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Urban Land Release in Libya: BAC and Land Release in Built-up Areas

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Urban Land Release in Libya: BAC and Land Release in Built-up Areas

This article's aim is to present several land-release principles for use in the battle-area clearance of Libya's built-up areas, also called Urban Land Release. Based on the practical, empirical experience of DanChurchAid, it is not intended as a one-size-fits-all solution to BAC task planning, but it may be helpful in other locations when compared with local knowledge of the situation on the ground. It does not apply to landmine clearance. BAC is the traditional means of clearing unexploded ordnance in open areas. Libya is now contaminated with UXO and explosive remnants of war as a result of the uprising that occurred in 2011. This article also examines the effectiveness of BAC as reconstruction occurs, particularly in Misrata, based on the experience of DanChurchAid deminers.

by Robert Keeley [RK Consulting, Ltd.]

Humanitarian mine action produces two main outputs with a socioeconomic impact. The first is land release for subsequent safe use by the local population. This is the main output of landmine clearance and UXO clearance in areas contaminated by cluster munitions where the local population is unwilling to use the contaminated areas.

The second main impact is that HMA reduces the risk of death or explosive remnants of war injury. HMA activities, such as mobile explosive ordnance disposal teams and mine-risk education, do not clear land for safe use but reduce the risk of death and ERW injury by removing hazards and modifying the behavior of the local population, thereby reducing the probability of the incidence. Notably, the local population is rarely dissuaded from using areas by the threat of ERW. Hence, any HMA activities that are based on the land's wholesale clearance are not likely to impact the livelihoods of the local population, as people would have used the land anyway.

Amount of area cleared in hectares or square meters, while a useful measure of efficiency, is not a very useful measure of impact (see definitions in Table 1). Therefore, HMA teams operating in built-up areas should focus on activities optimized for ERW's safe removal. Initially, this may appear the same as BAC, but it is important to understand that BAC is an area-clearance tool, and area-clearance tools are used for hazard reduction. Although eventually effective—teams will find ERW—it is not always efficient, especially in situations where the density of ERW contamination is comparatively low.

Examining UXO found during a BAC task. The item was hard to spot and is likely to have been missed by a previous search.
All photos courtesy of the author.

Development Evaluation Criteria

A key concept referred to in this article is the development-evaluation criteria created by the Organization for Economic Cooperation and Development. Table 1 details these criteria and respective definitions.[1] The most relevant terms in this document are impact, effectiveness and efficiency.

Land Release and Non-technical Survey

The humanitarian mine-action sector still struggles with defining the term land release. The Geneva International Centre for Humanitarian Demining has released three new International Mine Action Standards on the subject. Although a direct reference to "land release" is constrained to a single footnote in only one IMAS, a recent meeting of the IMAS Review Board determined that considering a review of the relevant standards, IMAS 08.20–08.22, was still too soon.[2] However, the mine-action sector's general consensus is that information-gathering and analysis techniques, such as Non-technical Survey, should be used to prioritize the use of technical resources in landmine-contaminated areas and these actions should have some sort of socioeconomic impact. Definitions of the three IMAS mentioned above are as follows:

- IMAS 08.20 defines **Land Release**:
  "Land Release is the process of applying all reasonable effort to identify or better define Confirmed Hazardous Area and remove all suspicion of mines/ERW through non-technical survey, technical survey and clearance using an evidence based and documented approach." [3]
- IMAS 08.21 defines **Non-technical Survey**:
  "The term 'Non-technical Survey' describes a... survey activity which involves collecting and analyzing new and/or existing information about a hazardous area. Its purpose is to confirm whether there is evidence of a hazard or not, to identify the type and extent of hazards within any hazardous area and to define, as far as is possible, the perimeter of the actual hazardous areas without physical intervention." [4]
- IMAS 04.10 defines **Battle Area Clearance:**
  "The systematic and controlled clearance of hazardous areas where the hazards are known not to include mines." [5]

