progress.

- When possible, avoid wooded areas that can damage the dog bone chain connected between the rollers. Do not use the rollers and/or push beam as a dozer or ram.
- When crossing a ditch, shell hole, or trench, approach the obstruction as squarely as possible. Avoid ditches, shell holes, or trenches that have a vertical wall on the enemy side.

EMPLOYING THE PANTHER

Step 1. Conduct a mission analysis to determine the scope of the mission and the equipment required for successful completion.

Step 2. Determine where, when, and how rollers will be installed on the Panther.

Step 3. Determine required vehicles:

- Panther and control vehicle (M88, M113, armored vehicle, or protection bunker).
- Recovery vehicle (M88 or another 60 chassis vehicle).
- Vehicle with a lift for the rollers (M88 or heavy expanded mobility tactical truck [HEMTT] wrecker).
- HEMTT cargo or stake and platform (S&P) transport to haul the rollers.
- Engineer squad vehicle (to mark the cleared minefield areas and report).
- Evacuation vehicle (HMMWV, control vehicle, or squad vehicle).
- Medical vehicle (if necessary).

Step 4. Determine if a HEMTT or an S&P transport will haul the rollers. Make appropriate arrangements for the transport of the rollers, and ensure that a lift is on hand at load-up and off-load locations.

Step 5. Ensure that the order of march for proofing is in the direction of suspected mined areas. The Panther is first, followed by the control vehicle (unbuttoned and 200 to 300 meters behind), the recovery vehicle, the engineer squad vehicle, the evacuation vehicle, the HEMTT cargo, and the medical vehicle (if present).

Step 6. Control the Panther vehicle from the T/C or troop hatch of the control vehicle.

Step 7. Install a tow cable on the rear of the Panther before operation to aid the recovery if a mine strike occurs.

Step 8. Conduct a minimum of three passes with the Panther. Overlap each pass a minimum of 12 inches to ensure proper coverage. This is in addition to the passes required to proof the entire road width. The Panther proofs a 4-meters-wide path.

Step 9. If a mine strike occurs, determine if the Panther is operational by a visual spot check. If required, use mine detectors to clear around the Panther before the inspection. If operational, continue the mission. If not operational, the engineer squad should clear a route to the rear of the Panther. The tow cable is then brought back to the recovery vehicle.

OTHER EQUIPMENT TO CONSIDER

- Computer, antenna, and Panther control box.
- Minefield marking kit.
- Combat lifesaver with lifesaver bag.
- Tow cables and a Class 60 tow bar.
- At least one eight-block section of Class 60 track.
- Two Class 60 hub and road arms.
- A Class 60 torsion bar.

INTERIM, VEHICLE-MOUNTED MINE DETECTOR

The interim, vehicle-mounted mine detector (IVMMD) (Figure 14-9), is a multivehicle detection and neutralization system consisting of a lead mine detection vehicle (MDV) with a pulse induction mine detector and a second mine-resistant vehicle (MRV) with the same detector towing proofing/detonation trailers. Support vehicles, carrying spare chassis and repair parts, follow the MRVs. The MRV detector has low ground pressure tires and is designed to overpass most AT mines at 10 miles per hour detection speed.

Figure 14-9. Interim, Vehicle-Mounted Mine Detector

CAPABILITY

The IVMMD detects and marks metallic AT mines on roads/routes (3 meters wide) and proofs the route with detonation trailers.

OPERATIONAL CONSIDERATIONS

- No capability to detect nonmetallic mines, but the trailers will detonate most mines.
- Proofing trailers are not effective against dual/multiple impulse mines.
- Detection rate up to 12 kilometers per hour; proofing rate is in excess of 15 kilometers per hour.
- Potential degraded performance in high-laterite soils.
- The proofing trailer limits the turning radius.
- The IVMMD is limited to roads. It is not designed for cross-country proofing operations.
- The vehicle is designed for crew protection up to blasts of 15 pounds trinitrotoluene (TNT) equivalent and provides protection against North Atlantic Treaty Organization (NATO) standardized, 7.62-millimeter ball ammunition.
- The IVMMD is designed for quick repair and comes with readily available parts in containers called the “red and blue pack.”
  - The red pack consists of mobile repair parts, lifting equipment, and spare tires to ensure that a damaged vehicle can be repaired in 2 hours.
  - The blue pack contains all secondary parts, such as a spare engine and maintenance parts required for the vehicle.

LAUNCHED GRAPPLING HOOK

The launched grappling hook (LGH) (Figure 14-10) employs bullet trap technology to catch a bullet in its internal framework and to launch a grapnel up to 100 meters. When pulled back to the operator using its retrieval line, the grapnel catches trip wires and detonates booby traps and land mines. Multiple grapnel firings are recommended to ensure a cleared, proofed lane. The LGH weighs 3.2 pounds and has a shoulder strap for transport. The LGH may be fired only once with ball ammunition but is reusable indefinitely with blank, 5.56-millimeter ammunition. When launched with the M195 grenade-launching blank, ranges comparable to live ammunition launch are achieved. A training bag with reusable nylon line is available that will facilitate the reuse of expended grapnels with blank ammunition. This system was a type-classified standard in December 1995. Production units are available through the supply system. The NSN for the LGH is 1095-01-412-4150. The NSN for the training bag is 1095-01-413-9232, LIN: Z37991.

Figure 14-10. Launched Grappling Hook

CAPABILITY

The LGH neutralizes trip wire-fuzed mines, explosive hazards, and booby traps.

OPERATIONAL CONSIDERATIONS

- The LGH can be fired one time only with live ammunition.
- M195 grenade launching blanks are in short supply.
- Training may be conducted with M200 blanks, but ranges are limited to 20 to 25 meters.
- The LGH cannot be fired with tracer ammunition.
- For maximum range, use standard ammunition. Blanks or other rounds will reduce the range.
- The firing angle should be between 15 and 30 degrees.
- After firing the grapnel, pick up the remaining line and move back 30 meters. Use a slow retrieval to clear the area of trip wires. The grapnel can skip trip wires if retrieved too fast.
- Launch the grapnels until no more mines detonate, and then proof the lane with one final grapnel.
- The grapnel, the bridal, and the retrieval line should be inspected before use. Grapnels with broken or missing tines should be used only in training.
- If the grapnel cylinder is cracked, bent, dented, or deformed, do not launch it.
- The rifle should be in the "semi" mode before firing. Take care when shoulder-firing due to the heavy recoil.

HANDHELD STANDOFF MINE DETECTION SYSTEM

The Handheld Standoff Mine Detection System (HSTAMIDS) (Figure 14-11) is a single-soldier-operable handheld mine detector designed to replace the currently fielded AN/PSS-12 metal detector (MD) in Army engineer units. HSTAMIDS integrates a state-of-the-art MD with a compact ground-penetrating radar (GPR) into a lightweight handheld system (about 11 pounds with batteries.). HSTAMIDS is powered by standard issue Army batteries (four types).

Figure 14-11. Handheld Standoff Mine Detection System

CAPABILITY

HSTAMIDS is capable of detecting metallic and low-metallic AP and AT mines in on-road and off-road conditions. Sensor fusion and sophisticated algorithms reduce the false alarm rate that current MDs experience in cluttered metal environments. The integral HSTAMIDS MD sensor is capable of operating and detecting the metallic content in mines in soils with high mineral and metallic content.

OPERATIONAL CONSIDERATIONS

- HSTAMIDS must achieve a stable operating temperature before operation. This takes about 5 minutes and is mainly due to cold weather.
- If multiple detectors are to be operated within 25 meters of each other, the systems must be started and noise canceled at approximately 2-minute intervals.
- If two or more operating systems are brought within 25 meters of each other, all but one system must be noise canceled at approximately 2-minute intervals to allow for proper noise cancellation.
- The GPR must be retrained if the ground to be swept changes dramatically from that of its initial training. Failure to do so may result in injury or death, as mines may not be detected.
- A normal sweep pattern covers the ground in front of the operator, advancing 1/3 of the sensor head diameter per swing, while keeping the sensor head parallel to and as close as possible to the ground. The height should not exceed 2 inches.
- The recommended sweep rate is 1 to 3.5 feet per second across a 5-foot lane.
- The GPR and MD can be operated together or separately.
- The GPR is capable of locating objects buried in soil to a depth of about 6 inches.
- The trigger must be released when there is a pause in sweeping or on the alert of a suspected

mine, to prevent the unwanted replacement of the initial training.

- The GPR sensor is ineffective underwater and has degraded effectiveness in extremely cold environments and in soils with ice and snow ground cover.
- The effective fording depth for the HSAMIDS is 4 feet, because only the sensor head will withstand prolonged emersion. Mount the battery case near shoulder level and keep the electronic unit (EU) above water.
- For underwater operation, search using the MD only. The GPR does not work underwater and is ineffective over extremely muddy ground.
- The GPR must be trained after a fording operation.
- The infrared (IR) lamps are used in low-light/night operations. The lamps will help illuminate most trip wires in the lane. The use of the IR feature requires the operator to use night vision goggles.
- If one of the following messages is heard while sweeping, stop immediately and retreat from the minefield according to established standing operating procedures (SOPs):
    - "Battery low."
    - "System over temp."
    - "Bit failure."

NOTE: Do not try to troubleshoot the system while in the minefield.

MINE DETECTION DOGS

Mine detection dog (MDD) teams (Figure 14-12, page 14-30) consist of a specially trained canine and a handler that are used to detect on- and off-route land mines (AT and AP), UXO, booby traps, and trip wires.

Figure 14-12. Mine Detection Dog

CAPABILITY

The canine's performance is limited to the skill of the handler. All data in regards to canine performance is subject to interpretation. Most data is anecdotal from humanitarian demining efforts. However, MDD teams were used extensively and successfully in Afghanistan during Operation Enduring Freedom. Dogs were integral components of area clearance teams, successfully locating and alerting on AT mines and UXO. Dogs detect the chemical scent of explosives, not the metal components of mines and UXO.

MINE DETECTION DOG TEAM AND ENGINEER INTEGRATION

Operational Considerations

MDDs are reliable, proven, and efficient detectors of mines, booby traps, explosives, and UXO. They have excellent mobility and utility over ground that is not accessible to most mechanical detection tools. MDDs possess superior olfactory capability, versatility, physical agility, and detection speed.

Dogs detect land mines by the chemical scent of an explosive. They alert the handler to a hazard by sitting down. Dogs can detect metallic and nonmetallic mines whether surface-laid, buried, or concealed in walls, floors, roadways (shoulders and ditches), or side-hill cuts. Dogs can detect trip wires, firing devices, and firing controls if trained to do so. However, not all dogs are trained to find trip wires and such.

Operational Missions

MDDs can be trained to conduct these operational missions:

- **Route clearance.** Supporting convoys or patrols, MDDs can rapidly detect mines and explosive booby traps along routes or potential ambush sites.
- **Area clearance.** MDDs can proof cleared areas; search for mines and other explosive, casualty-producing devices; and detect boundaries of mined areas.
- **Route reconnaissance.** MDDs can determine where mines are and are not and can locate mobility areas.
- **Casualty evacuation.** MDDs can clear access lanes for extraction of casualties.

