Mine Problems in Peacekeeping Operations 11

by
Gilles Courrègelongue
Chargé de Mission for International Relations, Conseil International et Développement, Défense Conseil International Group, Paris

INTRODUCTION

Landmines were first used during the American Civil War (Williamsburg Campaign 1862) but their use started only in 1918 to face a new weapon: the tank.

Antipersonnel use of mines was introduced later during World War II (WW II) to protect antitank mines from enemy deminers. Since then, antipersonnel mines have become the most common type of the 400 million laid since the beginning of WW II. A great quantity of these mines have been used in conflicts.

WHAT IS A MINE?

Official definition (from the Convention on Inhumane Weapons, 1980):

- Talking about mines, diplomats normally use the definition given in the Convention on Inhumane Weapons for the second Protocol (in Art. 2 § 1): a mine means any munition placed under, on or near the ground or other surface area and designed to be detonated or exploded by the presence, proximity or contact of a person or vehicle.

The above definition will be useful for future work on texts (for example to reexamine the Convention). However, another definition, found in a French Army manual, may be more useful in understanding from the field point of view the vast and complex problem of mine laying and clearing. The manual states that a mine is:

1. a firing device attached to
2. an explosive contained in
3. a casing

The Firing Device

The firing device is the most complex part of the mine. It is detonated or exploded by the presence of a person or vehicle. Thus, it transforms the involuntary action of the target into a deadly explosion. The firing device reacts:

Firing devices on antipersonnel (AP) mines are detonated through:

- pressure, trip wire: a person passing by; or
- release of pressure or traction: from tampering.

A tank or vehicle detonates a mine through:

- strong pressure: under its track;
- tilt rod, seismic, magnetic triggers: from a tank passing by; and
- electronic sensors: placed beside or on top of the mine.

The Explosive

The explosive is the killing device. In some rare cases it can be replaced by flare systems or even chemicals. The explosive must be adapted to its target both in quantity, from small charges to maim people to heavy charges designed to destroy a tank, and in quality, from simple charges to charges capable of piercing tank armor (hollow charges).

Almost all of the explosives in mines (TNT, B Composition, RDX, Tetryl, etc.) contain a high percentage of nitrogenous components.

The Casing

The casing is what we see around the mine. Its main purpose is to protect the explosives from the outside world. In some cases, explosives are formed into their own casing.

For the wide majority of mines, they are encased in a very light box originally in metal, but now are more often in plastic, bakelite, rubber or even made from crude wood or concrete. These casings do not affect the explosion, which will produce a simple (but still very dangerous) blast effect. Blast effect has only a short lethal range (around 1 m), and generally strikes a person in the lower part of the body or a tank on its tracks (a vehicle on its wheels).

To increase the killing capacity of antipersonnel mines, the casing can be reinforced to produce shrapnel by fragmentation from the initial blast effect. Fragmentation mines project deadly shrapnel out to a range of 40 m for stake and bounding mines, and even to 100 m with directed effect mines.

Unexploded Ordnance

Since a great quantity of fired ordnance fails to detonate, a battlefield can be covered by unexploded:

- air bombs,
- artillery and mortar shells,
- rockets and missiles, and
- rifle and hand grenades, etc.

Clearly all of these items possess explosives and casings. Unfortunately the characteristics of their firing devices may be unknown. In all cases, unexploded ordnance is highly dangerous to handle and step on.

The most serious problem is posed by cluster bomb submunitions. Cluster bomb munitions are used in great quantity, with one U.S. Air Force bomb carrying more than 4,000 bomblets. During the Gulf War, Allied forces scattered 24 million bomblets behind Iraqi lines. Cluster bomb munitions are not reliable; from 10 to 15 percent fail to detonate. Allied bomblets were responsible for many friendly troop casualties in the Gulf war.

The condition of abandoned ordnance stocks is generally unknown and can be easily booby trapped or used in booby traps. Thus, unexploded ordnance creates a problem very similar to mined areas and any ordnance found should be treated as a mine or booby trap.

How Mines Are Laid

Normally, mines are buried under 7.5 to 10 cm (3 to 4 inches) of sand or earth for camouflage reasons. However, some mines are laid on the ground because the earth would diminish their

killing power (fragmentation mines), and because camouflage is less important than speed (enemy attack).

Both burying and simple laying can be performed either by hand (normal case) or mechanically (engineer units of some regular armies). Even mechanical rninelaying can take too long, so automatic dispersal systems have been produced. They are not found in engineer units but in tactical air forces (air cluster bombs, helicopter containers, etc.) or artillery units (155 mm or larger shells and rockets).

Mining Concepts

Regular armies use mines to restrict the enemy's freedom of movement. The maiming of enemy soldiers is not as important as stopping their progress and delaying the attack long enough to strike the enemy with other much more deadly weapon systems: artillery and tactical air forces.

