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Survey and Clearance of Unexploded Submunitions Versus Landmines and Other ERW

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The authors argue that survey and clearance methods in areas contaminated solely by unexploded submunitions (from cluster munitions) should be different than those in areas contaminated by mines and other explosive remnants of war to achieve the most efficient outcome. This article seeks to explain how and why procedures are different, and proposes a land-release methodology for dealing with unexploded submunitions.

by Åsa Gilbert and Michael Creighton [GICHD]

Traditionally, the systematic clearance of explosive hazards is grouped into two main categories: landmine clearance and battle-area clearance.

While the land-release principles are similar for both, the operational methodologies applied to each category are different. Since mines are designed to be victim-activated, they pose a more direct risk to clearance technicians than do submunitions, which are designed to detonate before, upon or after impact. Thus, if mines and ERW are in the same area, the situation should first be treated as a mine-hazard problem and then as an ERW hazard.

Addressing areas contaminated by unexploded submunitions is classified as a BAC activity, but the operational procedures used are, in many ways, similar to mine clearance. Therefore, a truly efficient operational approach to the clearance of submunitions must incorporate aspects of BAC and mine-clearance procedures.

Characteristics of CMs and Explosive Submunitions

Because of the characteristics outlined below (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 other ERW clearance.

Pattern. The clearance of submunitions is distinct from the clearance of mines and other ERW, largely due to the unique patterns of dispersal and explosion exhibited by cluster munitions. Thus, in order to efficiently handle submunitions, clearance teams must not rely heavily on standard operating procedures used in mine clearance. Instead, techniques must be used for submunition identification and clearance that reflect the unique nature of cluster munitions, taking into account the scattering pattern, metal content, failure rate and risk for accidental detonation of submunitions.

- **Cluster munitions/submunitions.** Cluster munitions are distinct from other munitions. When fired, launched or dropped, the explosive submunitions are dispersed or released, and create a strike pattern or **footprint** on the ground. Unexploded submunitions will undoubtedly be within this footprint area, because of the high failure rate of explosive submunitions, as discussed later in this article. By identifying the footprint's shape, the center

Convention on Cluster Munitions Article 2 definitions as used in this article[1]:

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

- **Explosive Submunition**: 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**: an explosive submunition that has been dispersed or released by, or otherwise separated from, a cluster munition and has failed to explode as intended

An example footprint/pattern of 155 mm delivered explosive submutitions. The impact marks in this photo show the extent of the footprint.
Photo courtesy of FFI, the Norwegian Defence Research Establishment.

and outer edge of the strike can be better determined. This facilitates a more precise, systematic search of the hazardous area.

- **ERW.** In general, explosive remnants of war such as aircraft bombs, mortars and artillery shells, do not create a predictable pattern or footprint after being fired or delivered but may be concentrated in certain areas.
- **Mines.** Mines are often laid in rows and set patterns, so methodologies can be developed to assist clearing patterned minefields. Even when mines are laid randomly (generally known as nuisance minefields), it may still be viable to identify and analyze the laying tactics. Therefore, it is possible to determine areas likely to be mined and release areas that have no evidence of mines.

Metal content. Normally, submunitions contain significantly more metal than regular anti-personnel mines or non-metal cased anti-vehicle mines. This means that less sensitive detectors/locators, such as magnetometers, that are not sensitive enough to detect mines can be used effectively to detect the more metallic submunitions.

Failure rate. Research indicates that the failure rate of submunitions varies, but could be as high as 30 percent. Compared to other ERW types, this is considered high. The high failure rate is a result of several factors. The most dominant factor is linked to the arming process and fuze design, but other factors, such as quality of materials, storage procedures, weapons release conditions, weather and type of terrain may all contribute to the failure of submunitions to detonate.[2]

Each cluster munition holds a large number of submunitions (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, i.e., the footprint as discussed previously in this article.

Risk of accidental functioning. Fuzing of explosive submunitions varies, depending on the make and model. Most types are designed to detonate on impact with the ground or target. This is different from mines, which are generally designed to be victim-activated.

Unlike AP mines, the risk of activating a submunition below the surface by stepping on the ground above it is usually considered very low. Therefore, the area of a suspected submunition strike can usually be accessed to conduct survey activities. The principle to note is that unexploded submunitions should not be compared to AP mines, which in most cases, are victim activated.

It should be emphasized that accessing areas contaminated by unexploded submunitions should only be conducted by trained technicians. Even though unexploded submunitions do not pose an immediate threat to explosive ordnance disposal personnel as AP mines do, this should not be misunderstood as a lack of danger to the local population. Unexploded submunitions remain a danger to these communities and should be dealt with accordingly; however, on a procedural level, the risk of accidental functioning during clearance is much lower in the case of submunitions than with landmines.

