Humanitarian
mineclearance in:

Afghanistan
Angola
Armenia
Burma/Myanmar
Cambodia
Colombia
Georgia
Ivory Coast
Kosovo
Laos
Mozambique
Nagorno Karabakh
Somaliland
Sri Lanka
West Bank
Zimbabwe
Central African Republic

GETTING MINES OUT OF THE GROUND, FOR GOOD.

Carronfoot
Thornhill
Dumfries DG3 5BF
United Kingdom

T: +44 (0)1848 331100

mail@halotrust.org
www.halotrust.org

Technical Challenges in Humanitarian Clearance of Anti-Vehicle Mines: A Field Perspective

Geneva, 9th April 2015

(Slide 1)

Mr Chairman,

The HALO Trust is a UK and US registered non-governmental organisation devoted to clearing the debris of war.

(Slide 2)

HALO has been conducting humanitarian clearance of landmines and other explosive ordnance around the world since 1988. We are experienced in finding and destroying all types of landmines, submunitions, and general ordnance from small arms ammunition to air-dropped bombs and guided missiles, including Man Portable Air Defence Systems (MANPADS).

(Slide 3)

However, clearance of minimum-metal anti-vehicle mines has presented one of our most difficult technical challenges. Further, anti-vehicle mines cause a very significant humanitarian impact on civilians. Our work is devoted to dealing with the aftermath of conflicts of the past and this briefing is intended to give you our views on the clearance of anti-vehicle mines.

Minimum-metal anti-vehicle mines have been located and destroyed by HALO operatives in a variety of terrains. Of course the nature of a country post-conflict is that life moves on. In some circumstances, communities will continue to grow in spite of the threat of mines, as you can see in the picture on the left, while other areas can remain featureless and unused, as in the picture on the right. As a humanitarian operator we are required to adapt our approach to clearance to cater to different circumstances.

(Slide 4)

Landmines are indiscriminate weapons and continue to cause accidents long after conflicts have officially ended. Anti-vehicle mines usually cause multiple casualties, often fatalities, when activated by civilian vehicles. Many mines that HALO clears have been in the ground for more than thirty years but it is apparent that the majority of anti-vehicle mines are not degrading over time and will remain functional for many decades to come.

As well as causing loss of life and limb, the indiscriminate use of anti-vehicle mines blocks access to agricultural land and closes road networks. Post-conflict, their use can impede the return of internally displaced persons and refugees, halt relief efforts and the distribution of international aid, particularly if there has been no good early survey and if the dissemination of information on the mines problem is weak. The pressure to traverse mined areas often forces civilians to take huge risks with their vehicles and families.

One peculiarity of the impact of anti-vehicle mines is that often their presence can go unnoticed for long periods of time. This is because foot traffic and bicycles can pass safely along anti-vehicle mined tracks or across anti-vehicle mined ground without exerting enough force to activate these mines. However, as communities develop and invest in vehicles, accidents can start to occur where previously no mines were suspected. This has happened in rural Cambodia over the last five years where increasing mechanization of agriculture has led to a spike in anti-vehicle mine accidents.

I would like to explain more about both the impact of anti-vehicle mines and the technical challenges of clearing them by referring to two particular case studies. But first let us consider the three broad categories of anti-vehicle minefields that we encounter.

(Slide 5)

The first are structured minefields with mines laid in belts, sometimes marked and mapped. These are generally straightforward to clear although it is usually true that the smaller the metal content of the mine, the higher the cost to clear. In this map of Cuito Cuanavale in south-eastern Angola, infamously the most mined town in Africa, we can see one of the multiple anti-vehicle minebelts. Each red dot indicates where an anti-vehicle mine has been found and destroyed by HALO. We will not be discussing this type of minefield in further detail today.

(Slide 6)

The second type are large open areas, sparsely mined to defeat or channel movement of vehicles. In many places this is useful agricultural land which cannot be farmed with tractors for fear of accidents. It is worth noting that cattle, which may graze on such land, can initiate certain types of anti-vehicle mines. Areas near to settlements which were mined to protect military positions may also be required for construction as populations grow.

This photo from western Afghanistan shows relatively featureless agricultural land which was lightly seeded with anti-vehicle mines spread over vast areas – perhaps one mine every 50,000 square metres. However even just a few mines can block access to huge areas when nobody knows their exact location.

(Slide 7)

The third type is roads and tracks with the occasional mine laid along them. Only a few mines may be planted along many kilometres of road but can render the whole road unusable. This type of mine-laying is often conducted by guerrilla forces wishing to harass enemy movements. A mined road can cut-off whole communities from the outside world and prevent the movement of aid and other traffic. This can have a devastating impact in the immediate post-conflict scenario. Even one mine every 10 kilometres is enough to close a road to civilian traffic.