NOTE: Civilian trained/handled MDDs are normally only able to perform area clearance or route clearance. Speak with the handlers to determine the mission capabilities of each dog. Do not attempt to employ dog teams in a fashion that the dog is not trained for.

CAPABILITIES OF DOGS FOR MINE DETECTION

- Dogs are proven mine/UXO detectors, and they have a high detection success rate.
- Dogs provide a faster mine detection capability than current magnetic-anomaly detection equipment and manual probing techniques.
- Dogs provide a reliable detection capability without ever touching or disturbing the device itself; additionally, dogs will not initiate magnetic-influenced fuzes.
- Dog teams can effectively augment on- and off-route clearance capabilities.
- Dogs can provide a detection capability where mechanical clearance tools cannot operate.
- Dogs can find mines buried along railroad tracks, on or near metal bridges, in and around buildings and vehicles, amid any population, on deserted and active streets, and in the rubble of collapsed structures.
- Dog teams are excellent verification tools in wide-area searches.

LIMITATIONS OF DOGS FOR MINE DETECTION

- Dogs **do not** find every mine and must not be seen as the “silver bullet” mine detection solution to solve all mine problems in all environments, situations, or conditions.
- The depth at which dogs can find mines varies with each dog, environmental conditions, the type of mine or explosive, and the length of time the mine or explosive has been buried.
- A dog’s detection capabilities are reduced in areas of excessive noise and movement and by unfavorable weather and harsh terrain conditions (rain, dust, fog, mud, snow, dense undergrowth, heavy woods, or thick foliage).

- A dog's performance will depend on his mood and level of interest.
- A dog's effectiveness is degraded by fatigue, hunger, thirst, heat, and frigid temperatures.
- Dog working times vary from 45 minutes to 5 hours a day, depending on the dog and the work environment.
- The effectiveness of a dog team is limited by the abilities of the handler.
- The dog handler knows the capabilities and limitations of his dog.

SUGGESTED TACTICS, TECHNIQUES AND PROCEDURES FOR DOG TEAMS

NOTE: These are only suggested tactics, techniques and procedures (TTP) to employ dog teams in mine detection operations. Review these with the dog handler, and determine what his techniques are. If the MDD team has a different SOP, determine whether their practiced technique can work in your situation. Let the dog team supervisor make the final decision. Do not insist that these TTP be used if the dog team has never practiced them. Injury or loss of life may occur.

Clear Mines From an Area

Step 1. Markers are placed on the safe side of the area to be cleared.

Step 2. The dog moves up and back, clearing a 1-meter path as the entry point into the field.

Step 3. The dog begins clearance operations; hazards identified by the dog are marked.

Step 4. The AN/PSS-12 operator sweeps the path to the identified hazard.

Step 5. The prober moves up to probe and verify hazards.

Step 6. As the AN/PSS-12 operator moves forward, he moves markers up to delineate safe areas from uncleared areas. Markers are shifted until the entire area is clear, and boundaries of cleared areas are delineated. NATO standard minefield area markings are erected at the limit of the cleared area to identify uncleared hazard areas.

Clear Mines From a Road Intersection

Step 1. The dog moves from a known safe area and clears a 2-meter-wide path along the roadside.

Step 2. The dog team enters the hazard area and begins the clearance operation.

Step 3. The AN/PSS-12 operator sweeps the path to the extent of the dog leash or the identified hazard.

Step 4. All potential hazards are marked.

Step 5. The prober moves up to probe and verify hazards.

Step 6. As the AN/PSS-12 operator moves forward, he spray paints markers on the road to indicate the safe path.

Step 7. The passes are made according to numbered arrows, reference the mine dog training techniques handbook.

Step 8. Mines are prepped for demolition when hazards are identified and then daisy-chained and blown in place.

Clear a Lane to a Casualty in a Minefield

Step 1. The dog handler clears a 1-meter-wide path up to and around the casualty.

Step 2. The path is made to avoid possible hazards; all points indicated by the dog or the follow-on AN/PSS-12 operator are marked. These areas are marked only, not probed. The path to the casualty is adjusted to avoid potential mine sites.

Step 3. The AN/PSS-12 operator follows 25 meters behind in the same path to provide a second check.

Step 4. The lane marker uses spray paint to outline the cleared path and to differentiate potential mined areas from the cleared lane.

Step 5. Once the dog has finished, the dog team exits the lane and lets the AN/PSS-12 operator and the lane marker sweep around the casualty and check for mines that the dog may have missed. Once the area around the casualty is swept, the detector operator and the marker exit the lane. Medical teams or combat lifesavers and the litter team stand by to render care to the casualty.

Step 6. Once the lane is cleared, medical and litter personnel approach the casualty and render emergency first aid. As soon as possible, the casualty is removed from the minefield, along the cleared lane, to safety and additional medical treatment.

Step 7. If the casualty is dead, see the technique for area clearance (page 14-33). The same deliberate sweep method and team organization are used to clear a 2-meter wide path to the casualty.

Use Dogs to Proof an Area After the Mechanical Clearance

Step 1. Dogs are extremely good at proofing an area after the mechanical clearance equipment (including flails and MCAP dozers) have been used. Dogs can either precede mechanical area clearance equipment to locate AT mines or follow the mechanical area clearance equipment as proofing tools.

Step 2. The dog is capable of much greater proofing speeds than handheld mine detectors or probing.

Step 3. Following mechanical area clearance equipment (when dust generated by flail operations settles), the dog team can begin using the same clearance techniques as in area clearance operations. The dog will move up and back in a straight line from its handler.

Step 4. Clearing a series of 1-meter-wide paths, the technique is repeated until the entire area is proofed.

Step 5. The handler marks hazards identified by the dog during proofing operations.

Step 6. The AN/PSS-12 operator sweeps a path to the identified hazard and investigates the suspected hazard areas.

Step 7. The prober moves up, probes, and verifies hazards.

Step 8. Markers are shifted until the entire area is clear and boundaries of cleared areas are delineated. NATO standard minefield area markings are erected at the limit of the cleared area to identify uncleared hazard areas.

MATILDA

The Matilda (Figure 14-13) is a small man-portable robot used for contingency operations. Special features for military operations on urbanized terrain (MOUT), tunnel, and cave missions include a manipulator arm, a fiber-optic control kit, extended run batteries, an eight-bank battery charging station, and a diesel generator.

CAPABILITY

The Matilda is a remotely operated, line-of-sight, neutralization system for AP mines, IEDs, booby traps, and UXO. It is used in clearing areas that are protected by obstacles. The Matilda is reconfigurable for different missions by adding plug-and-play modules. It comes packaged in three shipping containers that hold the base platform, the manipulator arm, the sensor mount/light kit, the fiber-optic control system, the extended run time kit, special backpacks for operational mission loads, spare batteries, extra tracks, and spare parts. The Matilda base platform weighs 40 pounds, the manipulator arm weighs 46 pounds, the sensor/light kit weighs 24 pounds, and the fiber-optic system (for

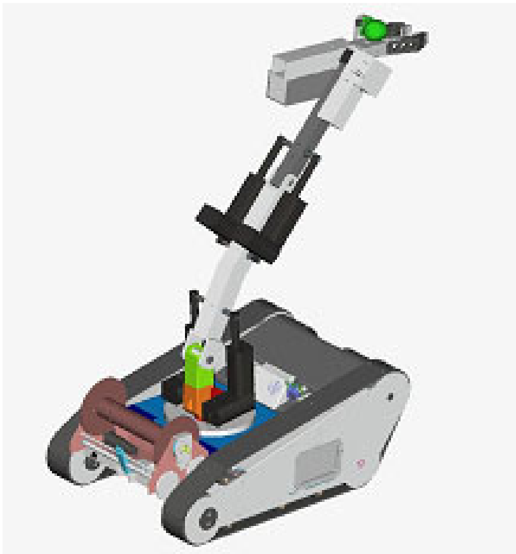


Figure 14-13. Matilda

missions not susceptible to RF operation) weighs 24 pounds. The Matilda is 20 inches wide by 26 inches long by 12 inches high with a 4-inch ground clearance. It can travel at 3 feet per second, carry 150 pounds, and tow 475 pounds.

OPERATIONAL CONSIDERATIONS

- The Matilda greatly reduces the risk associated with employing soldiers to clear tunnels, sewers, and caves and may accomplish the mission much faster.
- The Matilda has been successfully employed by Special Operations Command (SOCOM) soldiers without any personnel casualties.

- The primary purpose of the Matilda is clearing and proofing tunnels, sewers, and caves.
- The Matilda fulfills the immediate requirement for unmanned reconnaissance and neutralization of obstacles in tunnels, sewers, and caves.
- The Matilda is designed to provide a standoff capability for accomplishing hazardous obstacle neutralization missions.
- The unit will need and receive assistance from the Program Manager, Joint Program Office, Unmanned Ground Vehicles/Systems (PM JPO-UGV/S) and/or contract personnel for organizational and DS maintenance. The unit will identify faulty LRUs, remove them, and ship them to either the PM JPO-UGV/S or a designated contractor facility for repair. The support organization will replace faulty LRUs with repaired or replacement components.
- A mobile training team (MTT) is needed and will be provided by the PM JPO-UGV/S or the United States Army Maneuver Support Center (MANSCEN) to train Matilda operators and maintainers during initial issue and before deployment. Refresher training and maintenance visits should also be planned every six months.

COMMERCIAL OFF-THE-SHELF COUNTERMINE CLEARING EQUIPMENT

HYDREMA

The Hydrema (Figure 14-14) is a mechanical flail system. The vehicle is capable of operating over rough terrain or on tracks and roads. Based on a dump truck chassis, it has constant four-wheel drive and can sustain a continuous road speed of 35 kilometers per hour. For clearance operations, the vehicle has a fully independent hydrostatic drive that gives clearance speeds of up to 1.4 kilometers per hour in any terrain. The flail is 3.5 meters wide, and the flailing depth can be adjusted manually or automatically. The system has a tilting/turning capability that allows the flail to be stored in a transport position. The cabin has both a heating and air-conditioning system. The cab is armored for protection against 7.62-millimeter, armor-piercing ammunition.

Figure 14-1. Hydrema

Capability

The Hydrema is designed to clear AP mines, with limited utility against AT mines.

Operational Considerations

- The flail works very well in loose silt or sandy soil.
- The flail does not work as well in heavily rock-strewn soil.

- The largest drawback to using the Hydrema is the large dust cloud it creates when the flail is in use.
- The Hydrema flail is C-130 transportable (with modifications).

AARDVARK

The Aardvark (Figure 14-15) is a mechanical flail system mounted on a half-track chassis. The flail clears a 3.05-meter swath.

Figure 14-15. Aardvark

Capability

The Aardvark is designed to clear AT and AP land mines by detonation or destruction and is claimed to be capable of operating over the majority of terrain conditions encountered in minefields throughout the world. The Aardvark is claimed to be effective in a variety of soil types and mixes, and it accommodates flat and undulating contours with gradients of 30 percent. The average operating speed is 3 kilometers per hour; hard-surface clearance speed is 15 kilometers per hour.

Operational Considerations

Not suited for employment in heavily rock-strewn terrain, such as that found in Afghanistan.