Land-release Methodology

The footprints, or dispersal patterns, of submunitions can be used for more efficient survey of contaminated land. Teams can use the identification of one submunition as an indication of the presence of more submunitions in the same area, due to their high failure rate and dispersal characteristics.

Even if the conflict occurred several years earlier, or if a large number of the submunitions were moved and/or destroyed, the presence of one submunition remains a reliable indication of other submunitions in the area. In the case of overlapping strikes, locating the point where the footprints end is necessary. This requires clear and agreed working procedures on how to plan and conduct survey and clearance.

Sometimes the drills and equipment used during submunition survey and clearance are similar to those used in mine clearance, e.g., a systematic search below ground using detectors. However, using mine-clearance procedures and equipment during the survey and clearance of submunitions is highly inefficient, and should be avoided whenever possible. This is because the metal content is significantly higher in submunitions than in mines, and submunitions are not designed to be detonated by applying pressure. Nevertheless, because of the cost and logistical challenges involved in purchasing new equipment, when an organization undertakes the survey and clearance of submunitions, it may have to employ detectors designed to detect minimum-metal mines and use procedures developed for mine clearance.

	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 their delivery or dispersal process	High	Variable - can be as high as 30%	Designed to function by detonation prior to, on or after impact Possible to access the area during survey in most cases
Other UXO	Generally no pattern	High	Depends on type, but in general lower than for submunitions	Generally designed to detonate on impact Possible to access the area during survey

Summary table. Different characteristics of mines, submunitions and other UXO.
Graphic courtesy of the authors.

Submunition survey and clearance, therefore, can generally be conducted using more rapid and effective procedures than for mine clearance. These procedures provide several advantages, including the following:

- **Quicker search procedures.** When the contamination type contains a high metal content and does not include pressure/victim-activated devices, the search can be faster. In most cases, it is considered safe to conduct a surface search by walking the suspected area, coupled with vegetation cutting (if needed), to allow a more thorough ground search.
- **Quicker marking.** Depending on which working procedures are used, a less comprehensive marking system may be justified. A systematic search below ground may require a more complex marking system; however, some techniques, such as a surface-visual search, may allow for an expedited, less comprehensive marking system.
- **Quicker site set up/take down.** As a result of the less comprehensive marking system, the site set-up and take-down will be less time-consuming.

Although land-release methodologies for submunitions may not be as straight forward as for a patterned minefield, similar land-release principles, like the use of an evidence-based approach and the principle of all reasonable effort, should be applied. For instance, heavy contamination, intended land use or other factors may demand slower, more meticulous clearance procedures, which draw more heavily on mine-action principles.

Evidence-based Approach

A proposed methodology for the survey and clearance of submunitions is an evidence-based approach, that is, when clear evidence indicates the presence of submunitions, this method can be used, including when:

- Evidence of a strike is confirmed by either physical debris or a strong claim (by an informant).
- An evidence point is created, and from this point further survey/clearance commences.

Evidence-point criteria. The national mine-action authority and operators should develop and agree upon the criteria for the required level of evidence needed to create an evidence point. In general, however, when any of the following are present, an evidence point can be established:

- **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 are located in the area**

In some countries, suspected hazardous areas can be linked to boundaries that have been determined by the affected community. As people with no mine/ERW experience (local residents) tend to define these areas, however, civilians generally think the contaminated areas are larger than they actually are. As a result, assets are deployed to areas where no

Strikemark dual-purpose improved conventional munitions M77.
Photo courtesy of Åsa Gilbert.

evidence of contamination exists, instead of in evidence-based confirmed hazardous areas.

For effective use of resources and planning purposes, estimated areas may be attributed to each evidence point. The community should be closely involved in the process of identifying evidence points. However, this area should not be seen as an actual hazardous area, nor the boundaries as the extent of any contamination. Well-defined criteria will ensure that only land qualifying for further technical survey/clearance will be recorded and tasked for future 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 submunitions is necessary in order to remove the immediate threat to the local inhabitants. During this process, there may not be enough time to gather and record all available information. Most importantly, a minimum record should be kept and entered into a database, such as the specific location (using a Global Positioning System) of each individual item, the munition type found and the number of items destroyed. These records will facilitate the analysis of the data at a later stage. Also, sufficient and accurate recording of each item's location enables the footprint of the strike to be identified later and technical survey/clearance assets to be efficiently deployed in contaminated areas.

Mine-action programs often have roving EOD or rapid-response teams that carry out spot tasks (removal of individual munitions found) on an as-needed basis. As with the above example, a detailed record is very important for keeping all tasks, and this record should 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, analyzing previous survey records, EOD spot-task records and bombing data (if available). Then, the NTS teams should deploy to the field to investigate any previously recorded suspected-hazardous areas/evidence points and identify any new ones.

