Land Release

and Explosive Submunitions

November 2010

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The Geneva International Centre for Humanitarian Demining (GICHD) strives for a world free of anti-personnel mines and from the threat of other landmines and explosive remnants of war, and where the suffering and concerns of populations living in affected areas are addressed. The Centre is active in research, provides operational assistance and supports the implementation of the Anti - Personnel Mine Ban Convention.

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SURVEY AND CLEARANCE OF UNEXPLODED SUBMUNITIONS VS. LANDMINES AND OTHER ERW

The aim of Land Release is to increase efficiency in Mine Action. It is about releasing land where no evidence of explosive hazards has been found through survey techniques in order to focus clearance assets on actual hazardous areas. Once the location of mines/ERW has been identified, clearance is a relatively straightforward activity, but actually locating mines/ERW and deciding where to start and stop clearance is the main challenge in regard to efficiency.

This publication aims at explaining ***how*** and ***why*** survey and clearance methods for areas contaminated by unexploded submunitions (from cluster munitions) are different to those for areas contaminated by mines and other ERW. A proposed Land Release methodology for dealing with unexploded submunitions is also described.

The following terminology has been applied in this publication:

Explosive Submunition means a conventional munition that in order to perform its task is dispersed or released by a cluster munition and is designed to function by detonating an explosive charge prior to, on, or after impact.

Unexploded Submunition means an explosive submunition that has been dispersed or released by, or otherwise separated from, a cluster munition and has failed to explode as intended.

Cluster Munition means a conventional munition that is designed to disperse or release explosive submunitions, each weighing less than 20 kilograms, and includes those explosive submunitions.

Convention on Cluster Munitions Article 2 Definitions

Traditionally, the systematic clearance of explosive hazards is grouped into two main categories:

- Mine Clearance; and
- Battle Area Clearance (BAC).
  This is a broad term used for the clearance of ERW.

When conducting Mine Clearance and BAC, a specific area is searched in a systematic manner with the aim of locating all hazardous items within the identified boundaries. While the land release principles are similar, the operational methodologies that are applied to each category are different.

BAC includes activities such as a surface search of an area, which is when people walk shoulder to shoulder across the land, visually inspecting the ground for evidence of a hazard. It can also involve using procedures similar to those used in mine clearance, such as sub-surface searching in marked lanes.

If both mines and ERW are present in the same area, the situation should first be treated as a mine hazard problem, and then the ERW hazard should be addressed.

Addressing areas contaminated by unexploded submunitions is a BAC activity, but the operational procedures used are in many ways similar to the clearance of mines. Therefore, to ensure the efficient release of land through survey and clearance, a separate operational approach is required.

CHARACTERISTICS OF CLUSTER MUNITIONS AND EXPLOSIVE SUBMUNITIONS

PATTERN

CLUSTER MUNITIONS/SUBMUNITIONS

Cluster munitions are distinct from other munitions in that when fired, launched or dropped, the explosive submunitions are dispersed or released and create a strike pattern or "footprint" on the ground. There will undoubtedly be unexploded submunitions within the area of this footprint due to the high failure rate of explosive submunitions (NB discussed further later in this document). Through identifying the shape of the footprint, the centre and outer edge of the strike can be better determined, which facilitates a more precise systematic search of the hazard area.

Difficulty in identifying a 'footprint' generally increases over time, as natural changes affect the environment. Multiple strikes in the same area, or other factors such as heavy vegetation or urban terrain, can also make identifying the extent of an individual footprint difficult.

An example Foot Print/Pattern of 155mm delivered explosive submunitions.
The impact marks in this photo show the extent of the footprint.

ERW

In general, ERW such as aircraft bombs, mortars and artillery shells, do not create a predictable pattern after being fired or delivered. Therefore they generally do not produce a regular pattern or 'footprint'.

MINES

Mines are often laid in rows and in set patterns and so methodologies can be developed to assist clearing patterned minefields. Even when mines are laid randomly and not in a set pattern (generally known as 'nuisance minefields') it may still be possible to identify and analyse the laying tactics that were employed. It can therefore be possible to determine areas that are likely to be mined and release areas that have no evidence of mines.