Chapter 15

Breaching and Lane Marking Tactics, Techniques, and Procedures

LANE MARKING

There are two critical components to any lane-marking system—the patterns and the device used. Lane-marking patterns are the location of the markers indicating the entrance, the lane itself, and the exit. The marking device is the type of hardware employed to mark the entrance, the lane, and the exit.

Standard lane markings help the commander in two critical aspects of moving a unit through a lane. Lane markers, when used correctly, help the unit position its forces for a quick and efficient passage through an obstacle. A combination of lanes and traffic control points give the commander greater mobility in the forward and rearward movement of his forces. A lane marking system that is effective will enable a commander to maintain the tempo and the momentum of the attack. Recognizable lane markers help the commander prepare his forces to change from a combat formation to a column formation and to pass smoothly and quickly through the lanes. Entrance and exit marking devices must be highly visible to a tank/track commander (TC) from 100 meters away, while the handrail markers must be visible to the buttoned-up driver from 50 meters. Both the far-recognition markers and the final-approach markers should be visible to the TC from 500 meters away, giving him plenty of time to relay critical information to his troops regarding the maneuver formation.

The three standard levels of marking breach lanes and bypasses are initial, intermediate, and full (Figures 15-1 through 15-3, pages 5-2 through 5-4). Each lane-marking level provides an increase in the lane signature and capability. Lane requirements change as the breaching operation matures from an initial breach to the forward passage of large combat forces.

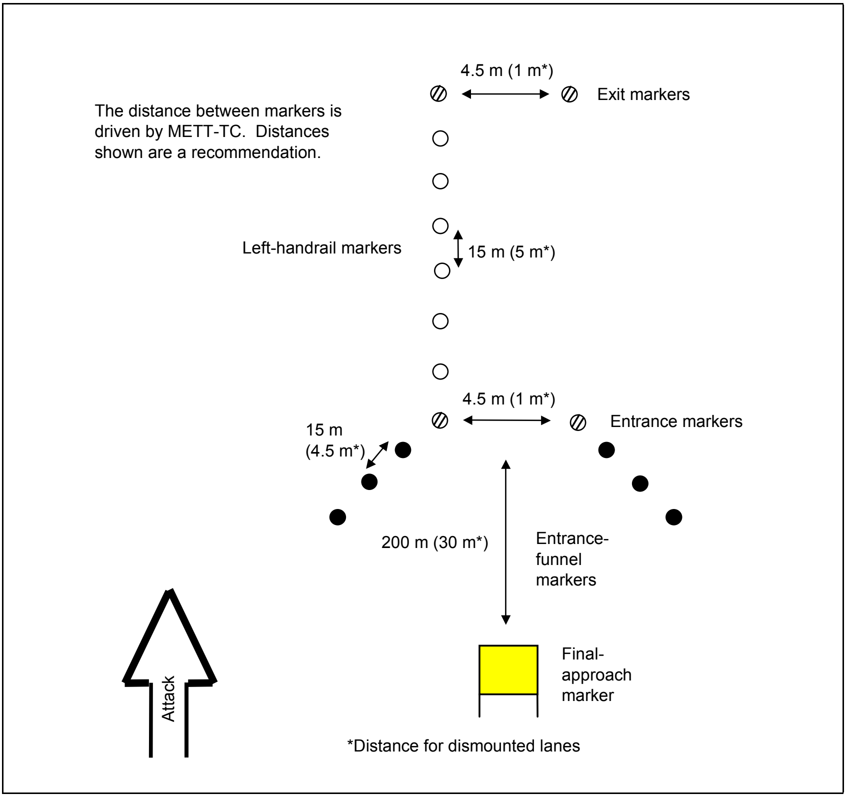


Figure 15-1. Initial Lane Marking

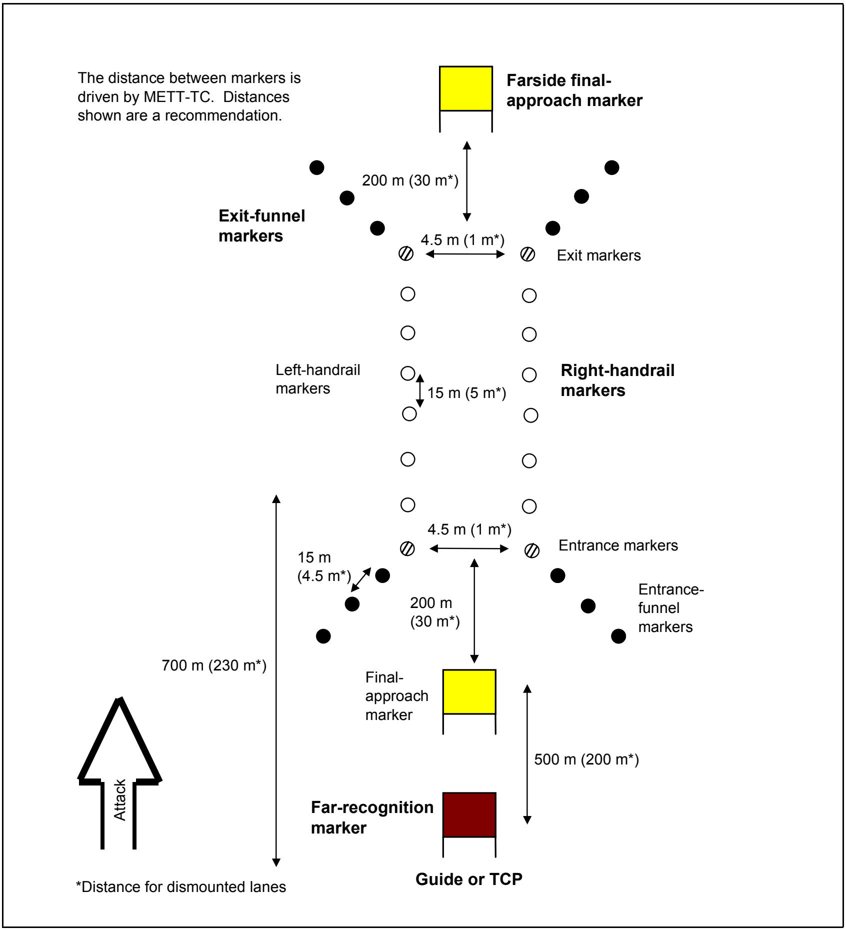


Figure 15-2. Intermediate Lane Marking

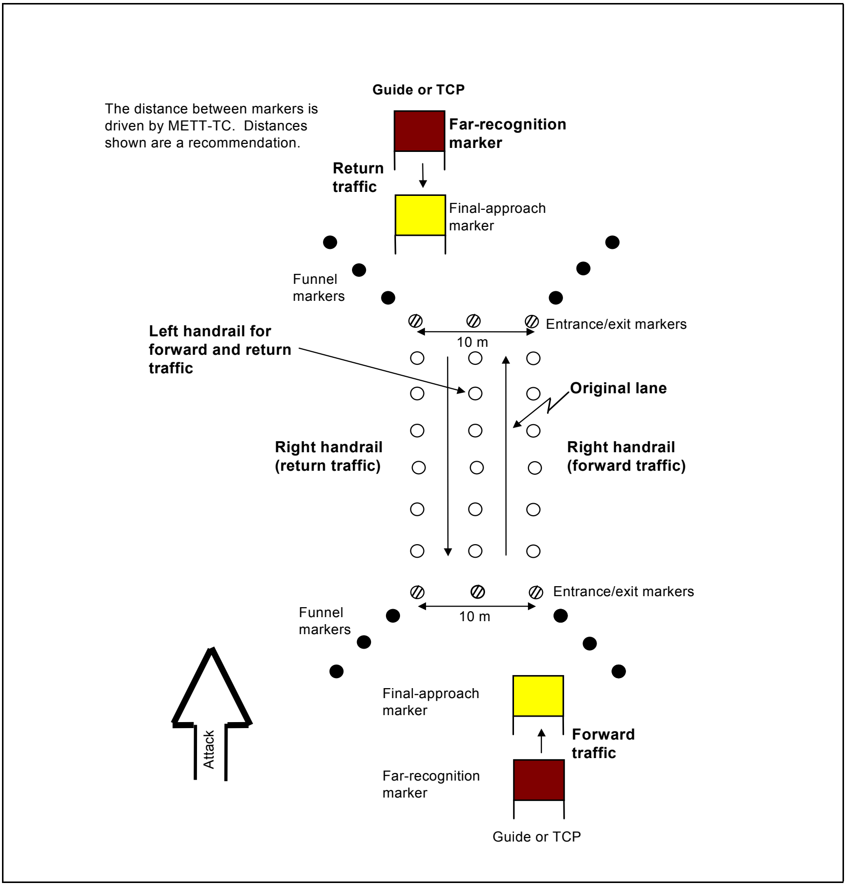


Figure 15-3. Full Lane Marking

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.

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 15-1.

Table 15-1. Guidelines for Lane-Marking Devices

Marker	Mounted Forces	Dismounted Forces
Handrail and funnel markers	Visible by T/C 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 T/C (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)	Lightweight, quick, and easy to emplace
	Easily man-portable	
Final-approach and far-recognition markers	Visible by T/C (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

Some of the items currently being used are as follows:

- Traffic cones and Hand-Emplaced Minefield Marking System (HEMMS) poles.
- Highway markers and picket tripods wrapped with barbed wire.
- Tippy toms and stakes with chemical lights or infrared (IR).
- Stakes painted florescent.
- Far-recognition markers using VS-17 panels.
- Cattle fence with mine signs.

Some general requirements for lane marking are as follows:

- 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 identified during limited visibility.
- Markers during a period of limited visibility should emit a constant source of light/energy rather than a pulsating strobe. Strobes complicate the recognition of the marking pattern or lane, particularly when approaching the mouth of the breach lane from an angle.

The following standard marking sets are available through normal supply channels:

- Minefield marking set number 2, line item number (LIN): M49096, NSN: 9905-00-375-9180.
- HEMMS, LIN: M49483, NSN: 9905-01-019-0140.
- Cleared Lane Marking System (CLAMS), NSN 2590-01-205-3082.

PROCEDURES FROM DESERT STORM

The 1st Infantry Division developed an extensive breach lane-marking system comprised of plywood panels, pickets, airfield landing lights, and chemical lights. Extensive rehearsals were undertaken to acquaint divisional forces and follow-on British forces with the marking system.

The United States Marine Corps (USMC) used plastic barrels and bottles filled with chemical light fluid to mark their breach lanes.

Road graders were used to cut ditches as guide markers through some lanes for vehicle drivers to guide on.

Return lanes (one-way traffic) were developed as quickly as possible following the construction of breach lanes to permit the quick return of casualties.

LESSONS LEARNED FROM DESERT STORM

The Iraqi forces constructed trenches and pits filled with crude oil that were to be ignited as part of their defensive barrier system. The solution to breaching these obstacles includes the following steps:

- Eliminate the fuel source.
- Ignite the fuel.
- Wait for the fuel to burn out.

Although United States (US) forces did not encounter Iraqi scatterable minefields, encounters with friendly UXO were treated as if breaching a scatterable minefield. Air Force cluster bomblets blew off vehicle tires and killed or wounded dismounted soldiers and noncombatants. Engineers were required to plow lanes through these areas and clear areas for occupation.

