The HALO Trust (HALO) has been working in Ukraine since 2015, a year after the hostilities in the east of the country began. Both the ongoing conflict in the Donbas and tensions on the border with Russia have left large areas of land contaminated with landmines and other explosive remnants of war (ERW). In places where the frontline has moved on and the fighting has stopped, mines and other ERW remain, preventing the lives of civilians from returning to normal.

HALO currently has around 400 full-time staff employed in Ukraine and is conducting manual and mechanical clearance, non-technical and technical survey, risk education, and some capacity building with state authorities to enhance their capabilities to carry out humanitarian survey and data gathering. HALO’s program in Ukraine is currently funded by the United States, United Kingdom, Germany, Norway, the Netherlands, Belgium, and Finland, and has received funding in the past from Switzerland, the Czech Republic, and the European Union.

As in every part of the world, Ukraine has its own set of challenges that affect humanitarian mine clearance. The key challenges facing humanitarian mine clearance in Ukraine relate to the main threat types encountered: tripwire-initiated devices and both metal- and minimum-metal anti-vehicle mines. There are additional challenges relating to the specifics of the Ukrainian context: demining in an active conflict zone, working without explosives, and the extreme weather conditions. New techniques and technology, some tried and tested in other countries, are being explored. These are too numerous to list; however, we will discuss a few of the key ways HALO is overcoming some of the challenges of conducting humanitarian mine clearance in Ukraine.

Context
The two regions of Donetsk and Luhansk are currently in a de facto state of division between the territory controlled by the government.
of Ukraine and separatist non-government controlled areas (NGCA). The terms of the Minsk ceasefire agreement created a 15 km (9.3 mi) buffer zone on either side of the line of contact between the two opposing forces and forbade the stationing of heavy weaponry within the zone. Despite the agreement, shelling and crossfire between both sides occurs on an almost daily basis.

Land inside the buffer zone and on the line of contact is heavily contaminated with landmines and unexploded ordnance (UXO).

While the location of the line of contact now remains largely static, in 2014 and 2015 it was far more fluid with large areas of territory regularly changing hands during the fighting. This has resulted in widespread mine and UXO contamination, not just along the current line of contact but also within and outside of the buffer zone. Additionally, civilians continue to live in areas where neither side has full control, commonly referred to as the grey zone. Here the threat from landmines and UXO is also prevalent.
Ukraine is a Party to the Anti-Personnel Mine Ban Convention (APMBC) and in 2018 received approval of its request to extend its deadline to 1 June 2021 to clear its territory of all known anti-personnel minefields. However, the extension request stated that achieving these obligations was dependent on “…completion of hostilities, restoration of the constitutional order and gaining the full control over the occupied territories, including over the state border between Ukraine and the Russian Federation.”

Currently HALO is only able to work in areas controlled by the government of Ukraine and is working across both oblasts inside and outside the buffer zone. HALO is unable to work on the line of contact or the grey zone but teams are working to survey and clear areas close by where the threat of mines and UXO is affecting the civilian population. Therefore the challenges outlined only refer to the areas within eastern Ukraine where HALO works. They do not refer to the nature of the mine and ERW problem in areas of Ukraine where HALO is not working: the grey zone, the line of contact itself, and the NGCAs, which may differ in terms of threat type.

Ukraine-Specific Challenges

Operating in conflict-affected regions. While the intensity of the conflict in Ukraine has decreased since the heavy fighting of 2014, indirect fire and shooting close to the line of contact remains a reality. HALO does not work in areas where there is a threat of mines being relaid. However, the buffer zone contains the most areas with mine contamination, and this means there is a need to work in some areas that are only a few kilometers from the line of contact. Although civilians and NGOs are not deliberately targeted, working in such close proximity to the line of contact does present a risk to demining teams from stray indirect fire. Careful consideration of the security situation in those particular areas is required before demining teams deploy close to the line of contact. If shelling occurs nearby or there has been a major escalation close to the minefield, work is suspended and teams moved in order to guarantee the security of demining staff. HALO does not deploy teams in those areas where there is a high threat of indirect fire or close to active military positions; however, there are inevitably times when demining teams within the buffer zone have to suspend work and are moved as a safety precaution.