METAL CONTENT

Normally, explosive submunitions contain significantly more metal than regular anti-personnel (AP) mines or non-metal cased anti-vehicular (AV) mines. This allows the use of detectors/locators that are otherwise not suitable for mine clearance operations, such as magnetometers.

FAILURE RATE

Research indicates that explosive submunitions have a typical failure rate of between 5 and 20 per cent,[1] which is high compared to other types of ERW. This high failure rate is a result of several factors. The most dominant cause is linked to the arming process and fuze design.

There are a large number of explosive submunitions in each cluster munition (up to several hundred in each container). This, coupled with the high percentage that fail to detonate, can create a grouped pattern of unexploded submunitions.

RISK OF ACCIDENTAL FUNCTIONING

The fuzing of explosive submunitions varies depending on the make and model. Most types are designed to detonate on impact with the ground or the target. This is different to landmines, which are generally designed to be victim activated.

The risk of activating an unexploded submunition below the surface, by stepping on the ground above it is generally negligible and therefore the area can usually be accessed to conduct any survey activity. Unexploded submunitions should not be compared anti-personnel landmines, which in most cases are designed to detonate when a person steps on it.

Because of the characteristics outlined above (pattern, metal content, failure rate, and risk of accidental functioning), the land release methodology for submunitions can, and should be, distinct from mine clearance and clearance of other ERW.

It should be emphasised that accessing areas contaminated by unexploded submunitions to conduct a survey activity is a procedure used by trained technicians who are capable of conducting a proper risk assessment before entering a contaminated area. It should not be confused with the risk that unexploded submunitions pose to a local population.

[1] Human Rights Watch Report 2008 *Flooding South Lebanon: Israel's Use of Cluster Munitions in Lebanon in July and August 2006, Volume 20 No. 2(E)*

Summary table: Different characteristics of Mines, ERW and Submunitions

	Pattern	Metal Content	Failure Rate	Risk of accidental activation (accessibility during survey)
MINES	Laid in a pattern or placed for tactical reasons.	Low/Medium/High	Not applicable	Victim activated No access to the area during survey
SUBMUNITIONS	Create a pattern or footprint as a result of the launching system	High	5 – 20 %	Designed to detonate on impact. Access to the area during survey in most cases
ERW	Generally no Pattern	High	Pending type of ERW but in general lower than for submunitions	Generally designed to detonate on impact Access to the area during survey

LAND RELEASE METHODOLOGY

Submunitions create a footprint and a certain pattern on the ground when they have been dispersed, released, or otherwise separated from the cluster munition. Because of the high failure rate, the discovery of one unexploded submuniton may act as evidence of the presence of more unexploded submunitions in the same area.

This is also the case even if the conflict occurred several years earlier. Even if a large number of the unexploded submunitions have been moved and/or destroyed, it is still likely that one unexploded submunition is indicative of others in the immediate surroundings. In the case of overlapping strikes, it is still necessary to find out where the footprints end. It is therefore important to have clear and agreed working procedures on how to plan and conduct survey and clearance.

Similar drills and equipment are used during clearance of submunitions and mines in some situations, e.g. a systematic search below ground using detectors. Because of the cost and logistical challenges involved when purchasing new equipment, an organisation may not have a choice other than to use detectors designed to detect minimum metal mines, and procedures developed for mine clearance.

However, when taking into consideration the type of hazard however (medium/high metal content), and the fact that submunitions are not designed to detonate by the application of pressure (e.g. when stepped on), using mine clearance procedures and equipment is highly inefficient and should be avoided whenever possible.

The survey and clearance of submunitions can generally be conducted using more rapid and more effective procedures than for mine clearance. For example:

- **Quicker Search Procedures**
  High metal content of the target and not pressure/victim activated.
  In most cases it is considered safe to conduct a surface-search by walking the suspected area and cutting of vegetation (if needed) to allow a more thorough search of the ground.

- **Quicker Marking**
  Depending on what working procedures are being used, a less comprehensive marking system may be justified.

- **Quicker Site Setup/Take Down**
  As a result of the less comprehensive marking system, the site setup and take down will be less time consuming.