Track-width mine plows were successfully used to counter pressure-fuzed antitank mines. In loose sand, plows could operate at a forward speed approaching 30 kilometers per hour. The following mine plow lessons were learned:

- Plowing produces a windrow of sand and earth that can be filled with mines. Units found that this windrow must be reduced. They reduced the windrow by using a mine rake or by laying a mine clearing line charge (MICLIC) alongside the windrow and detonating the line charge to defeat the mines.
- Units used mine plows to push up protective berms, to clear trench lines, and to delineate counterattack routes and laager sites in the sand.
- The nylon lifting strap on the plow wears quickly in the desert environment and needs to be replaced with more robust alternatives.
- Units encountered problems clearing concertina wire from plows and had to remove the wire by hand using bolt cutters or by constructing locally fabricated wire cutters from angle iron.
- The mine plow experienced difficulty with the depth adjustment bolts shearing off under normal use, requiring frequent replacement.

During Desert Storm, many senior commanders inquired whether the Air Force could breach minefields by bombing. After testing, commanders determined that the bombing of minefields produces too much ground movement and damage. The technique erodes the effectiveness of mechanical minefield equipment and its ability to conduct proofing operations following the bombing. This technique does not work and is not recommended.

Chapter 16

Destruction of Captured Equipment and Materiel

DESTRUCTION OF GUNS

Destroy gun barrels with explosives or their own ammunition. Remove or destroy small components, such as sights and other mechanisms.

EXPLOSIVES METHOD

- Block the barrel just above the breech. For small-caliber guns that use combined projectile-propellant munitions, solidly tamp the first meter of the bore with earth. For heavier guns that use projectiles separate from propellants, load a projectile and aim the tube to minimize damage if the round is ejected.
- Refer to Table 16-1 for the charge sizes required for standard barrel sizes.

Table 16-1. Required Charge Sizes

Serial	Barrel Size (mm)	Charge Size (lb)
1	76	10
2	105	18
3	120	23
4	155	38
5	203	66
NOTE: Determine the appropriate charge sizes for the barrel sizes not listed by comparing them to known barrel sizes. For example, you would use the explosive weight in Serial 3 for a 112-mm barrel (23 pounds) and Serial 4 for a 152-mm barrel (38 pounds).		

- Determine the required charge size using the following formula, if necessary:

$$P = D2/636$$

where—

P	=	*quantity of explosive (any high explosive [HE]), in pounds*
D	=	*bore size of the barrel, in millimeters*
636	=	*constant*

- Pack the explosive, preferably C4, into the breech immediately behind the tamping.
- Place the plastic explosive in close contact with the chamber.
- Close the breech block as far as possible, leaving only enough space for the detonating cord to pass without being bent or broken.
- If time permits, place 15-pound charges on the drive wheels of tracked guns and on the wheels and axles of towed guns.
- Connect the branch lines in a junction box, or use a line or ring main.
- Simultaneously detonate all charges.

IMPROVISED METHOD

- Destroy a gun with its own ammunition when block explosives are not available.
- Insert and seat one round in the muzzle end and a second charge, complete with propellant charge (if required), in the breech end of the tube.
- Fire the gun from a safe distance using the gun's own mechanism.
- Use a long lanyard, and ensure that the firing party is under cover before firing the gun.

DESTRUCTION OF ARMORED FIGHTING VEHICLES

- Destroy armored fighting vehicles (AFVs) beyond repair by detonating a 25-pound charge inside the hull. The charge may be a bulk 25-pound charge or a number of smaller charges placed on the drive, turret, and gun controls (see Figure 16-1).

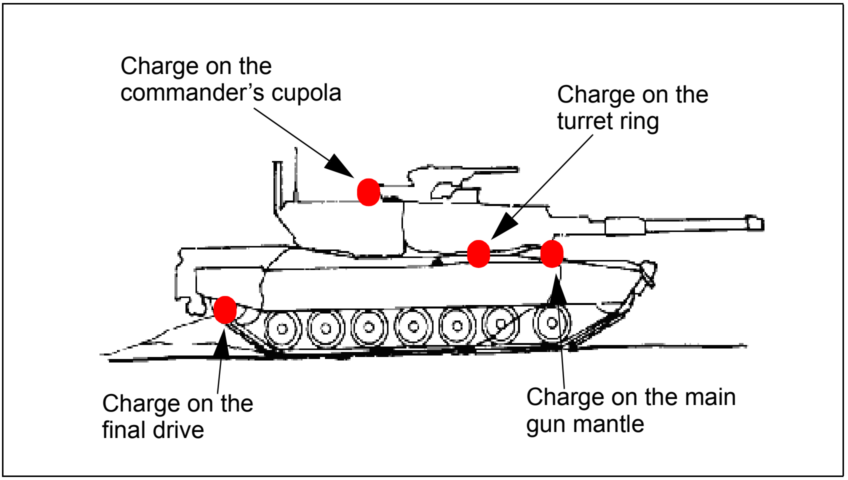


Figure 16-1. Placing Charges on an AFV

- To increase the amount of damage to the AFV, ensure that the ammunition within the AFV detonates simultaneously with the other charges and that all hatches, weapon slits, and other openings are sealed.
- If it is not possible to enter the AFV, place the charges under the gun mantle, against the turret ring, and on the final drive.
- If explosives are not available, destroy the AFV by using antitank (AT) weapons or fire or destroy the main gun with its own ammunition.

DESTRUCTION OF WHEELED VEHICLES

EXPLOSIVES METHOD

- Destroy wheeled vehicles beyond repair by wrecking vital external parts with a sledgehammer or explosives.
- If HEs are available, use 2-pound charges to destroy the cylinder head, axles, and frame (see Figure 16-2).

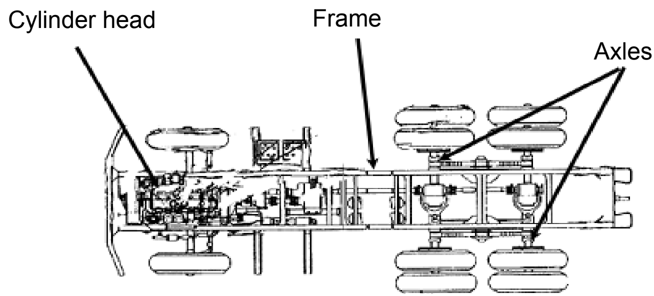


Figure 16-2. Placing Charges on a Wheeled Vehicle

IMPROVISED METHOD

- Drain the engine oil and coolant, and run the engine at full throttle until it seizes.
- Finish the destruction by igniting the fuel in the tank and burning the vehicle.

LESSONS LEARNED FROM DESERT STORM

Following the ground assault into Kuwait and Iraq, combat engineers and explosive ordnance disposal (EOD) technicians were given the mission to destroy large amounts of captured munitions, equipment, and facilities. Hundreds of ammunition bunkers and caches and captured vehicles and other equipment were destroyed using demolitions. Facilities, including warehouses and hangars, were destroyed using explosives.

The fast pace and large volume of work placed on combat engineers made the use of time fuzes and blasting caps too cumbersome and time-consuming. Satchel charges, using WWII technology, were extremely inefficient and the resulting destruction attempts unpredictable.

One engineer battalion destroyed 61 tanks, 47 armored personnel carriers, 305 trucks, 15 artillery pieces, 51 air defense artillery guns, and over two million rounds of ammunition. Most of these missions were accomplished in a matter of hours or days.

Initially, most units used the "P for plenty" rule when calculating the amount of demolition materiel to use to destroy vehicles. Techniques to disable tanks and artillery tubes were not well-known, and most units engaged in trial and error methods to determine the most effective placement of explosives to destroy captured materiel. Incendiary grenades proved ineffective in most cases against modern Iraqi equipment, requiring larger charges strategically placed to render equipment useless.

Safety and the use of risk assessments during equipment and materiel destruction missions is a concern. Desert Storm safety lessons learned included the following:

- Explosives were set on equipment or materiel with no guards posted to warn or prevent personnel from entering the blast minimum safe distance hazard area.
- Few verbal warnings were given over the radio or mobile subscriber equipment (MSE) to keep

soldiers and noncombatants out of the blast areas.

- There were numerous instances where soldiers drove or walked into danger areas after explosives were set and demolition chains activated.

DESTRUCTION OF EQUIPMENT

Desert Storm standards of destruction were as follows:

- **Combat vehicles.** Destroy the breechblock or the gun block and turret ring. Ignite ammunition magazines to create high order detonation of on-board munitions.
- **Tactical vehicles.** Damage the engine block or destroy the vehicle by burning.
- **Nontactical vehicles.** Damage the engine block or destroy the vehicle by burning.
- **Logistics stocks.** Destroy with demolitions or by crushing with heavy engineer equipment.

SAFETY MEASURES

- Commanders and leaders must conduct a risk assessment prior to commencement of demolition/destruction missions. Commanders must know who is to their left, right, front, and rear, and coordinate their materiel destruction missions with those units. Coordinate demolition missions with air liaison officers for fixed-wing and rotary aircraft. Warn all nearby aircraft of impending demolitions.
- Ensure that trained medical personnel are on site in case of incident or accident.
- Alert all personnel in the area of impending demolitions through the use of radio, Maneuver Computer System (MCS), or MSE notification. Radio nets must be monitored continuously.

- Use vehicle horns to signal blast intentions with a 1-minute continuous blast to alert personnel in the area.
- Post guards beyond the calculated minimum safe distance from the blast site to protect soldiers and noncombatants.
- All personnel must wear flak jackets and Kevlar helmets to protect themselves from blast fragments and must be prepared to mask in the event that smoke/fumes approach them.
- All soldiers and noncombatants should remain upwind of the blast to prevent exposure to toxic fumes. If necessary, downwind units should be notified to protect themselves from chemical smoke emanating from blast sites.
- No suspected chemical munitions will be destroyed. Mark, record, and report the location of suspected chemical munitions to the higher headquarters.
- Use the minimum amount of explosives to get the job done, and use nonexplosive demolition techniques where appropriate.
- Observe demolition misfire procedures. Request EOD support if unsure how to manage demolition misfires or in the case of high-risk destruction missions, such as large amounts of ordnance.

Chapter 17

Minefield Reconnaissance Operations

Minefield reconnaissance is vital to verify the accuracy of an assessment. It also determines whether a bypass or an in-stride breach is required. Effective minefield reconnaissance requires the combined assets of all elements on the battlefield. Engineers identify specific reconnaissance requirements and augment patrols and scouts to identify obstacle characteristics. The maneuver unit must integrate engineer reconnaissance into their reconnaissance plan.

Although engineer reconnaissance teams have the capability to clear or reduce small obstacles that are not covered by fire or observation, an engineer reconnaissance team's primary task is reconnoitering tactical and protective obstacles. The reconnaissance should include surveillance of supporting enemy positions and possible reduction sites. Another important reconnaissance task is locating and marking bypasses around obstacles and restrictions.

A more complete picture of obstacles and barriers can be obtained if engineers work closely with the other reconnaissance elements, especially task force (TF) scouts or long-range surveillance patrols. An engineer reconnaissance team can provide timely and valuable advice about encountering large obstacles during a mission. This knowledge is based on their engineer battlefield assessment and understanding of how the enemy may defend or guard a piece of terrain. This information is used by all elements to plan reconnaissance and confirm the obstacle template. Once located, the minefield and obstacle information is provided to elements of the breaching operation. This information is used to coordinate the suppression, obscuration, security, reduction, and assault (SOSRA) plans for the breaching operation.