 Destruction of items. Humanitarian demining operators do not yet have access to explosives in Ukraine, nor permission to carry out render-safe procedures. This hinders the work but is not an insurmountable problem. Rather than conducting demolitions, the destruction or removal of ERW requires close coordination with the State Emergency Service (SES). When HALO finds a mine or item of UXO, the SES is contacted and their assistance is requested. Although this generally works well, the situation in Ukraine means that the explosive ordnance disposal (EOD) capacity of the SES is often over-stretched. In some cases the lead time between the discovery of an item and its removal can be a number of days. In cases where the device poses a particular danger such as where a tripwire-initiated device is discovered, deminers have to be moved a safe distance away to work elsewhere on the minefield. Where there is a significant delay in a device’s destruction or removal the clearance strategy of the minefield can be disrupted.

Challenges in the Minefields

Non-technical and technical survey. The nature of mine clearance is that the majority of the time the mines remaining in a contaminated area are buried or concealed. Therefore in order to avoid clearing land unnecessarily non-technical and technical survey methods are used. Where minelaying has been conducted in a uniform pattern, technical survey methods can be useful. Technical survey involves conducting limited clearance to find exactly where a mine-line is, enabling the follow-up clearance of the minefield to be more targeted and avoiding the need to clear areas far from the identified pattern.
The type of minelaying in Ukraine varies between professionally laid defensive belts placed in a clear uniform pattern, such as a line of evenly spaced anti-vehicle mines across a field, and sporadic minelaying. The latter being due either to low-level tactical considerations dictating the logic of where small numbers of mines have been placed or because of nuisance minelaying conducted by non-professional soldiers or combatants.

The prevalence of this sporadic minelaying can often severely limit the usefulness of technical survey. It is difficult to find a pattern when there was no pattern or where the logic of the minelaying was down to tactical rather than geographic considerations relevant at the time.

Even in the case of defensive minefields laid in a clear uniform pattern by professional military units, an operator’s ability to conduct technical survey can be limited if a large number of mines have already been removed by military forces or the local population. These minefields still require clearance because some mines may have been missed. However, by removing mines from an area, the original pattern becomes obscured and establishing where the mine-line was can be difficult. This can result in larger amounts of clearance needing to be conducted in order to find a relatively small amount of mines.

Aids to non-technical survey. In cases where minelaying is sporadic and the benefits of technical survey are limited, good quality non-technical survey becomes ever more important. Where it can be difficult to establish a pattern or logic to the minelaying through technical survey or the early stages of clearance, information from local communities and other informants can often help mitigate this. A good understanding of the tactical situation in a particular area at the time of the minelaying can often be far more effective than trying to rely on traditional technical survey methods. Moreover, there is an archive of high-quality satellite images of Ukraine available on Google Earth. Given that the minelaying is relatively recent, predominantly 2014-2015, these images sometimes reveal evidence of minelaying that is no longer visible on the ground. An example of this are the tracks from a military minelaying machine, as shown in Figure 3. Such imagery aids the accuracy of non-technical survey and can eventually lead to more efficient clearance.

Clearing tripwire-initiated devices and minimum-metal mines. The most common devices encountered by HALO in Ukraine are tripwire-initiated hand grenades, anti-personnel bounding-fragmentation mines (OZM-72s), both metal-cased and minimum-metal anti-vehicle mines (TM-62 and TM-62P), and directional fragmentation mines (generally the MON series of anti-group mines). There is also the threat of UXO, ranging from small-caliber cannon rounds to large-caliber mortar rounds. Furthermore, many minefields contain a combination of different threats. Open media sources document that anti-personnel blast mines such as PMN-2s and MS-3s, along with a range of improvised devices and booby-traps, have also been used in the conflict, but at the time of writing HALO has not found these types of items during its clearance operations in Ukraine.

