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Tripwires: An Invisible Component?

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NOTES FROM THE FIELD

Tripwires: An Invisible Component?

Most landmines are pressure-actuated, but a number of other initiation mechanisms are used. This article explains why tripwires are particularly significant, and examines their implications for clearance operations.

by Colin King [C King Associates, Ltd.]

Many consider a landmine to be a buried device triggered by the weight of its intended target, but this perception overlooks a crucial component of the mine threat. While it is true that the vast majority of the world's legacy mines are actuated by pressure, several other forms of initiation are also used, including tripwires, electrical command wires, magnetic influence and tilt-rod fuzes. Most of these methods are rare among the aging mines that threaten communities in contaminated regions; however, tripwire-operated mines are relatively common and have been used extensively.

Tripwire initiation was developed to exploit the range and lethality of fragmentation warheads and therefore has a disproportionate significance for clearance operations. With a blast mine, you have to be unlucky enough to step on it directly, whereas a tripwire can be encountered anywhere over an area of several meters. This fact massively increases the likelihood of an encounter with a single mine within a given area.

The consequences are also disproportionate. If an adult treads on an anti-personnel blast mine, the chances are that he or she will lose part of a limb, but will probably survive. In contrast, when a fragmentation mine detonates, not only is the person who triggered it likely to die, but anyone else within a radius of about 10 meters (33 feet) will most likely be seriously injured or killed as well. With some "bounding" (jumping) mines, the radius may exceed 30 meters (98 feet).

All of these characteristics make the identification and location of tripwires a key priority for clearance teams, with both military engineers and civilian deminers using similar procedures for "tripwire feeling."[1] Yet, little has been done to analyze the nature of the tripwire threat or how the threat changes with time.

Types of Tripwire and Mines

The vast majority of tripwire is made from soft iron or steel; it has no protective coating other than a thin layer of paint and is therefore vulnerable to rusting. In the hot, wet climates of Southeast Asia and sub-Saharan Africa, tripwire is unlikely to last more than a few seasons. One notable exception is the tripwire manufactured for former-Yugoslav mines, which is made from multi-strand stainless steel and is plastic coated; this material is likely to survive for many years.

The two mine categories most likely to employ tripwires are bounding fragmentation mines and stake mines, the latter being the more widespread. In order to avoid initiation by falling branches, small animals and other environmental influences, the actuation of a tripwire fuze typically requires several kilograms[2] of force. This fact is one of the reasons why metal wires are used instead of, for example, nylon filament, which has too much stretch to function reliably.

Implications for Clearance

In areas covered by dense undergrowth, the potential presence of tripwires means that great care is needed when cutting vegetation by

Examples of various types of tripwire. From the top left, clockwise: Former-Yugoslav, plastic-coated multi-strand stainless steel; British high-tensile steel; Italian painted soft iron; American painted soft iron.

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hand. This level of attention makes progress extremely slow, with programs in some regions estimating that they have spent around 80 percent of their operational time on manual vegetation clearance. Coupled with this issue is the knowledge that, even among well-equipped deminers, the detonation of a tripwire-actuated mine is almost certain to cause casualties; few items of conventional personal protective equipment will stop the high-velocity fragments from a stake or bounding mine.

This dual consequence to manual mine clearance makes accurate assessment of the tripwire threat crucial. It has also been an important consideration in the development of mechanized techniques for vegetation clearance, since these procedures virtually eliminate the possibility of tripwires remaining in a "processed" area.

Failure Mechanisms

With stake mines, the degradation of the tripwire is concurrent with rotting of the wooden stake; when the stake gives way, the mine body falls to the ground. At this point, if the wire—still intact and above ground—is tripped, there is a good chance the mine body will be dragged across the surface without initiating. This malfunction occurs because the mine is no longer anchored and the drag of the mine body will alter the direction of pull. Instead of the force being applied axially along the striker retaining pin, it becomes almost perpendicular, substantially increasing the effort required to extract the pin and cause initiation.

As time progresses, both the wire and the mine body tend to become incorporated into the ground (as dirt and successive generations of foliage cover them), then decompose into the soil; eventually, this process once again "anchors" the mine body. In wet environments, most tripwires will rust away before this point and the threat will be minimal. However, under certain circumstances (such as dry desert conditions and where the tripwire is impervious to water), the likelihood of accidental initiation may actually increase again as the mine becomes lodged into position.

Bounding mines have different degradation mechanisms and are prone to failure in the long term simply because the buried mine body is constantly exposed to water and silt. However, those that rely on tripwires are effectively "neutralized" once the tripwire has rusted away (although some have optional pressure-actuated fuzes).

A stake mine is less likely to be initiated once the wood has rotted and the body is resting on the surface. However, once the mine becomes fixed in the ground, it may become more dangerous.

Hot/Wet Climates

Vegetation tends to grow fastest in hot, wet climates, so these regions are often the ones of greatest concern for tripwires among dense undergrowth. However, the very conditions that encourage rapid plant growth also promote the rotting of wooden stakes and the rusting of tripwires. In other words, in most situations where

Tripwires may survive for some time in the dry desert of northern Chad.

undergrowth has covered a minefield over a period of several years, it is unlikely that rust-prone tripwires will survive.

In Cambodia, where no tripwires have been found for many years, the realization of the changing threat has allowed a substantial increase in productivity. Sensible precautions are taken, of course, but the change has enabled the adoption of procedures that would have been completely unacceptable in the presence of tripwires, such as using manually operated brush cutters.

Conclusion

A tripwire greatly increases the "catchment area" of a stake mine or bounding mine, while detonation of the fragmentation warhead tends to inflict multiple casualties at substantial ranges. The unacceptably high threat from tripwire actuation therefore imposes serious limitations on clearance operations. Conversely, the ability to eliminate that threat offers clear benefits in most programs, with the potential to substantially increase clearance rates and reduce costs.

In most matters relating to mine clearance, building an accurate threat assessment allows a more "surgical" approach to the task. The characteristics of tripwires—a subject somewhat neglected by the mine-action community—form an important component of the intelligence picture. Right now, in many clearance programs, that picture is incomplete; the price is wasted resources and severely reduced production.

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Colin King served 14 years in the British Army, mostly in explosive ordnance disposal, including operations in Bosnia, the Falklands, the Persian Gulf and Kosovo; he also led the first British team to train Afghan deminers. He worked as a British EOD school instructor and an EOD intelligence analyst before his final tour with the Gurkhas and starting his EOD consultancy. His recent work includes mine clearance on the Falkland Islands, studies into the effects of aging on mines and regional cluster-munition stockpile-destruction programs. King also writes two reference yearbooks, *Mines and Mine Clearance and Explosive Ordnance Disposal*, for Jane's Information Group.

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