DETECTION

In any operation where enemy obstacles interfere with a friendly maneuver, obstacle intelligence (OBSTINTEL) becomes priority intelligence requirements (PIR). Finding enemy obstacles or seeing enemy obstacle activity validates and refines the Intelligence Officer's (US Army) (S2) 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. Reconnaissance teams gather the following OBSTINTEL information:

- **Minefield or obstacle location.** Plot the perimeter location on a large-scale map, and refer to recognizable landmarks.
- **Perimeter description.** Describe how the perimeter is fenced. If it is unfenced, describe how it is marked. If it is unmarked, show how it was recognized.
- **Nuisance mines.** If you discover a nuisance mine forward of the minefield outer edge, there may be others. Assembly areas may also be mined.
- **Types of mines.** Indicate whether mines are antitank (AT) or antipersonnel (AP) or have unknown fuzes (self-neutralizing or self-destructing). Recover specimens of unknown or new mines, and note the details.

- **Details of any other devices.** Describe booby traps, trip wires, and flares.
- **Laying method.** Indicate whether mines are buried or surface-laid.
- **Density and pattern.** Include the mine spacing and the number of mine rows. Estimate the mine density based on this information.
- **Minefield depth.** Provide the distance between strips or rows, and describe the markers.
- **Safe lanes and gaps.** Plot the location of suspected safe lanes and gaps, and describe their markings.
- **Ground conditions.** Include information on general ground conditions.
- **Other obstacles.** Plot the location and the construction of other obstacles.
- **Enemy defenses.** Describe the enemy's location and size. Include the location of enemy direct-fire weapons.
- **Reference points.** Distance and direction (azimuth) from known reference points to hazard areas or obstacles.

While assisting in a reconnaissance mission, engineers will use visual and physical means to detect mines and obstacles. They visually inspect terrain for signs of minefield indicators or other obstacles. They must be alert to dangerous battlefield hazards, such as bomblets from cluster bomb units (CBUs); dual-purpose, improved conventional munitions (DPICM); and other unexploded ordnances (UXOs). Minefields and other obstacles can be difficult to detect while mounted, during reduced visibility, and in time-compressed situations. Most obstacle detection occurs when dismounted. The engineer may be forced to dismount at long distances from a suspected obstacle before conducting a reconnaissance. Engineer reconnaissance teams must carefully choose their dismount point. Dismount points should be covered and concealed locations out of direct-fire range of suspected enemy locations. Characteristics of dismount points are that they—

- Afford cover and concealment.
- Are easy to defend for a short period of time.
- Are away from natural traffic flow.
- Are easy to locate.
- Are within close proximity to the objective to ease command and control.
- Are out of sight, sound, and direct-fire range of the objective.

The engineer reconnaissance team should search for disturbed earth, unusual or out-of-place features, surface-laid mines, tilt rods, and trip wires during minefield and obstacle reconnaissance. Maneuver units and ground and aerial scouts may assist in detecting mines by using the thermal sights in their vehicles and aircraft. Reconnaissance elements should conduct confirmatory visual inspections at suspect areas to ensure that the true extent of the obstacle is known.

AREA SECURITY AND RECONNAISSANCE

Enemy forces will protect their obstacles through observation and fire. When scout and engineer reconnaissance teams encounter an obstacle, they must assume the enemy can observe and engage them with direct or indirect fires. The scout or engineer reconnaissance team that detects the obstacle establishes overwatch before it proceeds with the reconnaissance. The overwatching element must be alert for signs of enemy forces in and around the obstacle. The element visually searches the dominant terrain on the far side of the obstacle for evidence of enemy positions or ambushes. Once it confirms the enemy situation from the near side, the scouts and engineers (not in overwatch) move mounted or dismounted to find bypasses around the obstacle. The scouts and engineers then establish observation points (OPs) on the far side to provide 360-degree security of the obstacle. If the scouts and engineers are unable to find a bypass, they conduct their reconnaissance from the near side under the security of the overwatch elements.

When a large obstacle is located and cannot be easily bypassed, the alternative is to support a breaching operation. Scouts and engineers perform additional reconnaissance tasks in support of the breaching operation. These tasks include determining the assets and time needed to reduce the obstacle and the location of the best reduction sites. Scout and engineer reconnaissance efforts focus on the following:

- Trafficable routes to the reduction site and routes from the far side leading to the objective.
- Proposed locations for positioning the support force.
- Dispersed, covered, and concealed areas near the reduction site.
- The best locations for the reduction effort. It is imperative that the reduction plan is sent to the reconnaissance teams once the scheme of maneuver is finalized. Information, such as the number of lanes required and the distance between lanes, will be needed for the reconnaissance forces to conduct the necessary reconnaissance.
- Positions on both sides of the obstacle that could provide enemy observation of the reduction site.
- Trafficability and soil conditions near the reduction site. This is especially important for minefield reduction because mine clearing blades (MCBs) will not work properly in all soil conditions.
- Soil type, such as loam, rocky, or sandy.

- The wind direction (for using smoke to obscure the enemy's vision).
- The location of the forward edge of the minefield to support mine clearing line charge (MICLIC) and MCB use.

Chapter 18

Countermine Operations in an Urban Environment

URBAN TERRAIN

Combat in urban areas requires thorough knowledge of the terrain and detailed intelligence preparation of the battlefield (IPB). To succeed in urban areas, commanders and leaders must know the nature of both the terrain and the enemy they may face. They must analyze the effect that urban areas have on threat and friendly forces. Because of the trend of increasing urbanization in every region of the globe, the potential is growing for United States (US) forces to become embroiled in combat operations in urban settings. Combat operations in urban settings are known as military operations on urbanized terrain (MOUT). MOUT operations are conducted on a complex, three-dimensional battlefield. Characteristics of this area of operation include close and restricted terrain, severely limited fields of fire and maneuver space for mounted elements, and virtually unlimited cover and concealment for dismounted forces.

LESSONS LEARNED

Recent operations in places such as Somalia, Chechnya, and Israel have pointed out the unique requirements when operating in the urban environment. Built-up areas with narrow streets easily restrict the movement of our forces and require different techniques to respond to the vulnerabilities of MOUT.

Military maps, usually the basic tactical terrain analysis tool, do not provide sufficient detail for a terrain analysis in urban areas. Leader reconnaissance and aerial imagery become much more important in urban terrain. Subterranean features (sewer systems, subway systems, and underground water systems), elevated railways, mass transit routes, fuel and gas supply and storage facilities, electric power stations and emergency systems, and mass communications facilities (radio and telephone) are often not depicted on military maps.

Contact your terrain team to get the latest geospacial information, such as imagery taken from satellite systems, such as Quickbird™ or IKONOS™. The Digital Terrain Support System is also a good source for urban mapping.

AREAS OF CONSIDERATION

BUILDINGS

Buildings have many hiding places for mines, booby traps, and improvised explosive devices (IEDs). Before approaching a building, check the surrounding area for booby traps and mines.

- Always attempt to clear a building from the top, down to the ground or basement.
- Avoid stairways, and attempt to enter through ceilings.
- Avoid doorways and windows; they are easily booby-trapped.
- When access to a building or room cannot be accomplished through the roof or ceiling, use explosives to create a mouse hole in the wall. This technique offers a remote, safe method of creating an access point.
- Mark rooms as they are cleared. Ensure that these markings are understood by the breach team and follow-on forces.

ROOF TOPS

Rooftops are excellent locations for snipers and are often booby-trapped. The use of aerial reconnaissance is probably the best way to identify these targets.

STREETS

Streets are usually avenues of approach. Forces moving along a street are often canalized by buildings and have little space for off-road maneuver. Obstacles on urban streets are usually more effective than those on roads in open terrain, since obstacles in urban areas are more difficult to bypass.

AREAS LITTERED WITH RUBBLE

These areas are not only obstacles to mobility, but they can contain mines and booby traps. Forces may need bulldozers, combat engineers, or explosive breaching tools to overcome and reduce these obstacles.

SEWERS, SUBWAYS, AND TUNNELS

Subterranean passages provide covered and concealed routes of movement throughout urban areas. A detailed knowledge of the nature and location of underground facilities is of great importance to both the attacker and the defender.

Sewers are separated into sanitary, storm, or combined systems. Sanitary sewers carry waste and are normally too small for troop movement or protection. Storm sewers provide rainfall removal and are often large enough to permit troop and occasional vehicle movement and protection. Except for groundwater, these sewers are dry during periods of no precipitation. During rainstorms, sewers fill rapidly and may overflow, even if regularly drained by electric pumps. During winter, melting snow may preclude their use. Another hazard is poor ventilation and the resultant toxic fume build-up that occurs in sewer tunnels and subways. The conditions in sewers provide an excellent breeding ground for disease, which demands proper troop hygiene and immunization.

Subways tend to run under main roadways, and they have the potential hazard of having electrified rails and power leads. Passageways often extend outward from underground malls or storage areas, and catacombs are sometimes encountered in older sections of cities.

Consult city engineers, as-built maps, or qualified civil engineers to evaluate subterranean mobility areas and their utility to the enemy and US forces. Consider the following:

- It is likely that the enemy will want to use tunnels, and they may have the advantage of marked routes and detailed reconnaissance. They may possess the element of surprise and be able to select ambush positions and withdrawal routes.
- When moving through tunnels, great care must be taken to avoid booby traps. These are normally deployed near junctions and often operated by trip wires, passive infrared (IR) triggers, or pressure fuzes buried in the floor.
- Standing water in tunnels provides excellent camouflage for antipersonnel (AP) mines and booby traps scattered on likely routes.
- If moving without light, the lead man should be alert for wires using a trip wire feeler.
- Avoid walking in water.
- With the battle above continuing, the possibility of artillery barrages, and the use of demolitions, there is a strong possibility of flooding or a cave-in. Escape routes must be identified, rehearsed, and marked.
- To aid in the protection against small-arms fire and fragmentation, it is advisable to wear all

combat body armors available, because cover is limited inside tunnels.

- In the close confines of a tunnel, passive vision equipment, such as night vision goggles (NVGs) that require ambient light, are of little use. In order to quickly identify enemy personnel or other threats, an IR or white light should be used.
- Tag lines aid in navigation and movement when operating in confined spaces such as buildings, tunnel systems, and caverns where visibility is limited and the sense of direction can be lost.
- Communications inside tunnels will be severely degraded.
- Robotics are the preferred method of cave or tunnel clearance. See Chapter 14 for information on the Matilda, a remote-controlled system designed for cave and tunnel clearance.

EQUIPMENT NEEDED

Many different types of mines and booby traps could be encountered during urban combat. The equipment needed to clear confined spaces includes—

- Mine detectors.
- Probes.
- Grappling hooks/launched grappling hooks.
- Ropes.
- Thermal or IR sights.
- Bulk explosives and firing devices.
- Body armor set, individual, countermine (BASIC).
- Engineer tape or other marking devices, such as florescent spray paint.