The possibility of a wide variety of threat types, including tripwire-initiated devices, has to be considered when clearing an area. Of land currently surveyed by HALO and remaining to be cleared, 75 percent has a potential tripwire threat. The remaining 25 percent are anti-vehicle mine-only tasks, of which 12 percent are minimum-metal mines and 13 percent are metal-cased mines.

Minefields that involve the clearance of tripwires, or minimum-metal anti-vehicle mines, are slower to clear than land with metal
anti-vehicle mines only, without the threat from tripwire devices. Additionally, unlike many countries with a historic legacy of mine contamination, most of the tripwires in Ukraine are still intact, having only been laid within the last five years and being made of either metal or nylon. This means metal detectors cannot be relied upon alone as a means of searching for tripwires. As a result, a visual drill involving the use of a fiber rod to guide the eye followed by the incremental removal of vegetation is required. This is intrinsically slow when compared with clearance methods for other threat types (as shown in Figure 4).

In minefields where there is only a threat of metal anti-vehicle mines, deminers can conduct clearance by walking over the suspect ground with a large-loop metal detector with the sensitivity calibrated to the mine-type. Deminers then manually investigate metal signals. This process enables clearance rates of over 50,000 sq m (59,800 sq yd) per team per month. This process is slowed, however, when the threat of tripwire-initiated devices is also a possibility. In such instances the slower tripwire search must be conducted across the minefield before a large-loop detector can be used to look for the buried anti-vehicle mines. Therefore, what would ordinarily be a relatively fast method of clearance is slowed to an average rate of 5,000 sq m (5,980 sq yd) per team per month, by the presence or suspicion of tripwire-initiated devices.

The clearance of areas where the threat of minimum metal anti-vehicle mines is suspected also poses challenges and is often slow compared with searching for metal-cased mines. This is due to the need to use more sensitive detectors to locate the mines, which inevitably also results in more signals from small metallic clutter being picked up that have to be investigated through manual soil excavation to determine whether a threat exists. This problem is exacerbated by contamination from shelling thereby increasing the levels of metal clutter in the soil.

Moreover, Ukraine’s famously fertile chernozem soil is heavily mineralized, further limiting the range of suitable detectors. While the challenge of searching for minimum-metal mines is not unique to Ukraine, in places where this threat is combined with a need to search for tripwire-initiated devices, it results in a significantly more time-consuming process when compared with clearing other types of mines.

**New Detectors**

HALO is anticipating deploying a team with combined ground penetrating radar (GPR) and metal detectors in 2019. The GPR detectors should enable metallic clutter to be distinguished from anti-vehicle mines. By being able to better distinguish between clutter and the profile of an anti-vehicle mine, teams can rapidly excavate clutter, leaving the remaining signals to be excavated as per standard procedures. This should increase the efficiency of clearing anti-vehicle minefields where there are large amounts of metal fragmentation from shelling. Such detectors have had a significant
Enabling work to continue in such conditions relies on using creative methods and respecting the tough conditions the teams are working in. Ensuring teams are equipped with suitable clothing and boots and have the facilities and time required to warm up on the minefields is fundamental. In such conditions it is crucial to ensure deminers are able to maintain concentration to ensure safe and efficient work.

**Mechanical assets.** HALO Ukraine is building its mechanical capacity and currently the program has two front loaders and is looking into further mechanical options. The front loaders are currently being used to clear areas such as former military positions that are difficult and slow for manual teams. Having a mechanical capacity also enables some clearance teams to be deployed through the winter months.

2019 will see the trial and deployment of lightly armored remote vegetation cutters. The objective of these machines is to support manual teams by cutting the vegetation ahead of their progress on a task. It is expected this will improve the efficiency of the drill by speeding up one of the most time-consuming parts of the process: the careful investigation and removal of vegetation. Depending on the success of these machines, a lighter equivalent will be considered with the aspiration to deploy them onto minefields where there is a mixed threat of devices such as tripwires and anti-vehicle mines.