Fade-out. A fade-out is the agreed distance from a specific evidence point where the Technical Survey/clearance is carried out. The fade-out distance is determined by the conditions specific to the area (i.e., geographical conditions, hazard type, delivery methods, etc.) and should be based on operational experience.

Technical Clearance Process as Illustrated in Figures A and B:

1. Identify evidence of submunitions
    - Unexploded bomblets
    - Fragmentation
    - Strike mark
    - Strong claim
2. Start clearance at the location of the evidence.
3. Clear x meters in all directions according to the agreed distance for FADEOUT from evidence (wx. 50m).
4. If no futher evidence has been found, stop clearance.
5. If no futher evedence has been found/ reported in the area, the CHA is released.

Figure A

Figure B

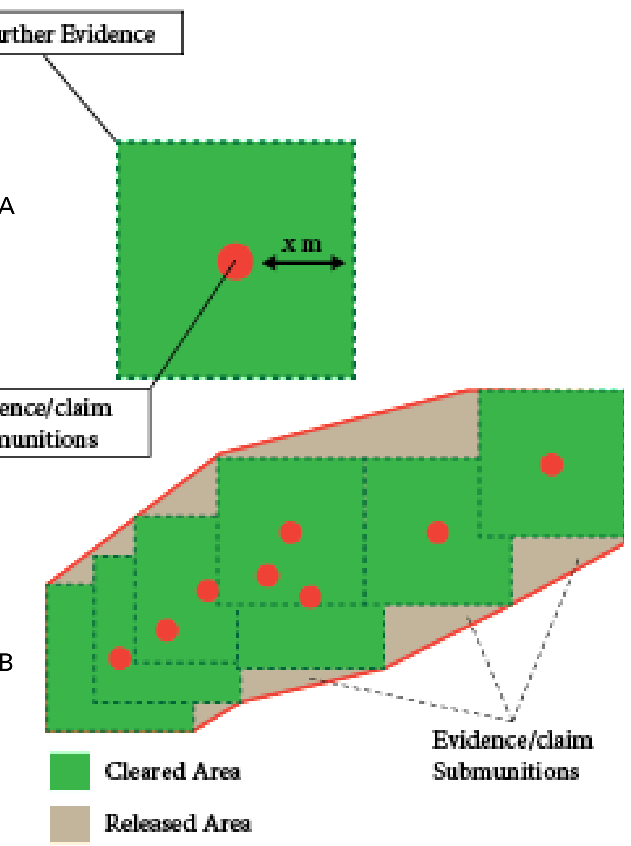

Figure A (top). One piece of evidence was found in the area. Clearance starts at the location of the evidence (red dot). If no further evidence is encountered within the fade-out (x meters in all directions from the evidence operationally conducted as a box search), no additional survey/clearance is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

Figure B (bottom). Three separate locations with evidence were identified during the initial NTS. 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.

If credible evidence corresponding with the correct level outlined in national standards and standard operating procedures is not found, the survey team should not record an evidence point or a hazardous area. This is essential for the validity of an evidence-based methodology, and avoids inflating the problem by populating the database with hazardous areas based on vague information or weak claims not based on any actual evidence.

Conversely, if sound evidence is available and the NTS team can clearly identify evidence of cluster-munition remnants, an evidence point should be recorded. If enough clear evidence exists 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 contamination area can be clearly identified.

Technical Survey and clearance. Once an NTS team conducts a survey and if a hazardous area or an area identified by an evidence point is identified, the area is then subjected to Technical Survey and/or clearance. The two activities are generally conducted concurrently, even though some organizations employ separate specialized 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 below the surface. The team commences the Technical Survey/clearance at the evidence point's location and then works its way outward to the agreed fade-out point.

If no other submunitions are found once the fade-out distance is applied and searched, it is reasonable to determine that no other submunitions remain from that strike/footprint. To give an example, if the fade-out is 50 meters (54.68

Surface Search - Visual.
Photo courtesy of Asa Gilbert.

yards), the ground will be processed for a distance of 50 m in all directions from where the evidence point is located. If no further evidence is found, the survey/clearance will stop. A total of 10,000 square meters (2.47 acres) will have been technically surveyed/cleared.

Conclusion

Submunitions are different from 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 submunitions so that the most efficient approach is used.

Although some mine-clearance procedures are also suitable for submunition survey and clearance, it is important that more efficient procedures specifically tailored to cluster-munitions identification and removal, including establishing the submunitions footprint, are used when possible.

See endnotes page 82

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