- Eye protection.
- As-built facility/sewer drawings.
- Explosive ordnance disposal (EOD) support.

Chapter 19

Gators and Scatterable Mines

COMMAND AND CONTROL

Command and control of scatterable mines (SCATMINEs) is more complex than command and control of conventional mines due to the delivery means and the varying duration of the hazard. SCATMINEs are dynamic weapon systems that can be rapidly emplaced and then cleared upon expiration of predetermined self-destruct (SD) timers. The physical boundaries of a scatterable minefield are not clearly defined. These characteristics require impeccable communication and coordination between emplacing and adjacent units to ensure that all friendly units know where scatterable mines are located, when they will be effective, and when they will SD. Due to the vagaries of SD mechanisms at the conclusion of SD timers, areas where scatterable mines were emplaced must be proofed by using explosive or mechanical clearance tools.

The corps commander has emplacement authority for all scatterable minefields within the corps area of operation (AO). He may delegate this authority to lower echelons according to the guidelines contained in Table 19-1, page 19-2.

COORDINATION

The fire support coordinator (FSCOORD) is involved in planning artillery-delivered (area denial artillery munitions [ADAMs] and remote antiarmor mines [RAAMs]) SCATMINEs, and the air liaison officer (ALO) is involved in planning air-delivered (Gator and Volcano) SCATMINEs. The engineer has primary responsibility

Table 19-1. Emplacement Authority

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

for planning and coordinating the employment of SCATMINE systems. Coordination with all units and subunits that could be affected by the employment of SCATMINEs is vital. A scatterable minefield warning (SCATMINWARN) will be sent to all effected units before the emplacement of the minefield.

Basic responsibilities of key commands, staff elements, and units are outlined in Table19-2.

LIFE CYCLE

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

Table 19-2. Coordination Responsibilities

Element	Responsibilities
G3/S3 with Engineers, FSCOORD, and ALO	Plan/coordinate the minefield location, size, composition, density, SD time, safety zone, and emplacement time.
	Designate and brief the emplacing unit.
	Incorporate the minefield and the safety zone into the obstacle plan.
	Receive/forward the scatterable minefield report and record.
	Disseminate minefield information in the SCATMINWARN to adjacent and subordinate units before laying the minefield.
	Post operation maps with the minefield location, safety zone, DTG, and SD time. Disseminate the SCATMINWARN 1 hour before initiation of the SD sequence.
Emplacing Unit	Calculate the logistical requirements.
	Calculate the safety zone.
	Emplace the minefield.
	Report the amount of ammunition expended.
	Prepare/forward the scatterable minefield report and record to the authorizing commander through appropriate channels.
Maneuver Units	Be aware of the calculated safety zone boundary, and advise the subunits of its location.

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 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.

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 SD immediately.

After the self-test, mines remain active until their SD time expires or until they are encountered. Mines actually SD at 80 to 100 percent of their SD time (see Table 19-3). The time period from when the mines begin to SD and when they finish is called the SD window. No mines should remain active after the SD time has been reached. The probability of a live mine existing past its SD time is 1 in 10,000. 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 19-3. 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

MARKING

The maneuver unit that is responsible for the area of ground in which the SCATMINE 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 and emplacing unit. However, it is unrealistic to expect units to mark artillery-delivered ADAM and RAAM, air-delivered Volcano, and Gator minefields. For this reason, units operating in the vicinity of these minefields must know calculated safety zones and use extreme caution. Mark scatterable minefields and ground Volcano minefields according to the guidelines in Table 19-4.

Table 19-4. 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 coming to rest. The commander must guard against friendly forces from maneuvering into the safety zone during the minefield life cycle (see Table 19-5, page 19-6). The safety zone may be marked with an antifratricide fence, depending on its specific location on the battlefield.

FRAGMENT HAZARD ZONES

If an antitank (AT) mine that is oriented on its side SDs, the explosively formed penetrator (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 safety zone (see Table 19-5). This fragment hazard zone is also associated with the Gator and Modular Pack Mine System (MOPMS) AT mines. Commanders must be made aware of the fragment hazard zone when the MOPMS is used for protective minefield missions.

Table 19-5. Safety and Fragment Hazard Zones

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

FENCING

Emplace the fencing for ground Volcano minefields 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. Install the fencing before delivering an air Volcano. Locate the fencing 100 meters from the centerline of the minefield and 100 meters from the start and end points.

REPORTING AND RECORDING

The speed and responsiveness of SCATMINE employment require accurate, uniform, and timely reports. Simply and rapidly report all known information on scatterable minefields/munition fields to all affected units. Record SCATMINEs even though they have SD capability. Disseminate the information to prevent casualties to friendly forces.

Scatterable minefields cannot be recorded in detail since the locations of individual SCATMINEs are unknown. A safety zone is calculated from one or more aim points for most systems. For example, a RAAM minefield or munition field is recorded based on the target location (the grid coordinates given to the firing battery). The size of the minefield/munition field depends on the number of rounds fired, the number of aim points, and the angle of fire. An artillery-delivered minefield/munition field is recorded by plotting it on a map, based on the aim point and the safety zone specified in the scatterable minefield/munition field report and record that was prepared by the emplacing unit. A ground Volcano minefield/munition field can be recorded more accurately by plotting each of the minefield/munition field corner points rather than an aim point (see Table 19-6, page 19-8).

A simple, uniform procedure is used to facilitate reporting and recording of scatterable minefields/munition fields. This procedure combines the report and the record into one document that is applicable for all delivery systems.

Table 19-6. Scatterable Minefield/Munition Field Report and Record Work Sheet

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. **Example:** 2XXXD157. 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 of system that emplaced the minefield/munition field. **Example:** Flipper, artillery, or Volcano.
4	Type of mines	Enter "AP" for antipersonnel mines or "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 the minefield/munition field	If the system that is used to emplace the minefield/munition field uses a single aim point to deliver the mines, enter that aim point. **Example:** MB 10102935. If the system has distinct corner points (Volcano), enter those corner points. **Example:** MB 17954790, MB 18604860, MB 18504890, and MB 19054895.

Table 19-6. Scatterable Minefield/Munition Field Report and Record Work Sheet (Continued)

Line No.	Information Required	Data
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 the mines and the report number. **Example:** BCO 23 ENGR BN 4. Reports should be numbered consecutively. This example would be the fourth minefield/munition field that B Company has emplaced.
17	Person completing report	Enter the name of the person completing the report. **Example:** SFC Jones.
18	DTG or report	Enter the DTG of the report. **Example:** 160725ZOCT02.
19	Remarks	Include any other items the reporting unit may feel are important.

SCATTERABLE MINEFIELD WARNING

The scatterable minefield warning (SCATMINWARN) (see Table 19-7) notifies effected units that SCATMINEs will be emplaced. The SCATMINWARN report and the field report and record are the only reports used with scatterable mines.

Table 19-7. SCATMINWARN Report

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

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 in hard-copy format. Send the report before or immediately after the mines have been emplaced.

Chapter 20

Unmanned Aerial Vehicle Landing Strip Construction

CONSTRUCTION

Unmanned aerial vehicles (UAVs) were used extensively during Desert Storm. They required extensive engineer support for the construction of runways. A preliminary implied task if the unit was operating in a mined area was area clearance. When performing area clearance for a UAV, the soldier must keep in mind that the area will have to be level and compacted. The runways required for operation in Desert Storm were 1,800 by 60 feet. See Table 20-1 for some of the runway requirements for current UAVs.

Table 20-1. Runway Requirements for Current UAVs

UAV System	Runway Requirements
Outrider	300 feet of unprepared strips or ship decks; automatic landing system
Predator	2,500 feet
RQ-1A/B Predator	5,000 by 125 feet (1,524 by 38 meters) of hard-surface runway with a clear line of sight to each end of the runway from the GCS to the air vehicles

LESSONS LEARNED FROM DESERT STORM

The UAVs used in Desert Storm required an engineer company to build a runway at every launch site. An engineer company was required to be dedicated to the UAVs for constant support since they moved every second or third day and required a new runway at every site. The UAVs also required two sets of M-19 matting

(234 bundles per set)—one to emplace for use and one to jump forward to the next site. This was a very labor-intensive operation and required extensive haul assets in the form of 32 stake and platform trucks to haul the matting, which had to be acquired from the host nation. This support proved to be very unreliable.

Appendix A

Standardization Agreement Definitions

Booby trap. An explosive or nonexplosive device or another material deliberately placed to cause casualties when an apparently harmless object is disturbed or a normally safe act is performed.

Cluster bomb unit (CBU). An expendable aircraft store composed of a dispenser and submunitions.

Countermine. An operation to reduce or eliminate the effects of mines or minefields.

Demining. Activities to remove the hazard of all mines and other unexploded munitions.

Improvised explosive device (IED). A device placed or fabricated in an improvised manner (incorporating destructive, lethal, noxious, pyrotechnic, or incendiary chemicals) and designed to destroy, incapacitate, harass, or distract. It may incorporate military stores but is normally devised from nonmilitary components.

Mine clearance. The process of removing all mines from a route or an area.

Minefield breach. A defined passage leading through a minefield, which may not be completely free of obstacles or unexposed to the effects of mines.

Minefield marking. A standardized system to indicate the location and extent of a minefield.

Scatterable mine (SCATMINE). A mine laid without regard to classical pattern that is designed to be delivered by aircraft, artillery, missile, ground dispenser, or hand. Once laid, it normally has a limited laid life.

Appendix B

Mine Clearing Line Charge Firing Procedures

NOTE: The following instructions can also be found with illustrations at www.wood.army.mil/CELL/.

PRESSURE CHECK

Step 1. Ensure that the release valve handle is in the HOLD position.

Step 2. Insert the ball lock pins into the RAISE position in the launcher rail supports.

Step 3. Move the hydraulic control valve handle to the PRESSURE ACCUMULATE position.

Step 4. Pump the handle until resistance is felt.

Step 5. Engage the detents by pulling down on the levers.

Step 6. Check the pressure gauge indication. It should be 2,250 pounds per square inch (psi) or higher. If the ambient temperature is 80 degrees or higher, the proper operating pressure can be lower. (See Technical Manual [TM] 9-1375-215-13&P).

Step 7. Return the hydraulic control valve handle to the MANUAL RAISE/LOWER position.

Step 8. Manually pump the handle until the detents engage (first click) and the clinometer reaches about 40 degrees.

Step 9. Continue pumping the handle slowly until the launcher rail reaches a positive stop.

Step 10. Release the detents by pushing up on the levers.

Step 11. Move the release valve handle slightly toward RELEASE, and slowly lower the launcher rail to 0 degree.

Step 12. Move the release valve handle to the HOLD position.

Step 13. Move the hydraulic control valve handle to the PRESSURE ACCUMULATE position.

Step 14. Engage the detents by pulling down on the levers.

Step 15. Pump the handle until 3,200 psi (green area) is indicated on the pressure gauge.

Step 16. Move the hydraulic control valve handle to the REMOTE RAISE position.

Step 17. Ensure that the detents engage, the clinometer reads between 45 and 47 degrees, and the white position marks on the rail supports are visible from the front and rear of the launcher.

Step 18. Return the hydraulic control valve handle to the MANUAL RAISE/LOWER position.

