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Mine Spike: A Landmine Neutralisation Tool for Combat Scenarios

by Brett Lowery, *QinetiQ*

Introduction

Landmine clearance operations can be broadly categorised into two roles: military and humanitarian demining. Military operations often require a fast passage through minefields to maintain the tempo of advance. This is known as "breaching" and it involves either rapidly clearing mines from an intended route (for example by a mineplough) or marking the mines so they can be avoided. Other military scenarios may require the clearance of mines and UXO before setting up a military outpost. Once the main conflict and initial military clean-up has ended, humanitarian demining agencies move in to clear the area of mines and UXO, making the land suitable for habitation and economic use.

Once a mine (or other suspicious object) has been detected, the current mine clearance procedures adopted by many armies and demining organizations require that the mine is uncovered prior to neutralisation. The reason for this may be to gather intelligence (e.g., identifying mine types), to gain direct access to the mine casing, to reduce the subsequent pulling force or just to ensure that the actual object detected is a mine. Once the soil cover is removed, the neutralisation techniques employed include pulling the mine with an attached rope and then removing the mine's fuse. Direct attack using an in-contact explosive, small-shaped charge or pyrotechnic torch is also used.

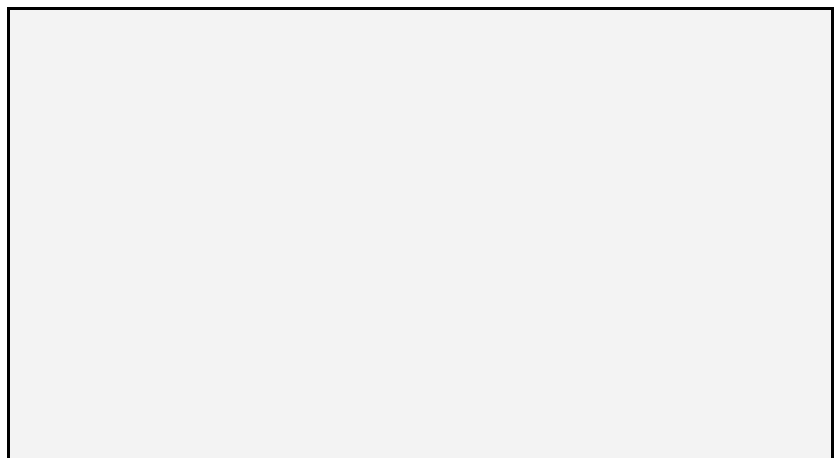
All options involving removal of the soil to expose mines involve risk to the deminer. Some situations might justify an element of risk, but what is really wanted is a technique that involves less risk. The other factor is time. Post-conflict and humanitarian operations are conducted relatively slowly, but combat scenarios require a fast method.

Mine Spike

An alternative solution to those mentioned above is to propel a barbed spike through the buried mine so that both can be pulled to the surface via an attached rope. Mine Spike is such a device that has been designed and developed by QinetiQ.

Mine Spike Concept

Mine Spike is best suited for attacking anti-tank (AT) mines that have a large



diameter to height ratio, such as mine types of Yugoslavian origin (TMM-1, TMA-3, TMA-4 and TMRP-6). The Mine Spike, in its current form, is not suited for neutralising small anti-personnel mines.

When the suspected target has been detected, Mine Spike is placed in a simple wooden frame above the buried target. The deminer then places the propelling charge (sheet of explosive) on the "thrust plate," inserts a standard detonator, attaches the command detonation wire and rope, and retreats to a safe location. The propelling charge is then initiated so that the barbed shaft with rope attached is driven into the ground/mine. The rope is then used to pull the mine to the surface from a safe standoff distance. The tension force in the rope can be quite large for deep buried mines, typically 250 kg, but is easily accommodated via a simple winch attached to a nearby tree or light vehicle. Once on the surface, the mine can be pulled to the side of the route or made safe by another neutralisation tool (e.g. attacked with a projectile, thermite or pyrotechnic torch).

Single and multi-spike variants have been developed. The multi-spike version provides a high probability of piercing mines while the single spike version is best suited for portable operations.

