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Clutter Reduction in Manual-Demining Operations with the Help of a Handheld Magnet Tool

by Arnold Schoolderman and Yolanda Rieter-Barrell [ TNO Defence, Security and Safety ]

A handheld metal detector is the most common detection tool in humanitarian demining, not only in manual-demining operations but also as a follow-up to mechanised demining. Most demining organizations adopt the metal detector as the prime detection tool since it is easy to learn and operate, is affordable, and fits well in the standard operations, but also as a follow-up to mechanised demining, not only in manual-demining operations but also as a follow-up to mechanised demining. Most demining organizations have been reported as high as 250 false alarms for every one alarm resulting from an actual mine. It is obvious that a technique to reduce the false-alarm rate would enhance the manual-demining process greatly.

This assertion is confirmed in a study by the Geneva International Centre for Humanitarian Demining, which ended in July 2010. The data necessary to quantify the clutter reduction by applying the magnet tools was gathered during live demining operations in Cambodia and Angola with the Cambodian Mine Action Centre and Norwegian People’s Aid, respectively, as partners. To this end, a procedure was set up to train the local deminers in the magnet-tool use. During the trials the deminers were divided into several groups. All deminers in one group worked with one

The authors discuss a study investigating the potential of permanent magnets for the reduction of metal clutter in manual demining operations.

In order to investigate the efficiency in clutter reduction by applying handheld permanent magnets in the “close-in” detection phase, a project was started by the Netherlands Organisation for Applied Scientific Research (TNO). The Netherlands Ministry of Defence financed this project as part of the Netherlands’ contribution to the International Test and Evaluation Program for Humanitarian Demining, which ended in July 2010.

Trials

Based on criteria applicable to humanitarian demining, such as cost, weight, robustness, carried force, etc., suitable magnet tools were selected and designed. Images 1–4 show examples of the magnet tools trialed in Cambodia and Angola. The data necessary to quantify the clutter reduction by applying the magnet tools was gathered during live demining operations in Cambodia and Angola with the Cambodian Mine Action Centre and Norwegian People’s Aid, respectively, as partners. To this end, a procedure was set up to train the local deminers in the magnet-tool use. During the trials the deminers were divided into several groups. All deminers in one group worked with one.
Strong handheld magnet tools with niobium magnets can be used in manual demining operations to remove metal clutter and thereby reduce the number of metal-detector false alarms. The magnet tools are cheap and easy to handle in comparison to a dual-sensor detector. Various magnet-tool trials in live demining operations did not show a quantitative increase in the cleared area per day. This is most likely due to the fact that the deminers working with the magnet tools encountered more magnetic clutter than the reference group. However, the deminers experienced the tools as a useful addition to their toolkit as they are convinced that the magnet tools speed up the demining process. Therefore, the magnet tools are useful in supporting a deminer's strenuous job and are now included in the toolkit of the NPA deminers in Angola. ❅  

Acknowledgments  

The authors thank the Netherlands Ministry of Defence (and especially Lt. Col. Alex Keizer and Lt. Col. Leon Lagerwey) for their support. The Cambodian Mine Action Centre and Norwegian People’s Aid were partners in the project’s trials and pilot implementation. Without the support and feedback of their staff and deminers, this project would have been impossible. Erik Tollefsen from GICHD and Noel Mulliner formerly with the United Nations Mine Action Service are acknowledged for their enthusiastic support throughout the project.

Finally, Goudsmit Magnetic Supplies in Waalre, the Netherlands, is acknowledged for its effort in redesigning and manufacturing the magnet tools used for the pilot implementation with NPA in Angola.

Figure 1(top) and 2 (bottom): Average area cleared per deminer per day (Figure 1) and the average number of metal parts found per square meter (Figure 2). Here the results of this trial in Malanje province, Angola, with NPA deminers are given. The true represents the deminers using the magnet-tool and the purple represents the deminers in the reference group who did not use the magnet-tool.  

Figure courtesy of author/CSOR

Trail Results and Pilot Implementation  

The trials of several types of magnet tools were conducted in Cambodia in 2006 and in Angola in 2007. Although many aspects—such as the mine threat, SOPs of the two demining organizations, etc.—were different, the results of these trials were quite similar. For this reason, only the results of the trial conducted in Malanje province, Angola are presented. Figure 1 shows the average area cleared per deminer per day (in square meters) for the deminers working with the magnet tool under trial (this tool is shown in Image 2 and Image 6) and for the deminers of the reference group, working without a magnet tool. Surprisingly, the deminers without the magnet tool were the most productive: On average they cleared 11% more land per day. This revelation can only be explained when considering that the deminers with the magnet tool encountered 15% more metal parts per square meter (Figure 2). At the end of all trials in Cambodia and Angola, all participating deminers were asked their experiences with the magnet tools. Without any exception they responded that the magnet tool sped up their work. Hence, the authors concluded the deminers’ lower productivity with the magnet tool is a result of an working in an area with more metallic clutter. Because the trials were conducted in live demining operations, controlling this aspect of the trials was impossible. The deminers used the magnet tool not only during the detection phase of the demining procedure, but also during excavation to find metal fragments in the removed soil.

The deminers who worked with magnet tools during the trials not only responded positively to the question of increased productivity by the magnet tools, but also recommended adding one of the trialed magnet tools (the ring magnet with the plastic casing and handle, shown in Image 2) to their demining toolbox. As a result of this recommendation, NPA Angola requested TNO to support a pilot implementation of this tool for all NPA deminers in Angola. For this pilot implementation, the tool was redesigned to allow production at the lowest price possible. One hundred samples were transported to Angola where the tools were handed over to the NPA deminers in October 2010 and were used in the clearance of a former military position at Camabole near the town of Malanje (Images 7 and 8).

Conclusion  

Figure 2: Average number of metal parts per square meter. The trials of several types of magnet tools were conducted in Cambodia in 2006 and in Angola in 2007. Although many aspects—such as the mine threat, SOPs of the two demining organizations, etc.—were different, the results of these trials were quite similar. For this reason, only the results of the trial conducted in Malanje province, Angola are presented. Figure 1 shows the average area cleared per deminer per day (in square meters) for the deminers working with the magnet tool under trial (this tool is shown in Image 2 and Image 6) and for the deminers of the reference group, working without a magnet tool. Surprisingly, the deminers without the magnet tool were the most productive: On average they cleared 11% more land per day. This revelation can only be explained when considering that the deminers with the magnet tool encountered 15% more metal parts per square meter (Figure 2). At the end of all trials in Cambodia and Angola, all participating deminers were asked their experiences with the magnet tools. Without any exception they responded that the magnet tool sped up their work. Hence, the authors concluded the deminers’ lower productivity with the magnet tool is a result of an working in an area with more metallic clutter. Because the trials were conducted in live demining operations, controlling this aspect of the trials was impossible. The deminers used the magnet tool not only during the detection phase of the demining procedure, but also during excavation to find metal fragments in the removed soil.

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Strong handheld magnet tools with niobium magnets can be used in manual demining operations to remove metal clutter and thereby reduce the number of metal-detector false alarms. The magnet tools are cheap and easy to handle in comparison to a dual-sensor detector. Various magnet-tool trials in live demining operations did not show a quantitative increase in the cleared area per day. This is most likely due to the fact that the deminers working with the magnet tools encountered more magnetic clutter than the reference group. However, the deminers experienced the tools as a useful addition to their toolkit as they are convinced that the magnet tools speed up the demining process. Therefore, the magnet tools are useful in supporting a deminer’s strenuous job and are now included in the toolkit of the NPA deminers in Angola. ❅  

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