Weapon Use in the Libyan Conflict

The fighting in Libya involved land-service ammunition with some air-delivered weapons and small arms and light weapons. Air strikes on existing Libyan Army ammunition-storage areas have scattered abandoned explosive ordnance and SA/LW ammunition, and caused significant contamination in the surrounding areas. The majority of the fighting was concentrated along nodal points, coast roads and around sites of particular interest, such as government buildings within town centers. Therefore, significant damage occurred in some areas, whereas other areas escaped unharmed.[6]

BAC in Libya

In Libya, much of the early humanitarian clearance work was conducted as the fighting continued and revolved around the BAC of urban areas, particularly in Misrata. Early work by international nongovernmental organizations showed that although a number of unexploded ordnance was identified, the amount was far less than what might be expected given the intense fighting. By talking to locals, it was learned that the local forces engaged in some informal UXO removal.

Although BAC can be conducted faster than demining, especially when it involves surface-visual clearance on hard surfaces, it remains slow and expensive. Clearing a city takes considerable time; the Joint Mine Action Coordination Team was originally tasked with clearing Misrata. The operation's relative costs and benefits were brought into particular focus given that a smaller-than-expected quantity of UXO was found. Therefore, it should be considered whether the principles of the emerging

Criterion	Definition
Relevance	The extent to which the aid activity is suited to the priorities and policies of the target group, recipient and donor
Impact	The positive and negative changes produced by a development intervention, directly or indirectly, intended or unintended. This involves the main impacts and effects resulting from the activity on the local social, economic, environmental and other development indicators.
Effectiveness	A measure of the extent to which an aid activity attains its objectives.
Efficiency	Efficiency measures the outputs—qualitative and quantitative—in relation to the inputs. It is an economic term which signifies that the aid uses the least costly resources possible to achieve the desired results. This generally requires comparing alternative approaches to achieving the same outputs, to see if the most efficient process has been adopted.
Sustainability	Sustainability is concerned with measuring whether the benefits of an activity are likely to continue after donor funding has been withdrawn.

Table 1. OECD Development Evaluation Criteria.
All tables courtesy of the author.

Ser	Datum	Uncontrolled
1	Days worked	17
2	Area Cleared (Ha)	66.64
3	Items found	81
4	Area cleared per day (Ha)	3.92
5	UXO per day	4.76
6	UXO per Ha	1.22

Table 2. DCA BAC Data for August 2011.

land-release concepts can be employed when focusing BAC efforts into areas containing UXO contamination and where its removal will have some socioeconomic impact.

Risk and Hazard. The discussions below depend on a mutual understanding of the formal definitions of **risk** and **hazard**, as follows:

- IMAS 04.10 defines **risk** as the "combination of the probability of occurrence of harm and the severity of that harm."[7]
- IMAS 04.10 also defines a **hazard** as a "potential source of harm."[8]

This is usually described mathematically as: $r=P_i \times S_o$ where r = risk, P_i equals the probability of the incidence and S_o is the severity of the outcome. In mine-action terms, risk can also be seen as a product of hazard x activity.

This means that removing the hazard can reduce the risk, or reducing the probability of an incident by modifying people's behavior (i.e., with mine-risk education). However, the converse must also be true: Risk is not actually reduced when work is done to search areas that are subsequently found never to have had ERW contamination.

ERW and Casualties

One problem facing the HMA sector involves how to measure the impact of EOD teams, given that they do not clear land. The more UXO that is safely removed, the safer the population. However, measuring the productive value of cleared land is not so simple. Estimating the impact of EOD teams and UXO removal is possible, and an established mathematical relationship now links the number of UXO and the number of casualties.[9] A mathematical function involves the percentage of ammunition that becomes UXO (commonly understood to be 10 percent), the percentage of UXO considered unsafe to move (and hence most likely to cause casualties) and the average number of UXO casualties per incident. In other words, the more ammunition used in a particular area, the more UXO that will remain in the area. As a result, more casualties will occur.

Any land-release technique forcing the HMA teams to concentrate on maximum-impact areas will improve **efficiency** and will have more of an **impact** on donor funds. This has already occurred in Libya. Although Misrata was one of the most heavily contaminated areas in Libya, some areas did not see combat, and identifying Misrata's contamination was the first step in this identification process. By using local knowledge and information about the conduct of the fighting (see Figure 1), teams can improve this process. Other procedures can further focus the teams' attention on the areas where the fighting was heaviest.