Regular armies do not expect heavy casualties to be created by mines. Normal firepower is much more efficient in killing large numbers of enemies. By their logic (see 1987 NATO STANAG for Standard Agreement), a mine field should not only be under the guard of friendly troops but also controlled by their firepower.

Since restriction of movement can be implemented by the enemy's simple observation that mines are present, this doctrine does not normally rely on surprise effect (i.e., a mine exploding under a soldier's legs). Under classical military discipline, minelaying by regular forces is supposed to respect safety regulations (STANAG describes the decision process and level, the organization of minefields, conventional markings and reports, etc.). To be sure to stop and control an enemy's movements without limiting their own freedom of maneuver and safety, many armies (like the French army) decide to fence in their mine fields on all sides.

Unfortunately, in many countries where peacekeeping and/or mine clearing operations are underway, mines have neither been laid according to military regulation nor to military logic. Irregulars do not possess enough firepower to strike their enemy with sufficient effect. For these groups the expected effect of mines is not to stop the enemy but to hurt him.

Terrorist use of mines should also be considered. This irrational use of such deadly weapons may have left mines:

- in unforeseen places: schools, hospitals, religious buildings, etc.;
- in unforeseen quantities: 18 mines to protect one doorstep; and
- in unforeseen ways: up to 5 AT mines buried one on top of the other.

Demining

Four different demining concepts are employed depending on the situation:

- Mine field breaching (strictly military),
- Route opening (military or civilian),
- Area mine clearance (military or civilian), and
- Proximity mine clearing (typically civilian, sometimes uncontrolled).

In addition to identifying the demining concept to be employed, a demining method must also be selected. Current demining methods include:

- manual detection,
- pyrotechnical and mechanical demining,
- and explosive sniffing dogs.

Manual Detection

Manual detection remains the most effective method. UN DPKO, providing mine clearance expertise for DHA, currently requires a 99.6 percent success rate of mine clearing. Today, such a result can only be achieved through manual work by human beings (and maybe through dog detection). All manual detection methods are dangerous because the mine clearers have to walk and expose themselves in infested areas.

Manual detection methods include:

- **Prodding (use of a nonmagnetic prod):** The mine clearers, protected only by special pants, work in a kneeling position regularly prodding

the ground almost underneath themselves. This is long and tiring work and the prodders have to be replaced every 20 minutes to avoid fatal lacks of concentration.

- **Metal detection by portable magnetometers:** This has been very effective when all the mines actually contain metallic components (as in 90 percent of today's mines). The number and size of metallic parts in mines has been reduced, so detectors have been improved to react to the smallest pieces. However, this has dangerously increased the rate of false alarms. In Afghanistan, up to a thousand harmless pieces of metal are found for one mine.
- Of course, metal detectors are unable to detect non-metallic-mines (10 percent of today's mines) and are dangerous in the presence of mines designed to detonate when receiving a signal from the metal detector.

Pyrotechnical and Mechanical Demining Without Previous Detection

Regular armies often possess rapid mine clearing systems; not all are usable outside of high intensity combat situations.

Pyrotechnical systems are surely the quickest mine clearing systems, but due to noise and collateral blast effects their use is difficult to imagine except for emergencies. They rely on a shock wave effect (sympathetic explosions) created by bangalore or pyrotechnic cords, or a gas pressure effect (gas explosion) from Fuel Air Explosives (FAE).

Mechanical systems can be classified in two categories:

- Those working on the ground itself and not on mines (i.e., displacing a 10 cm slice of earth) through ploughs and bulldozer blades.
- Those working on mines (making the mines react and explode), such as rolls and flails. Only rolls and flails can be used in peacetime, and flails have the advantage of working even in deep vegetation.

Use of Dogs

There are no casings that can completely prevent vapors of nitrogen-bearing compounds (characteristic of military explosives) from escaping. We believe that dogs are able to smell them; it has been shown that they work efficiently in airport security and other antiterrorist activities. The use of dogs has been apparently successful in Afghanistan, but under favorable conditions: uncovered air-dispersed butterfly mines laid down on dry terrain.

Like human prodders, demining dogs are not able to sustain their attention for more than 20 minutes. Also, they need much more time to recover (up to five hours in hardship zones). In such conditions, one British specialist with working dogs estimates their rate of demining at no more than 60 percent.

The South African Demining Company MECHEM has developed a new method to find a compromise between a dog's limits and capacities. One vehicle draws air through filters in order to enhance the concentration of a large number of air samples. These samples are marked with the sampling location provided by a GPS system. The samples are then put under the dog's nose and checked for a reaction. In this way, deminers can analyze in a few minutes what would normally take hours.

Destruction of Detected Mines

A mine is normally destroyed by explosives, usually demolition charges or explosive foams. When these are not available, fire can be used for mines with plastic casings. New destruction systems have been successfully used to destroy the mines without detonation. These systems include corrosive foams and laser beams.