(Slide 8)

Anti-vehicle mines can be put into two broad classes: metal-cased and minimum-metal.

Metal-cased anti-vehicle mines can be located and cleared relatively quickly using specially calibrated metal detector arrays. These detectors can be hand-carried or vehicle mounted. However, it is usually at least 10 times slower (and more expensive) to clear minimum-metal anti-vehicle mines. Some minimum-metal anti-vehicle mines are harder to detect than small anti-personnel mines. In cases where there is no metal detector available that can find the minimum-metal anti-vehicle mines to the required depth, clearance by full manual excavation can be 100 times slower. A useful alternative to full manual excavation is prodding which is significantly faster but is easily impeded by rocky ground. All of this means that the impact of minimum-metal anti-vehicle mines can be prolonged because clearance is slower or financially challenging to support.

To give you some idea of the humanitarian impact and technical challenges HALO has encountered, I would like to discuss two case studies. The first is an example of minelaying in an open space. The second is an example of minelaying along roads.

(Slide 9)

This is a map of Jebrail in western Afghanistan. Jebrail is located close to Herat city and anti-vehicle mines, both metal-cased and minimum-metal were laid to prevent movement of vehicles long before the area was built on. The land was later allocated to become a new suburb of the city to accommodate returning refugees.

The first attempt to clear the area involving a number of agencies, not HALO, and the use of Mine Detecting Dogs was not thorough enough to locate all of the anti-vehicle mines. Once construction of the new suburb was in flow it was discovered that not all of the anti-vehicle mines had been located and removed. A total of seventeen civilian anti-vehicle mine accidents occurred after the original 'clearance' killing sixteen people and injuring fifteen others. The photo on the right shows the aftermath of the last accident in November 2010 which killed two and injured one.

HALO was requested to re-clear the area and over nearly four years of work our teams located and destroyed another 11 anti-vehicle mines, both metal-cased and minimum-metal.

(Slide 10)

Jebrail was turning into a city suburb, and the population was already expanding very rapidly when HALO started work. This meant we were in the difficult position of having to conduct clearance operations while surrounded by schoolchildren walking to school, market traders plying their trade, piles of construction materials being deposited and moved, and vehicles of all types trafficking through the site. This required a broad combination of clearance methods – a variety of mechanical plant, metal detectors, dual-sensor detectors (metal detectors and GPR) and lots of simple manual excavation. In some areas the presence of overhead electrical power lines precluded the use of any kind of metal detector, while in others the presence of underground cables, piping and building foundations meant that intrusive mechanical methods could not be employed. Also, as there was no pause on the pace of construction, very detailed planning and prioritising of clearance was required in close coordination with home-owners and businesses.

This was a slow and costly operation. It would have been far simpler if clearance had been done correctly the first time, however some of the technology HALO used was not previously available to other operators. HALO holds itself to the very highest standards on quality of clearance both for the safety of our staff and for the people who follow behind us. Poor-quality clearance can be more dangerous than no clearance at all if it leads civilians to use land they falsely believe to be safe.

(Slide 11)

The second example is of anti-vehicle mines on roads in southern Angola. During the various stages of the conflict in Angola anti-vehicle mines were laid on roads and tracks to interrupt movement of vehicles, troops and supplies. This problem is spread across a large area of Angola but is particularly prevalent in the province of Kuando Kubango where there was very heavy fighting particularly up to the battle of Cuito Cuanavale in 1988. Both metal-cased and minimum-metal anti-vehicle mines were used.

The challenges of clearing minimum-metal anti-vehicle mines in particular has made progress on many of these roads very slow and you can see from the map that many are still suspect 13 years after the end of the civil war. Some of these roads are used by local people who take risks because of the need to travel for work, to access medical facilities, or to reach markets. Other roads have been unused by vehicles for decades and some communities are almost cut-off from the rest of the province with alternative routes being tens or hundreds of kilometres and requiring multiple days of travel. An example is Mavinga town, to the south-east of Cuito Cuanavale with a population of approximately 26,000 persons. Given the technical challenges of clearing these roads, it may be many more years before they can be opened again.

(Slide 12)

The particular challenge in this part of Angola is that most of the roads are just sandy tracks. Mechanical clearance methods work in these conditions but tend to destroy the little soil structure that does exist and the roots of plants that bind the soil together. This means that after mechanical clearance the road can be impassable to all but the largest trucks and off-road vehicles. To gain traction it has been known for some drivers to then pull off the track into the uncleared verges where there is still a potential risk of mines. Since there is no solid ground nearby it is not possible to rebuild the road with the resources available and it could be many years before the sand has stabilised again.