An example of low amounts of battle damage. No items of UXO were found around this building.

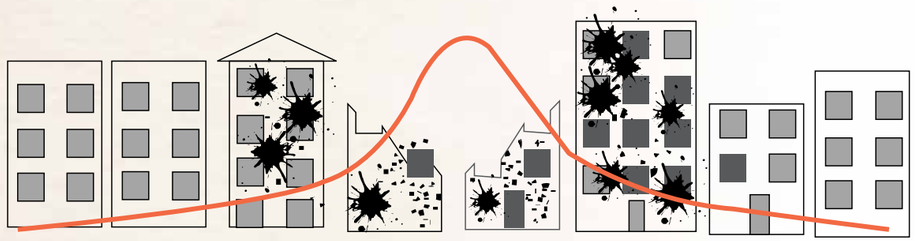


Figure 2. Distribution of battle damage around the focus of the fighting. The red line is a representation of how the density of damage is distributed across the battle area.
Illustration courtesy of the author/CISR.

The amount of UXO scrap found by a team of three searchers in one hour. UXO was subsequently found on the roof of a building in this same area by the team later that day.

UXO Scrap, Damage and Fragmentation

A simple proxy indicator of the probable density of ERW contamination will be the density of UXO scrap, which can be moved and is likely to decrease over time, and weapon damage to buildings, which includes fragmentation marks. This is a simple statement of proportion: The amount of fighting is proportional to the amount of building damage. Since the amount of ERW and the amount of fragmentation damage are both proportional to the severity of the fighting, using fragmentation as an indicator of ERW presence is statistically reasonable. As a general principle, one exploding weapon causes spalling/cratering over approximately one square meter (one square yard) and significant amounts of smaller fragmentation damage over an area of 100 sq m (120 sq yd).[10]

An area showing more moderate damage. Much of the damage to this building is from fires rather than from the blast or fragmentation effects of UXO. A small number of UXO items were found in the buildings pictured.

Experience From Misrata

Practical experience from Misrata supports a number of observations:

- **Fragmentation and battle damage is distributed around the foci of conflict.** It is possible to see a distribution of contamination around areas of most severe fighting which is similar to a statistical distribution. This appears to be a result of the nature of the fighting in Misrata. When walking a few meters away from severely damaged areas, no damage is observable in parts of the town. This distribution is represented graphically in Figure 2.
- **Items of UXO are strongly correlated with fragmentation and battle damage.** In general, the presence of UXO is very strongly correlated with the degree of observed battle damage. No items of UXO were found in areas without battle damage. The correlation with other ERW items, especially caches of abandoned ordnance, might be less strong, as ammunition stockpiles may be found away from conflict areas.
- **Far fewer ERW are being found than the amount of battle damage might suggest.** This lack of ERW is one key observation from the ground in Misrata. Looking at a building with 20-plus projectile strikes, one or two UXO items may be found in or around the building, but what was actually found on the ground was far fewer. Indeed the UXO-contamination level around the foci of fighting is estimated to be only about 10 percent of what might be found (i.e., one UXO for every five to 10 buildings searched). This is not because the ammunition used was particularly reliable; rather, information given to DCA suggests that local teams within the Libyan Transitional National Council collected ERW items before DCA (and indeed the other international NGO team working in Libya) could deploy. Seemingly, DCA teams are finding items missed by these original searchers. In conditions of such low contamination, making EOD/BAC interventions more efficient is even more important. Table 2 sets out performance data for DCA teams in Misrata for August 2011. This was effectively the first month of operations, and some days at the end of the month included a stand-down in preparation for the Eid al-Fitr holiday. These data give benchmarks by which any subsequent change in procedures can be measured.

