COUNTERING EXPLOSIVE HAZARDS: LOOKING FOR THE RIGHT TOOLS

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Explosive weapons are the major threat in current wars. Most likely they will remain the dominant threat in future warfare. There are many factors making this type of weapon a subject for discussion: effectiveness and low cost, destructive power, difficulty to discriminate between civilian and military targets, etc.

In recent conflicts, most casualties (both military and civilian) are caused by ordnance in its multiple variations: fired by guns or self-propelled, dropped by air platforms, thrown or emplaced (mines) or employed as a "terror" weapon. One peculiar characteristic of explosive weapons is that they continue causing suffering, without discriminating, when military operations are over. They may end up as ERW (Explosive Remnants of War), categorized into two types: AXO (Abandoned Explosive Ordnance) and UXO (Unexploded Ordnance). They may be transformed into IEDs (Improvised Explosive Devices) as well.

C-IED is a complex matter. There are different approaches to dealing with explosive hazards, but a comprehensive view of the issue would need a full encyclopedia. We will address just some aspects related with the use of tools, and we will leave other points of the matter for future articles.

LEARNING FROM FAILURE

Long time ago, back in the eighties, a young engineer officer instructed his platoon on how to lay and clear a minefield following STANAG 2036. The young officer was struck by the fact that laying a minefield using training mines always resulted in mine incidents (both while laying and clearing), so the obvious conclusion was that things were not as they looked on paper. Everything can be explained and at least three different causes were found: lack of experience which resulted in accidents, complicated method for laying mines, and the use of tools and procedures not certified by real experience.

Field manuals and SOPs suggested the use of probing to detect buried mines followed by manual excavation using conventional tools, but the use of tools (probes, digging tools, etc.) in the vicinity of ordnance is always dangerous. Practical experience showed that the current hardware for demining (entrenchment tools and bayonets) were not suitable. Regarding the procedure, it looked very good in the manual, but not that good in practice: it involved too many people and an excess of movement and complexity, as the combination of too many people and too much time within the hazard zone results in high risk.

Manual plastic tool for demining.

Handling of tools in the proximity of explosive hazards is always a risk to be considered by demining personnel, particularly when excavation and probing are done from above and close to the pressure plate. For this use, a simple and practical tool for demining was designed and tested with success. The tool, made of hard plastic material, consisted of a trowel, ripper and a prodder (inside the handle) attachable to the handle or the front end.

A period of practical experience and failure helped us to develop several lessons:

- Awareness of hazards due to the use of tools and heavy objects in the vicinity of armed mines. Tools must be dumb-proof and adapted to the needs: horizontal excavation, rather than conventional vertical digging.
- Always take into consideration stand-off and access in digging. Access from above should be avoided.
- Use of protective equipment such as gloves, helmet, jacket or goggles, as well as appropriate tools like demining scoop, together with robots that keep us at a standoff distance.
- Use standoff detection such as metal detectors, GPR, long linear junction detection or thermal vision. In other words, tools that compensate the limitation of our basic “eyeball” detection.

BACK TO THE FUNDAMENTALS: DISTANCE, TIME BARRIER… AND TOOLS

The main rules of the First Responder state that stand-off distance, time and barrier are the key factors to

Two arms C-IED robot aunav.NEXT

fight explosive hazards. UGV are essential to get the job done, mostly because they permit to operate from a safe location. Tools have to answer back to a real need: moving heavy objects, defusing, handling hazardous gadgets (X-Ray, NLJD Non-Linear Junction Detector), handling and moving a dead body, a car bomb, etc. However, the standard EOD robot and light UGV have many limitations. A possible solution is the two-arm robot combining strength and dexterity, where understanding what we expect from tools (standoff distance, tasks to be carried out with the same skill as humans, or more) is paramount. In the picture we see the two arms: one could be acting while the other is on standby (with an extinguisher or secondary tool for example), or both simultaneously performing a task requiring certain dexterity.

Robotic arm aunav.CID

Robots are tools specialized in 3D (Dirty–Dull–Dangerous) and 3H (Hot–Heavy–Hazardous) environments. In addition to substituting humans in hazardous environments, robots fitted with the right tool can be very efficient, reducing the job of the soldier to decision making. Mechanical tools compensate the limits of our physical capabilities, computers boost our limitations handling data and speed up decision making.

Robotic arm aunav.CID Light

The job done by a sapper squad clearing a road can be facilitated by a robotic arm with a “flexible” front end able to search, dig, clear and dispose of obstacles; again a good understanding of the task together with the need of saving lives is the key. Firefighting in hazardous areas or evacuation of casualties from the front line are tasks suitable for a “robotic buddy”, the former to perform a task beyond human abilities, the latter to save manpower in critical circumstances.

BACK TO THE FUNDAMENTALS (AGAIN): DISTANCE, TIME, BARRIER, TOOLS… AND KNOWLEDGE

There is always more than one method to do things, but the best path to success is learning from failure. Failure is not that bad, when we learn from it. Those with experience in forensic analysis of explosive incidents know that at the very end of the process we always meet the same sentence: “I didn’t know…” or “I wasn´t aware of…”. We also know that the best results in Counter-IED come from the “Lessons Learned” process and human network analysis.

The way in which people, individually and as a group, interact has been transformed by the use of technology. New technologies, combined with traditional weapons, could be the core element of a new kind of threat. Again knowledge, in this case understanding the threat, is the foundation for a “cat and mouse” game of both conventional and unconventional warfare.

So far technology is providing a substitute for human action, in our case robots performing hazardous tasks. The evolution is not limited to remote machine handling. Knowledge, and particularly the way we acquire and process it, remains the dominant factor in all human activities where risk is present. Handling knowledge and decision making are becoming the field of work for Artificial Intelligence. The use of knowledge as a tool is not within the scope of this article, but needs consideration as a subject matter for a future paper. ■

ABOUT THE AUTHOR

Rafael Jiménez Sanchez Joined the Spanish Military in 1978. After getting his commission as an Engineer Officer he was posted to the Mountain Brigade (Engineer Battalion) in San Sebastian. He graduated from the University of Zaragoza and got a Master Degree in Security and Defense. His Military records include courses such as UN Military Observer, Signal Officer, Camp Construction and EOD Officer.

His assignments and tours of duty since 1982 include Engineer Battalion at the Mountain Brigade, Instructor (Military Academy and Engineer School), Bridge Regiment, CID and EOD School. Tours of duty in Bosnia (1994-1996-1998), Instructor at ENTEC (2000), Chief Ops-Int and Spanish Engineer Unit Kabul (ISAF-2002/2003).

Promoted to Colonel in May 2011. He was appointed Director of the International Demining Centre (CID) and EOD School (Spanish Army).

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