Even though a land release methodology for unexploded submunitions may not be as straightforward as for a patterned minefield, similar land release principles should be applied. It is also acknowledged that sometimes an area must be subject to full clearance because of heavy contamination, intended land use, or other factors.

EVIDENCE BASED APPROACH

An “Evidence-based Approach” is one proposed methodology for the survey and clearance of unexploded submunitions. e.g:

- Evidence of a strike is confirmed by either physical evidence or a strong claim (by an informant) of the presence of cluster munition remnants;

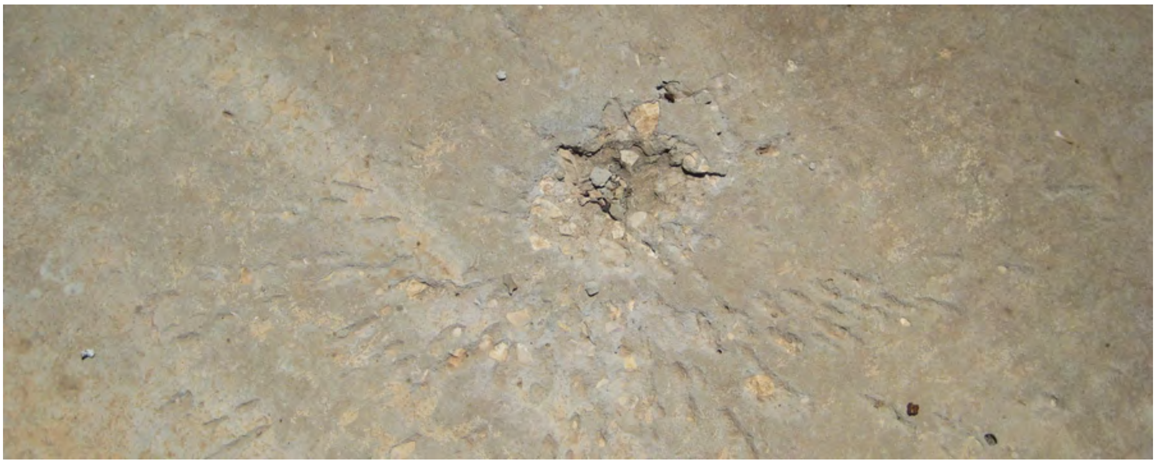
- An evidence point[2] is then created, and from this point further survey/clearance commences.

Criteria for the required level of evidence needed to create an ‘evidence point' should be developed and agreed by the National Authority and operators.

Example criteria for the creation of an ‘Evidence Point’:

- Unexploded submunitions
- Fragmentation of submunitions
- Parts of the delivery systems
- Strike marks
- Fragmentation marks
- Burned Areas
- A strong claim by an informant stating that unexploded submunitions have been located in the area. In most cases, the informant should be able to take the non-technical survey team to the location so that they can search for physical evidence to support the claim.

[2] This ‘point’ can be termed as required. ‘Evidence point’ will be used through-out this document.



Strike mark DPICM
(Dual-Purpose Improved DPICM M-77 Conventional Munitions) M-77

Some countries create suspect hazardous areas with boundaries that have been defined by the affected community. As these areas tend to be defined by people with no mine/ERW experience, they can be considerably larger than they should be in reality. This can often result in wasted time, and assets working in areas that are not actually contaminated and where there has been no real evidence of contamination, instead of in actual hazardous areas which have been confirmed by evidence. For effective use of resources, estimated areas may be attributed to each ‘evidence point’. However, this ‘area’ should not be seen as an actual hazardous area, nor the boundaries seen as the extent of any contamination.

Having said this, the community should be closely involved in the process of identifying ‘evidence points’. However, the extent of the survey/clearance should be determined mainly by the trail of evidence, as the technical survey (e.g. fade-out process) is conducted.

The only exception to this is when a confirmed hazardous area can be clearly defined at the non-technical survey stage, i.e. when there is enough evidence to accurately define the boundaries.

It should be noted that in some cases a hazardous area may need to be created at the non-technical survey stage due to land use or other community/development requirements. This should not be the default course of action.

Well-defined criteria will ensure that only land qualifying for further technical survey/clearance will be recorded and tasked for further activity. As stated previously, the local population should be involved in the process, but the final decision should be evidence-based and made by technically-qualified staff, following defined criteria.