Step 19. Release the detents by pushing up on the levers.

Step 20. Move the release valve handle slightly toward RELEASE, and slowly lower the launcher rail to 0 degree.

Step 21. Move the release valve handle to the HOLD position, and pull out the ball lock pins from the launcher rail supports.

Step 22. Insert the ball lock pins into the LOCK position.

Step 23. Place the detents in the DOWN position.

Step 24. Move the release handle to the RELEASE position.

LINEAR CHARGE LOADING AND PREPARATION

Step 1. Remove the packaged fuze from the center of the linear charge. Remove and retain the shunt from the utility kit.

Step 2. Remove the packaged chock cord assemblies from the center of the linear charge, and store the container.

Step 3. Remove the fuze from the package and inspect it in accordance with (IAW) TM 9-1375-215-13&P. If it is damaged, report the discrepancy and take appropriate action. Put the fuze box in the storage container on the launcher.

Step 4. Inspect the linear charge IAW TM 9-1375-215-13&P.

Step 5. Remove and retain the protective cap from the electrical receptacle. Place it in the storage container on the launcher.

Step 6. Fold back the layers of linear charge as necessary to access the arresting cable and linear charge fuze connectors. Pull the fuze connector cable 2 to 3 inches more out of the tub. Remove the charge electrical lead, and hang from the rear of the container.

Step 7. Loosen the hose clamp, pull back the sock, and ensure that all the electrical leads are secured to the arresting cable with masking tape only (remove any hose clamps securing the electrical leads) (Figure B-1, Page B-4).

Step 8. Place the arresting cable fuze connector on the linear charge. Check the hook-to-container connection. It should be routed from the outside to the inside of the box.

Step 9. Ensure proper fit of the fuze on the shaft of the linear charge. Remove it, and set it aside in a safe place.

Step 10. Ensure that the wires are not crossed or tangled under the sock of the arresting cable fuze connector.

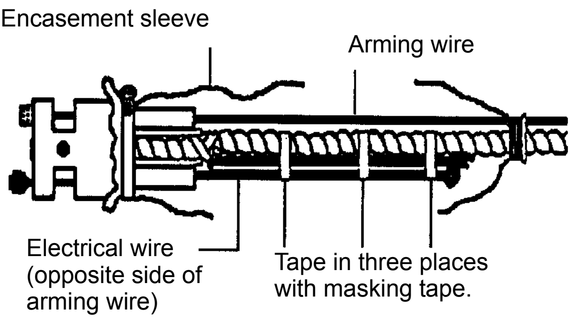


Figure B-1. Position of Arming Wire and Electrical Cable for Taping

Step 11. Remove the ball lock pin from the arresting cable fuze connector.

Step 12. Screw on and tighten the electrical connector to the fuze.

Step 13. Screw on and tighten the arming wire connector to the fuze.

Step 14. Slide the fuze into the arresting cable fuze connector, and connect it to the linear charge fuze connector shaft.

Step 15. Insert the ball lock pin until it seats.

Step 16. Test the connection by pulling the connectors in the opposite directions.

Step 17. Place the fuze into the holder, and repack the linear charge.

Step 18. Remove the protective nylon cover.

Step 19. Position the cover wear pad at the rear of the container.

Step 20. Attach the front and rear shock cords, leaving the flaps open. Do not attach the side shock cords until the protective cover is closed.

ROCKET LOADING AND CHECKING

Step 1. Release the detents by pushing up on the levers.

Step 2. Remove the ball lock pins.

Step 3. Lower the launcher rail to approximately 10 degrees, and then place the lever in the HOLD position.

Step 4. Engage the detents by pulling down on the levers.

Step 5. Insert the ball lock pins into the LOCK position.

Step 6. Open the shipping box, and remove the lid.

Step 7. Remove the bag from around the rocket.

Step 8. Using three soldiers, remove the rocket motor from the box.

Step 9. Ensure that the four nylon screws secure the front plate and that the ball lock pin is taped to the rocket motor.

Step 10. Rest the rocket on the linear charge, with the nozzle forward.

Step 11. Inspect the rocket IAW TM 9-1375-215-13&P.

Step 12. Using three soldiers, lift the rocket to the rail, with the rocket forward.

Step 13. Insert the rocket rear button lug into the launcher groove.

Step 14. Lift the forward hinged alignment pins, and slide the rocket onto the launcher rail.

Step 15. Insert the front button lug into the launcher rail groove.

Step 16. Lift the forward hinged alignment pins, and slide the rocket onto the launcher rail.

Step 17. Insert the front button lug into the launcher groove.

Step 18. Position a soldier to operate the rocket release mechanism.

Step 19. Pull back on the rocket release handle.

Step 20. Push the rocket rearward until it seats on the front and rear alignment pins.

Step 21. Release the rocket release handle.

Step 22. Pull the rocket forward (it should not move).

Step 23. Pull back on the rocket release handle, and hold it.

Step 24. Pull the rocket forward, clear of the alignment pins.

Step 25. Push the rocket back onto the alignment pins, and release the rocket release handle.

Step 26. Pull the rocket forward (it should not move). Repeat this check by raising the launcher rail and testing the cam working the rocket release handle.

Step 27. Turn the hand knobs into position.

Step 28. Hand-tighten all hand knobs to engage the rocket bands. The bolts should be at right angles to the rocket.

Step 29. Install zip ties to each hand knob.

Step 30. Release the detents, raise the launcher rail to 20 degrees, and reinstall the ball lock pins in the LOCK position.

Step 31. Insert the cable under the sheath, ensuring that 18 inches remain looped at the rear. (The cables should slide freely in the sheaths.) Tape the sheaths with masking tape.

Step 32. Place the bridle cables in an "S" pattern on top of the linear charge.

Step 33. Remove the bolt and nut from the harness connector.

Step 34. Insert the bolt through the harness connector and the rocket bridle loop.

Step 35. Using two wrenches, tighten the nut to the bolt.

Step 36. Reposition the bridle cables on the linear charge.

Step 37. Starting at the rear, close the hook-and-pile fasteners of the protective cover, covering the bridle cables so that they exit from the wear pad of the cover.

Step 38. Secure the side shock cord assemblies to the charge container.

Step 39. Remove the ball lock pins from the LOCK position.

Step 40. Tape two "half moon" packing foam pads together, and secure them to the rocket motor head, below the motor outlet valves.

Step 41. Slowly lower the rocket down onto the pad. Install the rail support assembly ball lock pins in the LOCK position.

Step 42. Move the accumulator control handle to the HOLD position.

CIRCUIT CHECKS MOD 0 AND MOD 1

Step 1. Remove the cable switch assembly, the 75-foot cable, the blasting machines, and the circuit tester.

Step 2. Connect the 75-foot cable to the cable switch assembly.

Step 3. Pull up the knob, run it through all positions, and return it to the OFF position.

Step 4. Test the test set.

Step 5. Test the blasting machines.

Step 6. Ensure that the launcher rail is raised to about 5 degrees.

Step 7. Tie off the 75-foot cable to the left rear of the launcher with a half-hitch knot.

Step 8. Run the cable through the pigtail holders on the left side of the launcher.

Step 9. Remove the protective cap from receptacle #1.

Step 10. Remove the safety switch lead from the safety switch assembly J1.

Step 11. Connect the safety switch lead to receptacle #1.

Step 12. Connect the 75-foot cable to the safety switch assembly J1. **NOTE: Turn off all radios within 100 feet.**

Step 13. Remove the protective cap from receptacle #2.

Step 14. Connect the linear charge lead to receptacle #2.

Step 15. Remove the protective cap from receptacle #3, and connect the shunt.

Step 16. Connect the branched cable to the test set.

Step 17. Ensure that the switch is in the OFF position.

Step 18. Operate the test set (it should not register).

Step 19. Move the switch to the POWER position.

Step 20. Operate the test set (it should not register).

Step 21. Move the switch to the ROCKET position.

Step 22. Operate the test set (it should not register).

Step 23. Move the switch to the CHARGE position.

Step 24. Operate the test set (it should not register).

Step 25. Manually raise the rocket rail to 47 degrees.

Step 26. Move the switch to the ROCKET position.

Step 27. Operate the test set (it should register).

Step 28. Move the switch to the CHARGE position.

Step 29. Operate the test set (it should register).

Step 30. Move the switch to the OFF position. If discrepancies exist, recheck all connections and repeat the above checks. If discrepancies still exist, disconnect the safety switch lead from receptacle #1, replace the protective cap, and contact unit maintenance.

Step 31. Slowly lower the rocket onto the pad, and return the release valve lever to the HOLD position.

Step 32. The primary operator keeps the blasting machine, and the test set is put away.

Step 33. Roll up the extra cable, and store it with the cable assembly switch.

Step 34. Remove and retain the shunt from receptacle #3, and replace the protective cap.

Step 35. Store the shunt. Secure the rocket with a ratchet strap.

CIRCUIT CHECKS MOD 2 AND MOD 3

Step 1. Remove the blasting machine and the test set from the storage container.

Step 2. Ensure that the trailer disconnect device is not installed and that the cables are installed (TM 9-1375-215-13&P).

Step 3. Test the test set.

Step 4. Test the blasting machine (an orange light should be visible between the connection posts when operated).

Step 5. Ensure that the launcher rail is at about 5 degrees.

Step 6. Connect the safety switch electrical lead to receptacle #1. Connect the branched cable connector W5P1 to safety switch connector J1. **NOTE: Turn off all radios within 100 feet.**

Step 7. Remove the protective cap from receptacle #2.

Step 8. Connect the linear charge lead to receptacle #2.

Step 9. Remove the protective cap from receptacle #3. Connect the shunt plug.

Step 10. Connect the branched cable to the test set.

Step 11. Ensure that the switch is in the TEST position.

Step 12. Operate the test set (it should register).

Step 13. Move the switch to the ROCKET position.

Step 14. Operate the test set (it should not register).

Step 15. Move the switch to the CHARGE position.

Step 16. Operate the test set (it should not register).

Step 17. Place the ball lock pins in the RAISE position, and engage the detents.

Step 18. Move the hydraulic control handle to the PRESSURE ACCUMULATE position.

Step 19. Pump the handle until 3,200 psi is achieved.

Step 20. Move the control box power switch to the ON position (the ON lamp should light). If it does not light, check the NATO connector and the RESET button. If it still does not light, check the bulb.

Step 21. Raise the launcher rail by activating the ON position and the RAISE ROCKET switches simultaneously.

Step 22. Move the switch to the ROCKET position.

Step 23. Operate the test set (it should register).

Step 24. Move the switch to the CHARGE position.

Step 25. Operate the test set (it should register).

Step 26. Move the switch to the TEST position. If discrepancies exist, recheck all connections and repeat the above checks. If discrepancies still exist, disconnect the safety switch lead from receptacle #1, replace the protective cap, and contact unit maintenance.

Step 27. Slowly lower the rocket onto the pad, and return the release valve lever to the HOLD position.

Step 28. The primary operator keeps the blasting machine, and the test set is put away.

Step 29. Roll up the extra cable, and store it with the cable assembly switch.

Step 30. Remove and retain the shunt from receptacle #3, and replace the protective cap.

Step 31. Store the shunt. Secure rocket with a ratchet strap.