**Melting frozen ground.** During winter, fires are lit in safe areas within the minefields to heat up a saline solution and provide warmth during breaks. The saline solution is used to thaw frozen ground. When a metal signal has been identified and isolated, the hot liquid is then poured over the soil. The ground is then covered with cut vegetation, which acts as insulation trapping the warmth. This process enables the ground to thaw overnight and makes soil excavations possible the following day.

**Incremental Changes to Drills**

Seemingly small innovations can make drastic differences to clearance rates. An example of this is the **quadrat method**, using a 2-by-2 m (2.19-by-2.19 yd) boxing drill where lanes are cleared using the standard manual trip-wire search drill to create boxes over which a detector can be swept but without the need to use a fiber rod to slowly inspect the area inside the box. The size of the box and the fact it is surrounded by cleared ground negates the presence of tripwires that are not clearly visible and sweeping a detector over the top ensures there is no device without a tripwire on the surface. Innovations such as this have made the existing drill faster without compromising on safety.

**Challenges From Extreme Climate**

Over the course of a year in Ukraine the temperature can vary across 60 C, and these extremes pose additional challenges for mine clearance. In the summer, temperatures on minefields can reach 40 C (104 F), and over the course of the long winter the temperature can drop to -20 C (-4 F). In January and February, the months with the most extreme weather, only the mechanical clearance teams can work. Snow makes effective and safe tripwire clearance impossible, and the short days and freezing temperatures can often inhibit clearance on tripwire minefields for even longer from November to March.

The cold conditions also affect other aspects of clearance. Snow and frozen ground make excavations incredibly slow and grueling. Enabling work to continue in such conditions relies on using creative methods and respecting the tough conditions the teams are working in. Ensuring teams are equipped with suitable clothing and boots and have the facilities and time required to warm up on the minefields is fundamental. In such conditions it is crucial to ensure deminers are able to maintain concentration to ensure safe and efficient work.

![Image 6. A HALO Ukraine front loader conducting mechanical mine clearance in challenging winter conditions.](image-url)
Looking Ahead

Beyond security and access restrictions, the primary challenges of conducting humanitarian mine clearance in Ukraine are from tripwire-initiated devices and minimum-metal anti-vehicle mines. HALO Ukraine is developing both technical and human methods to overcome the challenges posed and to increase the efficiency of clearing land. This involves using techniques and technology used elsewhere in the world but also requires the trialing of new ideas and innovations. Similarly, the challenges of working within the context of Ukraine are, where possible, also mitigated and overcome through innovative means and where necessary through liaison with state bodies.

Ultimately the importance of optimizing clearance rates and increasing the efficiency of HALO’s work in Ukraine is to remove life-threatening hazards from ERW contaminated land. The more efficiently minefields can be cleared the faster land can be returned for use by landowners and the community. Restoring land to its original state helps the lives and livelihoods of those living in affected areas return to normal.

Although seeking new innovations is important, the majority of the work is ultimately done by Ukrainian men and women. High-quality training provides the skills required to clear the land. Oversight and guidance from experienced demining team leaders and supervisors in the field ensures that safety is maintained and the quality and thoroughness of HALO’s clearance remains to the highest standards. It is therefore the quality of HALO’s personnel that is the most important factor. Developing their skills and building their experience allows HALO to deliver its lifesaving work despite the challenges faced within Ukraine.

See endnotes page 69

Toby Robinson
Operations Manager
The HALO Trust

Toby Robinson is currently Operations Manager for HALO in Ukraine, responsible for overseeing the delivery of mine clearance operations by over 400 staff. He has previously worked for HALO in Cambodia, Nagorno-Karabakh, Somalia, and Zimbabwe and holds a bachelor’s degree in international relations and strategic studies.

Rosanna O’Keeffe
Field Officer
The HALO Trust

Rosanna O’Keeffe has worked as a field officer in Ukraine since August 2018. She is responsible for overseeing trials of new clearance methods as well as supporting the operations and clearance managers. Prior to Ukraine she spent time with HALO in Cambodia and Abkhazia. O’Keeffe has a bachelor’s degree in archaeology and anthropology from the University of Cambridge and a master’s degree in migration studies from the University of Oxford.