INITIAL RESPONSE

In the initial post-conflict phase, the rapid removal and destruction of surface-located unexploded submunitions is necessary in order to remove the immediate threat to the people. During this process there is often not enough time to gather and record all available information. However, it is very important that a minimum record is kept and entered into a database, such as the GPS location of each individual item, the type of munitions and the number of items destroyed. This will facilitate the analysis of the data at a later stage. Also, sufficient and accurate recording of the location of each item enables the footprint of the strike to be identified later, and technical survey/clearance assets to be deployed in contaminated areas.

Mine action programmes often have Roving EOD or Rapid Response teams that carry out spot tasks on an as-needed basis. As with the above example, it is very important that a detailed record is kept for all tasks to be incorporated into the later planning and tasking of technical survey/clearance teams.

NON-TECHNICAL SURVEY

Before conducting a non-technical survey, a desk assessment should take place where old survey records, EOD spot task records, and bombing data (if available) is analysed. Then, the non-technical survey teams deploy to the field in order to investigate any previously recorded suspect hazardous areas/'evidence points' and to identify new ones.

If credible evidence is not found that corresponds with the correct level outlined in national standards and SOP's the survey team should not record an 'evidence point' or a hazardous area. This is essential for an 'evidence-based' methodology to be valid. It also avoids inflating the problem by populating the database with hazardous areas based on vague information or weak claims.

Conversely, if sound evidence is available and it is possible for the non-technical survey team to clearly identify evidence of cluster munition remnants, an 'evidence point' should be recorded. If there is enough clear evidence to determine which specific area is contaminated, then the survey team should document the boundaries of the contamination. This can provide better planning information for further technical survey and clearance. However, this should **only** be done if the boundaries of the area of contamination can be clearly identified.

TECHNICAL SURVEY AND CLEARANCE

Once a survey has been conducted by a non-technical survey team, a hazardous area or an area identified by an 'evidence point' is then subject to technical survey and/or clearance. The two activities are generally conducted concurrently even though some organisations have specialised technical survey and clearance teams.

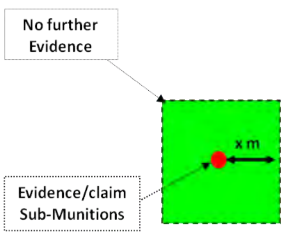
With an 'evidence-based' approach, the task is carried out in the same manner whether the area only requires a surface search, or if items are assessed to be below the surface. The team commences the technical survey/clearance at the location of the 'evidence point', and then work their way outwards, to the agreed 'fade-out' point (see below for explanation of fade out).

FADE-OUT

A ‘fade-out’ is the agreed distance from a specific ‘evidence point’ that the technical survey/clearance is carried out. The ‘fade-out’ distance is determined by the conditions specific to the area (e.g. geographical conditions, hazard type, delivery methods, etc) and should be based on operational experience and described in National Standards and Standard Operating Procedures.

If no other unexploded submunitions have been found once the fade-out distance has been applied and searched, then it is reasonable to determine that there are no further unexploded submunitions remaining from that strike/footprint. To give an example, if the fade-out is 50 m, the ground will be processed a distance of 50m in all directions from where the ‘evidence point’ is located. If no further evidence is found, survey/clearance will stop. A total of 10,000 m² will have been technically surveyed/cleared.

However the fade-out distance applied to surface and sub-surface searches may differ, depending on the operational experience of a specific country or region.



1) **Identify evidence of Sub-Munitions**
-Unexploded bomblet
-Fragmentation
-Strike mark
-Strong claim

1) **Start clearance at the location of the evidence.**

2) **Clear x metres in all directions according to the agreed distance for FADEOUT from the evidence. (ex. 50 m).**

3) **If no further evidence is found stop clearance.**

4) **If no further evidence has been found/reported in the area the CHA is released.**

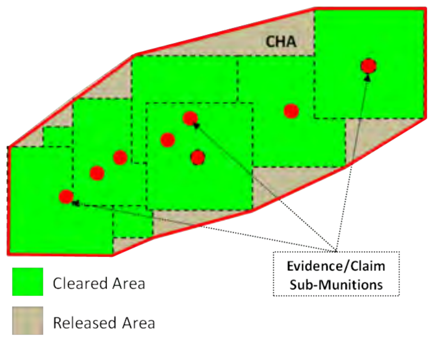


Fig. A

Fig. B

Fig A: One piece of evidence was found in an area. Clearance starts at the location of the evidence (red dot). If no further evidence is encountered within the fade-out (x metres in all directions from the evidence operationally conducted as a box search), no additional survey/clearance is required.