MOVEMENT PREPARATION

Step 1. Ensure that the rocket head pin is not in the rocket, but taped to the rocket.

Step 2. Place a piece of foam from the rocket packaging between the rocket and the charge so that the weight of the rocket rests upon it.

Step 3. Secure the launcher rail down with a ratchet strap (not too tight) to prevent bouncing during movement.

Step 4. Secure the rocket cable to the top of the charge container with tape.

Step 5. Ensure that the safety switch cable is fully connected to receptacle #1.

Step 6. Ensure that the charge cable is fully connected to receptacle #2.

Step 7. Ensure that the firing cable is fully connected to the safety switch box.

Step 8. Ensure that the pressure accumulator gauge reads between 3,200 and 3,500 psi.

Step 9. Ensure that the ball lock pins are in the LOCK position on the launcher rails.

Step 10. Ensure that the detents are in the DOWN position.

Step 11. If using the M34 blasting machine, ensure that it is putting out 220 volts. If using the new battery-operated blasting machine, ensure that the battery is good.

ASSAULT POSITION PREPARATION

Step 1. Insert the pin in the head of the rocket (remove the tape if using the Smokey Sam).

Step 2. Remove the ratchet strap from over the launcher rail.

Step 3. Move the launcher rail pins from the LOCK position to the RAISE position.

Step 4. Connect the rocket firing cable to receptacle #3.

Step 5. Ensure that the pressure accumulator gauge reads between 3,200 and 3,500 psi.

FIRING PROCEDURES

Step 1. Ensure the proper standoff from the minefield (62 meters from the back of the launcher).

Step 2. Ensure that all vehicles within 200 meters are buttoned up and that there are no vehicles within 30 meters, except a plow or a roller tank.

Step 3. Connect the blasting machine.

Step 4. Raise the launcher rail.

Step 5. Ensure that the rail is at 47 degrees and locked in the UP position.

Step 6. Set the control box to the ROCKET position, and fire the rocket.

Step 7. Ensure that the charge is clear of your vehicle and the plow and/or roller tank.

Step 8. Set the control box to the CHARGE position, and fire the charge.

AMMUNITION INFORMATION NOTICE

NOTE: The following information should be passed to all personnel who are responsible for inspecting or using subject item and to supporting explosive ordnance disposal (EOD) units.

Malfunctions have occurred where an arresting cable snapped 20 feet from the container attachment point. Two of the probable causes that can be prevented by the user are as follows:

- **The fuze is not in the fuze holder.** Ensure that the connected fuze is placed into the fuze holder and that the linear charge is repacked into the proper position.
- **The cable is not inserted into the cable sheath on the launcher.** Ensure that the first 18 inches of the bridle cables under the cable sheath slide freely and that approximately 18 inches of the cable are looped out of the rear of the cable sheath. Ensure that the bridle cable loop is placed on top of the linear charge in an S-curve pattern from the rear to the front portion of the linear demolition charge container.

If either of the above procedures are not followed, the charge and the arresting cable experience excess stress from wild oscillations during firing and they may snap.

Prior to firing the M58 HE linear charge, inspect the electrical wires under the nylon sock at the arresting cable fuze connector. There have been reports of the electrical wires being secured to the arresting cable with a hose clamp. If this condition is discovered, the hose clamp should be removed and the wires taped away from the arming wire in three locations with masking tape (see Figure B-1, page B-4).

Appendix C

Metric Conversion Chart

Use *Table C-1* to convert from US to metric measurement and from metric to US measurement.

Table C-1. Metric Conversion Chart

US Units	Multiplied By	Equals Metric Units
Length		
Feet	0.30480	Meters
Inches	2.54000	Centimeters
Inches	0.02540	Meters
Inches	25.40010	Millimeters
Miles (statute)	1.60930	Kilometers
Miles (nautical)	1.85320	Kilometers
Yards	0.91400	Meters
Area		
Square inches	6.45160	Square centimeters
Square feet	0.09290	Square meters
Square yards	0.83610	Square meters
Volume		
Cubic inches	16.38720	Cubic centimeters
Cubic feet	0.02830	Cubic meters
Cubic yards	0.76460	Cubic meters
Gallons	3.78540	Liters
Fluid ounces	29.57300	Milliliters
Quarts	0.94600	Liters
Weight		
Ounces	28.34900	Grams
Pounds	453.59000	Grams
Pounds	0.45359	Kilograms

Table C-1. Metric Conversion Chart (Continued)

US Units	Multiplied By	Equals Metric Units
Short tons	0.90700	Metric tons
Long tons	1.01600	Metric tons
Metric Units	**Multiplied By**	**Equals US Units**
Centimeters	0.39370	Inches
Meters per second	2.23700	Miles per hour
Millimeters	0.03937	Inches
Kilometers	0.62137	Miles (statute)
Kilometers	0.53960	Miles (nautical)
Meters	3.28080	Feet
Meters	39.37000	Inches
Meters	1.09360	Yards
Area		
Square centimeters	0.15500	Square inches
Square meters	10.76400	Square feet
Square meters	1.19600	Square yards
Volume		
Cubic centimeters	0.06100	Cubic inches
Cubic meters	35.31440	Cubic feet
Cubic meters	1.30790	Cubic yards
Milliliters	0.03380	Fluid ounces
Liters	1.05700	Quarts
Liters	0.26420	Gallons
Weight		
Grams	0.03527	Ounces
Kilograms	2.20460	Pounds
Metric tons	1.10200	Short tons

Glossary

AA	assembly area
ABC	airway, breathing, and circulation
AC	hydrogen cyanide
AD	antidisturbance
ADAM	area denial artillery munition
adj	adjective
AFV	armored fighting vehicle
AIN	ammunition information notice
AISI	automated integrated survey instruments
ALO	air liaison officer
AO	area of operation
AP	antipersonnel
APERS	antipersonnel
APOBS	antipersonnel obstacle breaching system
AT	antitank
ATTN	attention
AVLB	armored vehicle-launched bridge
AVLM	armored vehicle-launched, mine clearing line charge
AWW	arming wire weave

BASIC	body armor set, individual, countermine
BII	basic-issue item
BIP	blow in place
bn	battalion
BT	booby trap
CA	civil affairs
CBU	cluster bomb unit
cdr	commander
CG	phosgene
chem	chemical
CL	combat lifesaver
CLAMS	Cleared Lane Marking System
cm	centimeter(s)
CMCBTC	countermine/counter booby trap center
CPR	cardiopulmonary resuscitation
CSS	combat service support
DC	District of Columbia
dd	day
DM	adamsite
DPICM	dual-purpose, improved, conventional munition
DS	direct support
DSN	defense switching network

DTG	date-time group
EFP	explosively formed penetrator
EMP	electromagnetic pulse
engr	engineer
EOD	explosive ordnance disposal
EU	electronic unit
F	Fahrenheit
F	Fahrenheit
FAE	fuel-air explosive
FD	firing device
FEBA	forward edge of the battle area
Flipper	The M138 Flipper is a manual dispenser capable of dispensing AT and AP SCATMINEs. It can be mounted on a variety of ground vehicles.
FM	field manual
frag	fragment
FSCOORD	fire support coordinator
G2	Assistant Chief of Staff, G2 (Intelligence)
G3	Assistant Chief of Staff, G3 (Operations and Plans)
Gator	An air-delivered scatterable mine.
GCS	ground control station
GD	soman

GPR	ground-penetrating radar
GPS	Global Positioning System
H	mustard
HE	high explosive
HEAT	high-explosive antitank
HEMMS	hand-emplaced minefield marking set
HEMMT	heavy expanded mobility tactical truck
HMMWV	high-mobility, multipurpose, wheeled vehicle
HMX	high-melting explosive
HQ	headquarters
HSTAMIDS	Handheld Standoff Mine Detection System
HVAP	high-velocity, armor-piercing
IAW	in accordance with
IBASIC	Improved Body Armor Set, Individual, Countermine
IDA	improved dog bone assembly
IED	improvised explosive device
illum	illumination
in	inch(es)
IPB	intelligence preparation of the battlefield
IR	infrared
IVMMD	interim, vehicle-mounted mine detector

kg	kilogram(s)
L	lewisite
LBE	load-bearing equipment
LGH	launched grappling hook
LIN	line item number
LOC	lines of communication
LRU	line-replaceable unit
LZ	landing zone
m	meter(s)
MANSCEN	Maneuver Support Center
MCAP	mine clearing/armor protection
MCB	mine clearing blade
MCS	Maneuver Computer System
MD	metal detector
MDD	mine detection dog
MDI	modernized demolition initiator
MDV	mine detection vehicle
MEDEVAC	medical evacuation
METT-T	mission, enemy, terrain, troops, and time available
METT-TC	mission, enemy, terrain, troops, time available, and civilian consideration
mfr	manufacturer
MICLIC	mine clearing line charge

mm	millimeter(s)
mm	month
MO	Missouri
MOPMS	Modular Pack Mine System
MOUT	military operations on urbanized terrain
MP	military police
mph	miles per hour
MPS	multiperiod sensing
MRV	mine-resistant vehicle
MSE	mobile subscriber equipment
MSR	main supply route
MTOE	mission table(s) of organization and equipment
MTT	mobile training team
N/A	not applicable
NATO	North Atlantic Treaty Organization
NFW	no further work
No.	number
NSN	national stock number
NTC	National Training Center
NVG	night vision goggles
OBSTINTEL	obstacle intelligence
OD	olive drab

OP	observation post
PASGT	personnel armored system, ground troops
PCC	precombat check
PCI	precombat inspection
PIR	priority intelligent requirements
PM JPO-UGV/S	Program Manager, Joint Program Office, Unmanned Ground Vehicles/ Systems
PMCS	preventive-maintenance checks and services
POC	point of contact
psi	pound(s) per square inch
PSYOP	psychological operations
PZ	pickup zone
RAAM	remote antiarmor mine
RDX	rapid-detonating explosive
RF	radio frequency
S&P	stake and platform
S2	Intelligence Officer (US Army)
S3	Operations and Training Officer (US Army)

SANDI	Stop and gain control of yourself and the patrol. Assess the situation of both the mines and patrol individuals. Note the situation for future reference. Draw back to the last known safe area. Inform higher headquarters of the situation.
SCATMINE	scatterable mine
SCATMINWARN	scatterable minefield warning
SD	self-destruct
Sep	September
SFC	sergeant first class
SIR	serious incident report
SITREP	situation report
SME	subject matter expert
SOCOM	Special Operations Command
SOF	special operation forces
SOP	standing operating procedure
SOSRA	suppression, obscuration, security, reduction, and assault
SRS	Standardized Robotic System
T/C	tank/track commander
TC	training circular
TF	task force

TM	technical manual
TNT	trinitrotoluene
TO	theater of operations
TTP	tactics, techniques, and procedures
UAV	unmanned aerial vehicle
UN	United Nations
US	United States
USAREUR	United States Army, Europe
USMC	United States Marine Corps
USSR	Union of Soviet Socialist Republics
UTM	universal transverse Mercator
UXO	unexploded ordnance
VC	Vietcong
VECP	value engineering change proposal
Volcano	A multiple delivery mine system.
VS	visual signal
WP	white phosphorus
WWII	World War II
yy	year

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