Sometimes, destroying the mines in their original location is not feasible. Destruction is not suitable in populated areas and archaeological sites, such as the Angkor temple in Cambodia. In-place destruction presents many drawbacks, even in deserted mined areas. Problems that may occur include:

- When destroyed by explosives, there will be numerous projectiles from flying pieces of metal. This method could disturb future demining operations. Remember, portable magnetometers will give off a false alarm from the metal pieces.
- When detonating by shock wave, there will be possible damage or detonation of neighboring mines, making future operations hazardous.

Neutralization, transport, and then destruction in special sites is certainly the safest solution. Neutralization requires a good knowledge of the type of mines encountered; mines should be neutralized according to the manufacturer's process. It is estimated that about 360 models of mines are produced in the world. Knowledge on neutralizing the mines is available by consulting an explosives ordnance disposal (EOD) expert and/or a data base. Even if minelayers try to use different types of mines, the number of types available in one given area is necessarily limited.

THE IMPLICATIONS OF TODAY'S DEMINING EFFORTS

Current statistics:

- There are today over 110 million active mines laid on the planet.
- Every month, 800 people are killed by them.
- Many more are maimed and mutilated.
- Every year, two million new mines are laid.

Current demining efforts:

- The rate of demining is one hundred thousand mines per year.
- Every year, the number of mines increase by one million nine hundred thousand!

What this means:

- At this rate—if the human race stops laying new mines—it will take over 1,100 years to clean the Earth of mines and over 300 years to clean only existing roads, villages and houses.

The cost of demining today:

- Financial cost is high, neutralizing one mine (original mine cost is $3.00) costs $1,000.
- Human cost is much higher. For every 2,000 mines neutralized, one deminer is badly wounded. For every 5,000 mines neutralized, one deminer is killed.

The conclusion: **WE ARE LOSING THE WAR AGAINST MINES!**

WHAT CAN WE DO?

Positive changes to the world mine population can occur by:

- Developing mine awareness campaigns everywhere. These programs can be implemented by NGO or UN Humanitarian Agencies.
- Enforcing export control on mines (87 percent of neutralized mines were imported ones). In the last ten years, the biggest exporters have been China, Italy, and the USSR. A voluntary moratorium on mine exports has been accepted by the United States, European Union Countries, and Russia.
- Enforcing controls on mine usage through the Re-examination Conference of the 1980 Convention on Inhumane Weapons. On this occasion, Austria, Cambodia, Estonia, Ireland, Mexico and Sweden will propose a general ban on antipersonnel land mines. Belgium has already adopted such a law for its own armed forces.
- Developing viable rapid detection systems through the use of contemporary technology. Presently, the cost of mine clearing at $1,000 per mine leaves a wide margin for improvement through research and development (R&D). Meetings on mine clearing technology are occurring through the NATO Industrial Advisory Group (NIAG), European Union Common Research Center at Ispra (Italy), and the U.S. Congressional Office of Technology Assessment.

New Technologies for Demining

During the last 50 years, although mines have been subject to attention from engineers, mine clearing still relies on the same old principles: those that allowed Allied troops to land in Nor-

mandy (June 1944). The improvement of mine clearing technology requires looking at other industrial sectors to adapt new systems to the problem. Several potential technologies that could be applied against:

- Casing characteristics: infrared technology, penetrating radars, etc.
- Explosive characteristics: biological, chemical and nuclear detections.

This last field of research is surely the most attractive from a logical point of view. Explosives are the only mine components that will never be replaced. Unfortunately (or fortunately) infrared and penetrating radars are much more advanced than the other technologies.

How the system works is a problem for the scientists. Users will sort them between airborne systems and vehicle-transported systems.

Until now, no really effective system has been found, even through infrared and penetrating radars. The tests (generally on specially prepared test grounds) have revealed some common logical characteristics:

- It is easier to find big metallic anti-tank mines than little, plastic anti-personnel mines.
- It is easier to find mines when they are in groups (planted in line).
- It is easier to find mines when the ground is free from saline water.
- It is easier to find mines when they have just been laid.

In this field, the most successes have been won through infrared technology. Employing this technique relies on traces (anomalies) in the ground from burying activities. Dozens of years after minelaying, the infrared film may still detect the impressions. Disturbances in the ground notably affect heat circulation.

THE CORRECT USE OF TECHNOLOGY AND THE CORRECT USE OF HOPE

Positive results have been few but, nevertheless, carry more hope than the current situation. Scientists, military researchers and industrialists must be encouraged. They have good reasons to maintain hope.

Soon, even with the temporary technological inefficiencies in detecting individual mines, airborne technologies will at least be able to locate mine concentrations.

Technologies being tested are generally used alone; in such conditions the detectors are easily confused. In the field, they will certainly be used together with other devices in a multidisciplinary mine clearing system, including neutralization and destruction devices.