Fig B: Three separate locations with evidence were identified during the initial non-technical survey survey. The survey team identified a hazardous area polygon based on the evidence. During the survey/clearance operation, all evidence was dealt with individually. When applying the fade-out, and if additional evidence is found, the survey/clearance is extended. If no further evidence is found, the remaining area is released.

SURFACE AND SUB-SURFACE

Depending on the ground conditions (hard/soft, dense/sparse vegetation) and the speed, direction and angle of impact, unexploded submunitions can be either on top of or below the ground, or both, in the same strike area. A surface search is aimed at locating items on top of the surface. A sub-surface search aims at locating **both** surface and sub-surface items to an agreed depth.

SURFACE (locating items on the surface)

Visual Search
Locating items on the surface using visual search

Instrumented Aided Visual Search
Locating items on the surface using visual search and a detector

SUB-SURFACE (locating items on **and** below the surface)

SURFACE SEARCH – LOCATING ITEMS ON THE SURFACE

Visual Search

Explosive submunitions are designed to detonate on impact, above the ground, or on a time delay, and are not victim-activated. After a risk assessment, it may be considered safe to conduct a visual search by walking through the area. This will enable the quick removal of any immediate threats and for information to be gathered in order to establish the footprint. Then, sub-surface clearance based on ground conditions and the intended future use of the land may be carried out.

In some cases there may be a need for sub-surface clearance without a prior visual search, due to the risk assessment (e.g. sensitive unexploded submunitions and soft ground).

Surface Search - Visual

Instrument-aided Visual Search

During an instrument-aided visual search, the searcher uses a detector to assist the eye. This approach is recommended in areas with vegetation and/or when the unexploded submunitions have been on the ground for a long period of time and have become difficult to see.

Detectors not only assist when searching under vegetation and scrap, but also increase the safety of searchers when cutting back vegetation. The use of the detector considerably reduces the risk of accidentally cutting into an unexploded submunition, and subsequently detonating it.

If a signal is detected during a surface search, the searcher will carefully investigate the area. If no unexploded submunitions are found on the surface, the searcher will ignore the signal (as it must be indicating something below surface level) and continue the surface search. These signals may be marked for later follow-up. They should not however be excavated at this stage, as the purpose of the surface search is to find out the extent of the strike/footprint. Depending on the ground conditions (i.e. the likelihood on finding items below surface), and operational assessment, the clearance may be conducted through visual search only and then the area released.

SUB-SURFACE SEARCH

The procedures used for locating unexploded submunitions below the surface are similar to those used in mine clearance. First, a comprehensive marking system is set out to separate searched and unsearched areas and the clearance operators are deployed into lanes. As unexploded submunitions contain considerably more metal content than most AP mines, detection is easier if the correct detector equipment is used as procedures can be carried out at a significantly higher speed.

Reduced Clearance Depth

Depending on the ground conditions in an area (soft/hard etc), it may, after a thorough assessment, be suitable to make adjustments to the standard clearance depth. If the ground is hard, and operational experience/trials indicate that unexploded submunitions do not normally penetrate very deeply, then the overall clearance depth for that specific site may be reduced.

The test item for calibrating the detectors will be placed in accordance with the new clearance depth, and the detectors will be recalibrated, which means sensitivity will be reduced. In doing this, less metal scrap will be located and the overall clearance speed should improve.