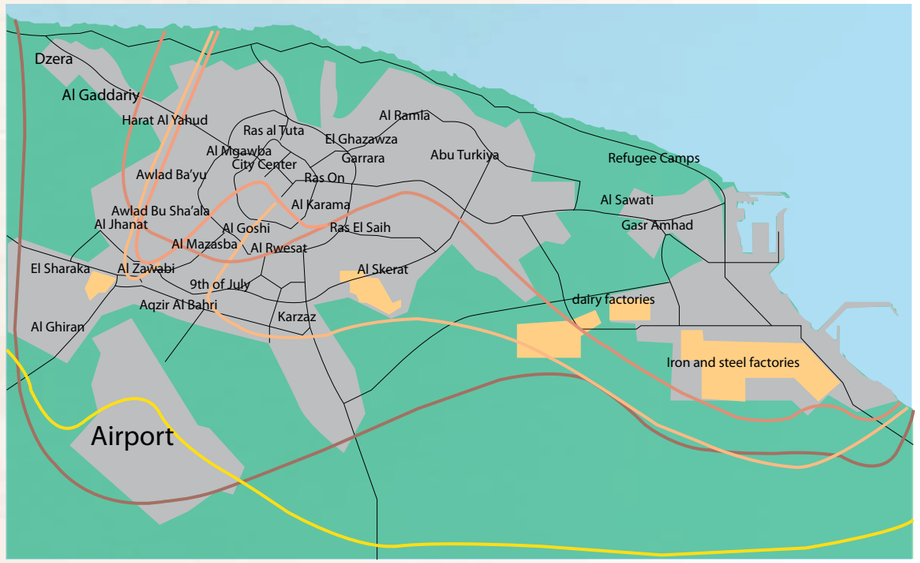


Figure 1. Wikipedia map of the battle of Misrata.
Map courtesy of Wikipedia/CISR.

Damage Category	Definition	Remarks
Severe	Significant or total collapse reulting from repeated strikes. Significant amount of fragmentation or SA/LW strike damage	Can be harder to search than buildings with moderate damage
Moderate	Some strikes on buildings resulting in noticeable damage, but no general collapse. Fragmentations or SA/LW strike damage present.	
Light	Some fragmentation marks on buildings. No significant damage.	
Nil	No visible battle damage	

Table 3. Categorization of buildings by damage and fragmentation marks.

Damage Category	Definition	Remarks
Nil	Reactive call-out only to spot tasks such as abandoned explosive ordnance or caches of SA/LW ammunition. Do not carry out prophylactic BAC.	
Light	As per Nil. In the event that some UXO reported then 'clear to fade.'	
Moderate	'Clear to fade' if UXO reported or 'clear to boundary' (of project) if area required in support of a funded development project. Clear as prophylactic BAC task when no severe areas left.	
Severe	Carry out BAC tasks on severe areas as priority when no EOD spot tasks reported. Clear to fade.	Consider mechanical assistance for searching rubble.

Table 4. Resource Allocation in Urban Land Release.

Categorizing Explosive Fragmentation Battle Damage

If the above principles are operationalized for practical use in urban land release, identifying different categories of battle damage will be useful; this information could then be used to prioritize efforts and identify different technical interventions. This should assist in improving the allocation of resources to the problem and improve efficiency.

In Misrata, four categories of battle damage were identified. These are explained in Table 3.

Limitations

One apparent limitation of using battle-damage evidence to cancel areas for BAC is that the **outliers**, i.e., the one-off item of UXO that was the only explosive-ordnance item to fall in an area of light or nil battle damage will not be found. Nor will this method find ERW caches in areas where no immediate fighting occurred.

The technique described is purely a method for categorizing buildings and surrounding areas based on the degree of battle damage. While this method is considered a useful means of categorizing areas, other data-gathering methods exist. For example, local knowledge may also highlight one-off ERW items (since abandoned ordnance is less likely to be as closely correlated with battle damage as is UXO) or identify buildings that were occupied by fighters but were less damaged. Table 4 shows how other factors can be incorporated as part of a resource-allocation process in urban land release.

On the other hand, BAC will not find all ERW in built-up areas. It will not work in abandoned or locked buildings, and even the best BAC searchers will not be likely to spot UXO in unusual locations. We know that from World War I and World War II small numbers of UXO plague Europe long after the wars. Therefore, assuming BAC activities in built-up areas have a risk-reduction output rather than area clearance is important. ERW reports can be used to modify the default-option response, which the damage category suggests.