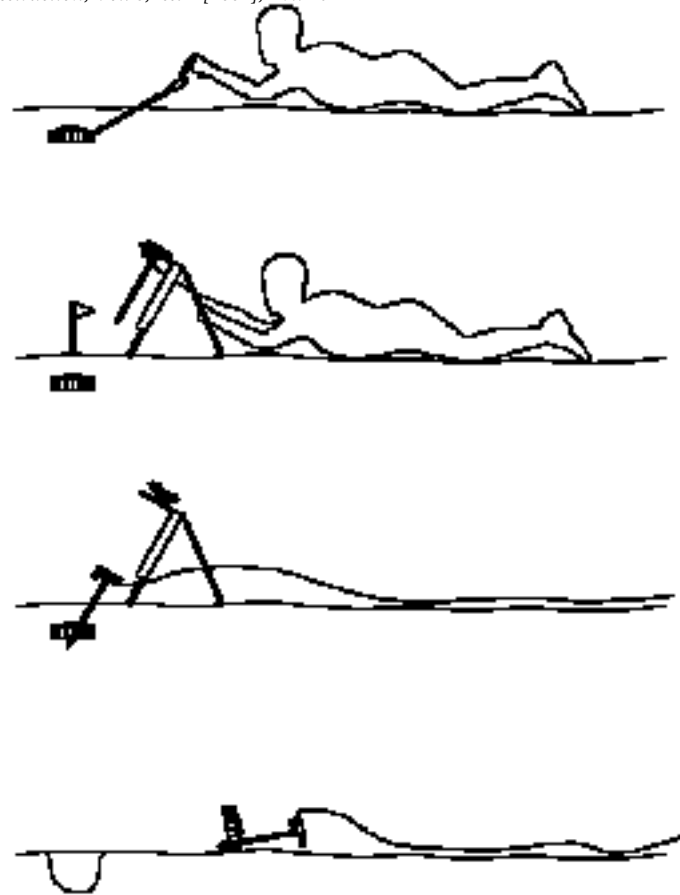
The following are Mine Spike's main advantages:

- Prior removal of the soil is not required.
- The standoff technique minimizes risk to the deminer.
- There is a higher probability of pulling the mine to the surface.
- It can be re-deployed if the target is missed on the first attempt.
- It increases the speed of clearance.

If positive target identification is essential before a neutralisation attempt, then a small portion of the soil cover can still be removed to gain visibility. However, this does not have to be the same extent required for securing the rope, etc.

Testing

Trials against surrogate mines filled with TNT, but with no fuses, showed that the shock impact velocity (~ 50 m/s) was too low to cause a reaction in the mine's explosive fill. This is important, as the main concern with the Mine Spike concept is that it might



The Mine Spike concept.



Typical Mine Spike setup.

initiate mines. Clearly, though, the likelihood of causing detonations can only be resolved by attacking a wide variety of live fused mines and analysing the results statistically. First generation mines tend to have large pressure pads and single impulse fuses. Second generation mines generally have smaller fuse pods and double impulse fusing as a countermeasure to prevent blast overpressure from explosive breaching devices. If the Mine Spike misses the fuse pods and only penetrates the mine's explosive fill, then there is a high probability that the mine will not detonate. Recent trials against live fused TMM-1 mines, which represent a severe test case (single impulse fuse with large pressure pad), caused 50 percent detonations. The other 50 percent were successfully retrieved to the surface.

The aim is to supply Mine Spike without its energetic components (sheet explosive and detonator) so that it is effectively an inert item, thereby alleviating the need for costly ordnance approval procedures and associated storage/transportation requirements. Sheet explosive and detonators should be readily available to military and humanitarian demining organisations.

Current developments include an active Mine Spike version that will induce a burn in the mine's highly explosive fill once it has been pulled to the surface. This could be tailored to cause a high probability of a slow burn, disruption, deflagration or detonation of the mine, depending on the countermine scenario. Other developments are working towards a lighter, non-magnetic influence design.



Conclusion

Currently there is no single neutralisation tool that will counter all mine and UXO types in a range of scenarios. Only field experience in mined areas will determine whether a given neutralisation technology has a significant role to play.

Mine Spike is a simple AT mine neutralisation tool that has been designed to counter the buried AT mine threat. Mine Spike has application where buried mines need to be pulled to the surface quickly, without significant prior disturbance of the soil cover—which may be an issue if booby traps are known to be deployed. It has been successfully used to pull buried, live fused TMM-1 mines to the surface in research trials, but in-field use and feedback from experienced deminers are required to determine if Mine Spike has a role to play in the demining community.

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