EXAMPLES OF TECHNICAL SURVEY AND CLEARANCE METHODOLOGIES	
Fade-out	A set distance investigated from the last evidence identified.
Visual Search	A surface search may be conducted in order to rapidly remove the submunitions located on the surface and to establish the footprint. Depending on the situation, sub-surface clearance may only be required where surface located evidence is found.
Instrumented-aided Visual Search	
Sub-Surface Search	The procedures used for locating items below the surface are similar to those in mine clearance. Items on top of and below the surface will be removed in the process.
Reduced Clearance Depth	Site specific amendments may be applied where the clearance depth is reduced. Based on the new clearance requirements, the sensitivity of the detector can be reduced, which will increase the overall clearance rate.
Systematic Search	A certain percentage of the area is surveyed / cleared, using standard procedures. If nothing is found, the area is released. If evidence is found, the fade-out methodology is then applied.
Cut lanes or Exploratory lanes	Lanes are cleared into the area to gather information and evidence.

TOOLS FOR TECHNICAL SURVEY AND CLEARANCE

In many cases, clearance operators use the same metal detectors for clearing both submunitions and landmines. These detectors were originally designed to find minimal metal anti-personnel mines (AP mines) in humanitarian or military clearance operations.

Some clearance operators are equipped with detectors designed for UXO clearance, or with magnetic locators suitable for finding larger metal objects. As explosive submunitions contain significantly more metal content than AP mines, but less than most UXO, detectors with magnetic locators are a more appropriate tool for detecting unexploded submunitions

Cluster munition survey/clearance operations can greatly benefit from more appropriate detector systems such as magnetometers, other magnetic detectors, and electromagnetic pulse induction detectors. These are designed to find larger metal targets such as mortar and artillery rounds. Such detectors can also be equipped with data loggers and GPS interfaces. The type of search, i.e. surface or sub-surface, also influences the choice of detector.

Consideration should also be given to the sensitivity settings used during operations. These can in most cases be manipulated, in order to focus more efficiently on the unexploded submunition hazard. If it can be proved that the equipment is able to detect the applicable target to the agreed depth, then detectors capable of adjustable sensitivity (e.g. lower sensitivity levels), such as wide area detectors and magnetometers can be used. If traditional mine clearance detectors are used, they should be calibrated against the applicable target (e.g. half a BLU 26 at 20cm), and not to a minimum metal mine or standard test piece.

METAL DETECTORS

The highly sensitive metal detectors normally used for mine clearance operations are generally not suitable for efficient ERW and unexploded submunitions survey/clearance. The detectors are designed to enable the detection of minimum metal mines and will slow down operations considerably by picking up all small pieces of metal (scrap and fragments). The metal mass of an unexploded submunition is significantly larger than most fragments or scrap. Using these detectors can make the search procedures significantly less efficient.

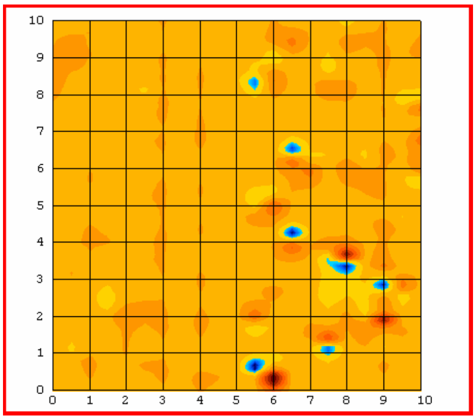
UXO DETECTORS

There are a number of UXO detectors on the market with technical applications that enable a more efficient detection of unexploded submunitions. Generally, the same basic principles are used as for metal detectors. However, UXO detectors come with additional features such as metal discrimination mode, larger search heads, and software designed to ensure fewer false alarms from metallic waste and fragments. UXO detectors can be further divided into:

1. Electromagnetic Induction Detectors
2. Magnetic Locators
3. Magnetometers
4. Wide Area Detectors

DATA LOGGER

A data logger is used in conjunction with a UXO detector. After searching an area with the detector, the information is downloaded to a computer and analysed by software. Areas containing ferromagnetic objects can then be separated from areas not containing ferromagnetic objects for further survey/clearance.



An example of information displayed by a data logger.

DUAL SENSORS

Dual sensors generally combine ground penetrating radar (GPR) technology, highly sensitive metal detector technology, and advanced data fusion algorithms. This combination results in reduced false alarm rates, enables the operator to distinguish between the target items and scrap metal, and allows the detector to automatically adapt to varying soil conditions.