Prioritization

The principles set out previously can prioritize HMA assets between EOD spot tasks and wide-ranging BAC tasks in built-up areas. Table 5 provides prioritization guidelines; these compare the type of task with likely attributes of contamination and impact. This can help determine whether multi-purpose HMA teams deploy as small, mobile EOD teams or should combine for area-clearance tasks.

Other Techniques

Marking. Not all abandoned buildings are freely accessible, which may mean that not all severely damaged buildings can be cleared during urban BAC activity, and some contamination may not be found during prophylactic BAC searches. Improving BAC effectiveness in terms of contamination and impact is possible by the use (in Libya) of simple add-on stickers in Arabic and English, including a message similar to that in Figure 3.[11] These stickers should help improve the impact of HMA activity and will help the local population when they encounter ERW.

Human information. As implied in Table 4, collecting human information will be important. Using community-liaison teams to seek out human input on ERW is critical. MRE can help facilitate this but only when it includes information about how suspect ERW can be

Priority	Definition	Contamination	Impact	Remarks
Priority One	Item of ERW reported as spot task	X	X	Strong in terms of both contamination and impact
Priority Two	BAC in support of funded development project		X	Strong in terms of potential impact. Moderate and severe areas only except where clearance is specifically funded.
Priority Three	BAC in 'Severe' areas	X		Most likely to be contaminated, but impact not so clearly measurable.
Priority Four	BAC in other areas			Consider relocating some teams to other regions if too many P4 tasks being undertaken.

Table 5. Prioritization in Urban HMA.

To the occupier:

A search of the area around this building has been carried out for dangerous explosive items, but access to this property was not possible. If subsequently you find any items that you suspect might be an explosive item, contact us at [telephone number] and we will check it for you as soon as possible.

Please DO NOT touch the item yourself and please also make sure that no one else touches it in the meantime. Do not become a casualty.

Figure 3. Message to occupiers of a building in Misrata that could not be searched.

reported. MRE is more useful when a feedback loop is incorporated. Like the stickers on abandoned buildings, human input will help improve the impact of HMA activity as it will help the local population confront ERW.

Clearing to Fade. Clearing to fade is a concept whereby BAC teams search outward from ERW-contamination areas until they find no more contamination. Based on DCA's experience in Misrata, the approximate mean distance between UXO (in contaminated areas) is 25 m (27 yd). Therefore, the clearing-to-fade distance recommended here is 50 m (55 yd), or twice the average distance between UXO pieces in contaminated areas. Teams stop at least 50 m (55 yd) beyond the most recently found piece of UXO. The distance can be increased when practical, e.g., to extend the search by a few meters to allow a wall or road junction to act as a boundary.

Independent Confirmation

Produced by the French NGO Agency for Technical Cooperation and Development (ACTED), a map served as independent confirmation of this hypothesis (see aerial photo, next page). In order to plan possible aid interventions, this map showed battle-damage areas after an ACTED survey. Based on DCA's work conducted in August, the UXO data was superimposed on this map to show a high degree of correlation between UXO finds and battle damage. The few outliers are marked; they were explained previously.

