Technical notes for mine action

TNMA

# Technical Note 09.10 / 01

Version 1.0

# PROM 1 - Metal Detector Warning

## Warning

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The contents of this document have been drawn from an evaluation trial report by the European Commission (EC) Joint Research Centre (JRC), and have been technically validated as far as reasonably possible. Users should be aware of this limitation when utilising the information contained within this document. **They should always remember that this is an advisory document only; it is not an authoritative directive.**

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## Foreword

Management practices and operational procedures for humanitarian mine action are constantly evolving. Improvements are made, and changes are required, to enhance safety and productivity. Changes may come from the introduction of new technology, in response to a new mine or UXO threat, and from field experience and lessons learned in other mine action projects and programmes. This experience and lessons learned should be shared in a timely manner.

Technical Notes provide a forum to share experience and lessons learned by collecting, collating and publishing technical information on important, topical themes, particularly those relating to safety and productivity. Technical Notes complement the broader issues and principles addressed in International Mine Action Standards (IMAS).

Technical Notes are not formally staffed prior to publication. They draw on practical experience and publicly-available information. Over time, some Technical Notes may be 'promoted' to become full IMAS standards, while others may be withdrawn if no longer relevant or if superseded by more up-to-date information.

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Technical Notes are compiled by the Geneva International Centre for Humanitarian Demining (GICHD) at the request of the United Nations Mine Action Service (UNMAS) in support of the international mine action community. They are published on the James Madison University (JMU) website (http://www.hdic.jmu.edu/) and the GICHD website (http://www.gichd.ch/).

## Introduction [1]

The European Union (EU) Joint Research Centre (JRC) were requested by a demining organisation to conduct trials into the feasibility of the activation of PROM 1 anti-personnel mines by physical contact with a metal detector that had failed to indicate the presence of the mine.

It is not proposed to reproduce the full report in this technical note, only the abstract and conclusions. The final report can be located on the JRC website at http://demining.jrc.it/aris/publications/prom/abstract.htm, or from:

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[1] All information in this TNMA was obtained from an evaluation trial report by the European Union (EU) Joint Research Centre (JRC).

# PROM 1 - Metal detector warning

## 1. Scope

This Technical Note provides technical information on the possibility that a metal detector, if used in an unusual sweep pattern, could possibly fail to indicate the presence of a PROM 1 and then initiate the mine by accidental contact. The EU JRC evaluation trial provides evidence of such a possibility; therefore demining organisations should be made aware of this potential hazard.

## 2. Background

It is not proposed to reproduce the full report in this Technical Note, which only serves to warn the mine action community of this potential hazard, and to provide contact details from which the full report may be obtained.

## 3. Abstract of EU JRC Report

Measurements of the horizontal detection distance of a VPROM1 inert mine have been made with five different models of commercial metal detectors, two having differential coils and three having non-differential coils, in air and in highly magnetic soil, with the heads horizontal and tilted. The VPROM1 is the training version of the PROM1 antipersonnel bounding fragmentation mine.

The measurements were made in response to a request by a demining agency, which suspected that some fatal accidents involving activation of PROM1's had been due to physical contact of a metal detector with the protruding pronged fuze. It was thought that the presence of regions of reduced sensitivity straight in front and behind the head of a differential coil detector had prevented the detector giving its alarm sound early enough to provide adequate warning. In the work reported here, horizontal detection distances at prong height of the order of 10cm were recorded. Significant reductions in detection distances were found in sectors 30º wide.

No similar effect was found for the non-differential coil detectors. The results are therefore consistent with the above hypothesis. The waveform of the detector current appeared to play no part. Highly magnetic soil had only a small effect.

All the detectors, including those with differential coils, were sufficiently sensitive to make it possible to detect the PROM 1 in a preliminary sweep, made well above the prong height.

## 4. EU JRC Report Conclusions

### 4.1. Differential receive coil metal detectors:

The measurements show that there are regions of reduced sensitivity in front and behind the search head of the two differential coils metal detectors. The sensitivity pattern is clearly described by the manufacturers in the relevant operator manuals and, in fact, highlighted as a potentially useful feature.

In the work reported here, horizontal detection distances at prong height of the order of 10cm were recorded. Significant reductions in detection distances were found in sectors 30º wide.

The detectors use different current forms (pulsed and continuous wave) and have search head with different shapes (circular and elliptic) but show similar loss of sensitivity.

Tilting of the search head of the differential coil detectors had only a small effect on the sensitivity patterns. The regions of reduced sensitivity were moved but not significantly so.

Highly magnetic soil had only a minor effect on the shape and size of the sensitivity graph.

### 4.2. Single receive coil metal detectors:

All the single receive coil metal detectors tested, detected the VPROM1 with a sufficient safety margin at all angles, independently of the current forms and the shapes of the search head.

Highly magnetic soil had only a minor effect on the shape and size of the sensitivity graph.

### 4.3. Observations:

The tests reported here were deliberately conducted with a sweep pattern different from that recommended by the manufacturers, but which might conceivably occur in practice.

The state of maintenance of detectors after rigorous field use should not be overlooked as a contributing factor in accidents. Two of the detectors loaned from BiH showed poor electronic stability.

There may be some risk of missing a mine due to accidental manual or automatic re-zeroing, depending on the design of the detector and the manner in which it is held and swept. The importance of matching Operating Procedures and training to the particular detector in use is especially apparent from this observation.

Despite the large metal content of the VPROM 1, the "weak spots" in front and behind the search heads of the two differential coil metal detectors tested were large enough that it would be possible to get very close to the prongs before the detector sounds. If a detector of this pattern were moved forward or backward towards a PROM 1 at any realistic sweeping speed, and the search height matched the height of the mine prongs, a deminer would have only a fraction of a second to react before the mine was activated.

**We consider that these results should be reflected in future operating and training demining procedures.**

### 4.4. Recommendations:

Differential receive coil detectors, with a coil format similar to those tested here, must be swept laterally and not in a forward / reverse motion.

Personnel should be trained to follow the operating procedure recommended by the manufacturer for the specific model of detector in use.

When the presence of PROM 1’s is considered possible, the deminer should make a preliminary sweep at a height of about 20cm above the soil on a medium sensitivity setting. In this way, any PROM 1 present would be safely detected, without false alarms from small metal objects. Another sweep, at a lower height, should then be conducted to detect mines with lower metal content