The picture at the right shows what happens when a vehicle strays off the cleared track. This accident was with a non-governmental organisation vehicle travelling on one of these roads in 2010, the driver was lucky to survive.

(Slide 13)

Standard metal detectors were often unable to find minimum-metal anti-vehicle mines to the required depths. HALO has therefore looked at alternative methods. We have been engaged with this problem for a decade and some notable progress has been made: where there are now metal detectors available that can find most minimum-metal anti-vehicle mines, there are also mechanical techniques that are cost-effective given the right conditions.

HALO has been a pioneer in the use of ground-penetrating radar in humanitarian mineclearance. Dual-sensor detectors which combine metal detectors with ground-penetrating radar have proved reliable and effective in improving clearance rates under the right conditions. However, when the mines are outside of metal detector range it becomes dramatically more difficult. HALO is trialling the use of handheld and vehicle-mounted ground-penetrating radar systems (see picture left) to search for minimum-metal anti-vehicle mines without having to rely on any metal signal. However, these systems are still at the prototype stage. We hope that one day ground-penetrating radar will prove to be a reliable standalone clearance tool, however the cost and complexity of deploying it may preclude its use in some situations.

HALO has also been a leader in the development of mechanical techniques for humanitarian mineclearance, and minimum-metal anti-vehicle mines in particular. The 'gill bucket' (see centre picture) is a simple addition to the bucket of a front-end loader and is easily constructed. It enables soil to be dug and sifted in one step. This method is very useful in areas with deeply buried mines, rocky ground or a lot of metal contamination which prevents the use of any kind of detector. However, this method is slow and expensive and requires moving around large quantities of soil.

On large open areas the Rotary-Mine Comb (see picture right) can be the most effective clearance tool. It uses a single-pass process, combing through the soil and lifting anti-vehicle mines to the surface by means of its two counter-rotating combs. The mine is moved gently without detonating it. Where it can be used it is usually faster and cheaper than any other method. Rotary-Mine Combs are used extensively by HALO for clearance of minimum-metal anti-vehicle mines in Afghanistan, including at Jebrail as we discussed earlier.

However full mechanical clearance requires disturbing all of the soil structure down to a certain depth. If the area is to be used for agriculture then this is not a problem, and may even be an advantage, however, on roads the destruction of the ground can render the road useless particularly on sandy ground, as explained earlier. In these conditions we prefer to use non-intrusive methods.

(Slide 14)

There are a variety of other techniques which have been proposed or are being trialled for minimum-metal anti-vehicle mine clearance. The first type is related to explosive trace detection (dogs, rats, bees and chemical sniffers). Although these are widely used it is HALO's belief that these methods can miss mines. The examples from Jebrail are just a few of the anti-vehicle accidents that have occurred on dog cleared ground in Afghanistan and elsewhere which HALO itself has fallen victim to. Many minimum-metal anti-vehicle mines are very solidly constructed and are not believed to leak any kind of explosive traces, especially in dry conditions.

Mechanical tillers and flails are often expensive to run and have a high chance of causing the anti-vehicle mine to detonate as they are designed to engage mines rather than locate them. While this may be acceptable in some places it would not be in a situation such as Jebrail. Tillers and flails also tend to spread soil and debris over a large area.

There are some more advanced detection methods that are being researched including seismic methods, and Nuclear Quadrupole Resonance: however none of these have progressed to field trials.

HALO is keeping a watching brief on all developments in this field but there is no sign of a single panacea on the horizon.

(Slide 15)

Despite the challenges that we face our work is continuing. Brave women and men of The HALO Trust, supported by our generous donors, work hard every day to clear the legacies of conflicts of the past. Anti-vehicle mines and particularly minimum-metal anti-vehicle mines, cause a very real impact on civilians and produce a significant technical challenge for clearance. We will continue working with the techniques we have deployed and press on with research and development to see how we can achieve appropriate clearance standards more quickly and more cheaply without loss to quality.

Despite improvements that have been made with clearance techniques there are still places where full clearance of the minimum-metal anti-vehicle mine threat is so slow and expensive that without further improvement there is no prospect of these areas being cleared in the near future.

(Slide 16)

Clearing minimum-metal anti-vehicle mines, especially those on sandy roads, is the biggest technical challenge that HALO currently faces. We need cost-effective solutions that live up to the quality standards that we and our beneficiaries require.

Our aim is to see land cleared and returned to productive use, thus both removing the threat of death and injury and allowing people to rebuild their livelihoods. We look forward to a day when all people can live free from the fear of landmines.

Thank you for your attention.

END