SIGNATURE DETECTOR

The GICHD initiated a study surveying the availability of affordable metal detectors from the civilian market, which are capable of profiling the signature of generic submunition types. These detectors should have a relatively easy user-interface and a design rugged enough for field use. Ergonomic factors, as well as battery consumption, are also relevant.

The GICHD found that the signature metal detector technology could, under the right conditions (known target and competent user), be a more cost-effective, safe, and faster detector system for projects involved in survey/clearance of unexploded submunitions than the detectors that are used in such operations today.

The signature metal detector can be used to measure the target's conducive and ferromagnetic properties in order to "profile" each type of explosive submunition. Each can then be identified by its distinctive digital footprint or "signature". The detector can be programmed to only sound an alarm when an object with this signature is encountered. When set up correctly, the signature metal detector can reduce the False Alarm Rate (FAR), while still obtaining the same accuracy or 'Probability of Detection' (PoD) as a standard metal detector used in UXO clearance. As of publishing date, the GICHD is, together with its partners, undertaking field trials of the Signature Metal Detector system.

For more information on all detector types please refer to the GICHD publications "Guidebook on Detection Technologies and Systems for Humanitarian Demining 2005" and " Detectors and Personal Protective Equipment Catalogue 2009" www.gichd.org

ARMOURED EXCAVATORS AND FRONT-END LOADERS

Under certain circumstances, armoured machines such as excavators and front-end loaders may be suitable tools to assist survey/clearance operations. Machines can provide access when working with rubble removal in built-up areas, or assist with tasks where the required clearance depths are deeper then normal. Consideration should, however, be given to the risk associated with operating in areas contaminated by unexploded submunitions with shaped charges[3].

MSB Front-end loader moving rubble (Photo by Magnus Bengtsson)

EXPLOSIVE DETECTION DOGS

Explosive Detection Dogs (EDDs)are a viable option when it comes to survey of unexploded submunitions. EDDs can be very effective in areas that have high levels of scrap and fragmented metal, and in areas with highly mineralised soils where detector performance may be limited. As for any survey asset, a comprehensive accreditation process will need to be in place.

LIABILITY

The issue of liability, with regard to the clearance of unexploded submunitions, is no different to that of mine clearance. As long as the operational procedures have been agreed to, and are documented in national standards and accredited SOPs, and these procedures have been followed correctly, the operator should not be liable for any post land release incidents. This is the same for land released through survey and through clearance. The National Mine Action Authority (or equivalent) is responsible for ensuring that the required procedures have been followed and that “all reasonable effort” has been applied.

[3] Unexploded submunitions with shaped charges can pose a hazard to armored vehicles due to the directed explosive jet.

CONCLUSION

This chapter explains ***how*** and ***why*** land release procedures for areas contaminated by unexploded submunitions differ from areas contaminated by mines and other ERW. It is clear that unexploded submunitions are different to both mines and other ERW in a number of ways.

Because of these unique characteristics, it is an advantage to develop a unique land release methodology for the survey and clearance of unexploded submunitions so that the most efficient approach is used.

This methodology may include an agreed "fade-out". This gives clear guidance on when to stop survey/clearance and avoids continuing work into areas where there is no evidence of contamination. It can also include the decision to not create a hazardous area, but instead an 'evidence point' when conducting a non-technical survey. This limits the probability of over-inflating recorded hazardous areas through a lack of evidence.

While some procedures used in mine clearance are also suitable for unexploded submunitions survey/clearance, it is of importance that more efficient procedures, allowed by the unique characteristics of submunitions, are used wherever possible.

KEY FINDINGS

1. Unexploded submunitions differ from mines and other ERW in their characteristics and therefore they require different land release methodologies and operational systems to gain the most efficient outcome.

2. The recording of 'evidence points' (or similar), as opposed to recording polygons (hazardous areas), should be considered when there is no clear evidence indicating the boundaries of the unexploded submunition contamination.

3. While some procedures and equipment used in mine clearance are suitable for unexploded submunition surveys/clearance, the unique characteristics of submunitions enable more efficient procedures and more suitable detection equipment to be used.

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