Resource Allocation Through Response-time Analysis

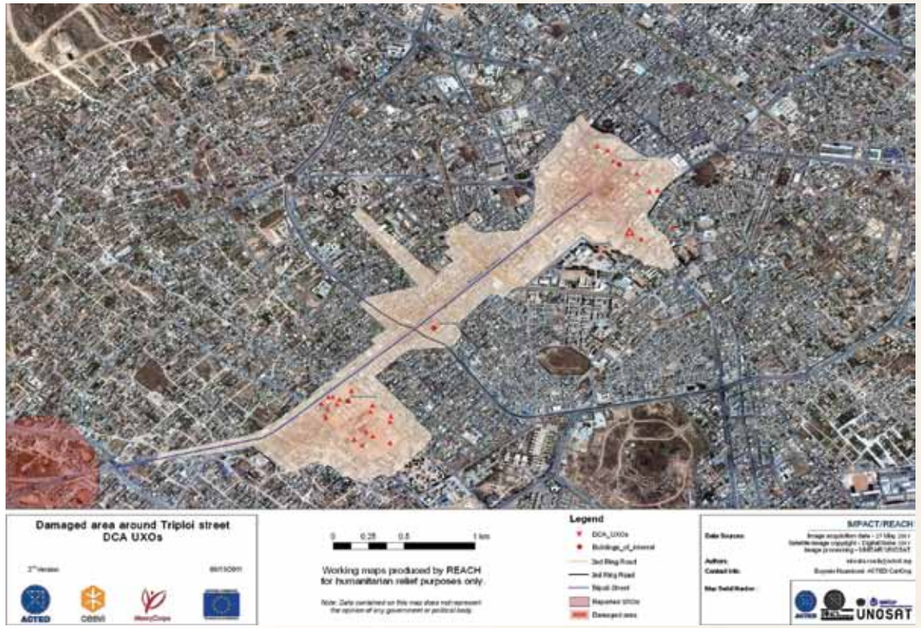
The information contained in Figure 5 is based on an approach called response-time analysis used by a number of countries, including Australia and the United Kingdom. Under such an approach, an average response time is set as a standard by the appropriating authority. This would be the expected time between an item of UXO being reported to the implementing agency and its mobile EOD team arriving to deal with the suspect item.

Given the time necessary to deal with an average find after the team arrives on site, and typical travel times between two separate locations, one could expect each team to deal with two separate UXO tasks each working day. This process allows analysis using the principles set out in Figure 5 (previous page).

This analysis can be carried out at a program level to determine whether there are sufficient EOD teams in the country, and repeated at a project level to establish whether the capacity is allocated efficiently between provinces or regions.

A DCA searcher checks severe damage to a building. The building includes a great deal of blast damage and collapse in some areas. An item of UXO was found on the roof of this building.

Can you spot the UXO? This neighborhood has no readily identifiable fragmentation or battle damage, yet apparently has UXO, as reported to DCA by a neighbor. It is unlikely to have been spotted by BAC.



The pink shaded area on the map was produced by Agency for Technical Cooperation and Development to show battle-damaged areas in Misrata. The red marks show where UXO was found by DCA in August 2011.

Top left. DCA teams working around "Severe" damaged buildings. Top right. An MRE poster provided by Handicap International. Center and bottom. This cluster munition was reported to DCA by a resident who could see it on the garage of his neighbor's house. It would have been missed by BAC teams who would not have been granted access to the house, and it would not have been spotted by the householder as there is no view over the garage from the house.

- *If EOD teams are each carrying out an average of two tasks per day and there is no backlog of tasks, then the number of teams available can be considered sufficient and their management efficient.*
- *If EOD teams are carrying out an average of two tasks per day and there is a backlog of tasks, then the number of teams available may be insufficient, even if they are being managed efficiently.*
- *If EOD teams are carrying out less than two tasks per day and there is no backlog of tasks, then there may be too many teams available (or a problem in the task reporting process).*
- *If EOD teams are carrying out less than two tasks per day and there is a backlog of tasks, then it is likely that the teams are being managed inefficiently.*

Figure 5. Principles for EOD response-time analysis.

Conclusion

BAC is traditionally used in open areas and is conventionally considered a means to release land for subsequent safe use. DCA's experience in Libya in 2011, specifically in Misrata, suggests that BAC may not always be an efficient way of achieving a socioeconomic impact due to a number of confounding factors. These include the underestimated amount of UXO found and the large number of buildings not accessible to searchers. However, findings from initial DCA operations show a strong correlation between the degree of battle damage and the amount of UXO found. Therefore, using the degree of battle damage—supported by reports from the local population—should allow searchers to focus on reported ERW and on areas where ERW are most likely found within an urban land-release concept. Urban land release will not find all ERW, especially items of abandoned ordnance not found in the close proximity of battle areas. However, the comparatively small number of ERW found using conventional BAC reveals the importance of focusing activities in areas where ERW are most likely found. Support from enhanced MRE and community-liaison efforts will further improve the efficiency and impact of humanitarian mine-action activities in built-up areas.

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see endnotes page 81

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