CAMBODIAN MINE ACTION CENTRE

INTERNAL METAL DETECTOR TRIALS

16 – 25 August 2004

CAMBODIAN MINE ACTION CENTER (CMAC)
METAL DETECTOR TRIAL REPORT

August 2004

References

[1] Afghanistan Trials Report Summary – February – March 2002

[2] "Metal Detector Trial", Letter, 2 July 2004, File 157/DG/CMAC/04

[3] "Humanitarian Mine Action – Test and Evaluation – Metal Detectors", CEN Workshop Agreement CWA14747:June 2003

[4] "Metal Detector Handbook for Humanitarian Demining", Guelle, Smith, Lewis & Bloodworth, 2003, ISBN 92-894-6236-1

[5] "International Pilot Project for Technology Co-operation, Final Report", Das, Dean, Lewis, Roosenboom & Zahaczewsky, EUR 19719 EN, 2001

Introduction

1. CMAC conducted internal trials of four metal detectors in August 2004 to determine the most suitable metal detector for operations and conditions in Cambodia.

2. Four international firms were invited to participate as they were recognized as leading manufacturers of metal detectors appropriate for humanitarian mine clearance. They had also participated in the UN supported Afghanistan Detector Trial of 2002[1] and will be represented in the forthcoming EU sponsored STEMD[1] metal detector trials in Laos (October 2004). All four manufacturers submitted detectors for evaluation.

3. The four firms and the metal detectors tested were:

a.	Ceia / Italy	Model MIL-D1 (version 3.30)	Ser # 20414020101
b.	Ebinger / Germany	Model 421 GC	Ser # 1203
c.	Minelab / Australia	Model F3	Ser # 11011
		Model F1A4	Ser # 57944[2]
d.	Schiebel / Austria	Model ATMID	Ser # 112218

4. Each manufacturer was requested to provide two of the same production model detectors for the trial so that in the event that one detector broke down, the other detector could continue to be tested. Some tests varied slightly from the original criteria outlined in reference [2] to suit Cambodian conditions. The tests are explained in Annexes A – G.

[1] STEMD – "Systematic Test and Evaluation of Metal Detectors" project.

[2] Not for trial purposes but used only for occasional confirmation/comparison as this is the most common in-service detector used by CMAC.

Conduct of trials

5. The first part of the trial was conducted at the CMAC Training Centre (TC) in Kampong Chhnang and served two purposes:

a. to establish baseline tests to compare the detector performance in the air and controlled soil pits with known and repeatable targets, and

b. to bring the participating manufacturers' representatives to one place in order to train the CMAC trials team.

6. The second part of the trial was conducted in conjunction with six experienced CMAC de-miners at two sites in and near Kampong Chhnang. These deminers were selected from three CMAC Demining Units (DU) and represented typical users of the equipment.

7. The trials team oversaw the process while the participating manufacturers' representatives were welcome to attend as observers.

The Trials Team

The trials and evaluation team comprised: (left to right)

Back Row: Mr Rin Sitha (deminer), Mr Sok Ly (deminer), Mr I Soeun (team leader), Mr Chhoun Sarik (Technical Instructor), Mr Mong Sokhunthearath (Metal Detector Officer).

Front Row: Mr Horng Ra (deminer), Mr Nhep Nora (deminer), Mr Phum Pearith (deminer), Mr Chap Srapon (deminer).

Absent: Major Alastair Rankin, Trial Coordinator, Major Barry Smith, evaluator, Mr Ian Dibsdall, scientist.

Evaluation criteria

8. The technical performance of the detectors was originally to be evaluated in nine tests conducted at the CMAC Training Center (TC) in Kampong Chhnang and at various locations in the field. These tests were designed using previous UN and CMAC trials and the CEN CWA14747:2003 working agreement[3] as a guide. It was mutually agreed to dispense with two of the proposed tests (Tests 3 and 9) for Electromagnetic Sensitivity as these results were for interest only and data is readily available from a variety of sources. It was also mutually agreed that Test 6, the Contaminated Soil Lane Test, would be more applicable if changed to a Laterite Soil Depth Test.

The tests conducted are listed below. Full details can be found in Annexes A – G.

Test	Title	Purpose
1	In-Air Test	Determine maximum detection capability against international standard targets (ITOPs)
2	Compacted Soil Depth Test	Determine maximum detection capability against inert Type 72 AP mines in compacted normal soil
4	Proximity Test, small target near small target	Determine minimum distance at which two small AP mines could be distinguished as separate targets
5	Compacted Soil Test Lane	Determine the capability of the various metal detectors operated by experienced deminers to detect buried targets in a compacted normal soil lane
6	Laterite Soil Depth Test	Determine maximum detection capability against inert Type 72 AP mines in laterite soil
7	Wet Soil Test Lane	Determine the capability of the various metal detectors operated by experienced deminers to detect buried targets in a wet soil lane
8	Proximity Test, large target near small target	Determine minimum distance at which a large AT mine and a small AP mine could be distinguished as separate targets

Table 1 – List of Tests

9. Of the remaining seven tests, four were designated as "pass" or "fail" tests and three were for information/confirmation purposes only as detailed below. The tests were not conducted sequentially, but in parallel. Thus, a complete picture of performance and suitability was only available at the end of all the individual tests.

<u>Pass or fail test considered independently critical by itself:</u>

Test No. 2: Compacted Soil Depth Test (TC)

This was the most critical of all tests because the detectors had to locate a Type 72 mine in natural Cambodian soil. The Type 72 mine is one of the most common mines found in Cambodia and is generally difficult to detect at depth. To pass the test, a detector had to locate the buried mine at a depth of 11cm or more. Detection at less than 11cm would be recorded as 0cm. Any detector that failed this test was considered technically unacceptable.

<u>Pass or fail tests considered critical as a group:</u>

Test No. 5: Compacted Soil Test Lane (TC)
Test No. 6: Laterite Soil Depth Test (Kampong Chhnang Laterite Pit)
Test No. 7: Wet Soil Test Lane (TC)

A detector had to pass at least two of the three tests in this group to be considered technically acceptable.

Test for information purposes only:

Test No. 1: In-Air Test (TC)
Test No. 4: Proximity Test between a Small Target near a Small Target (TC)
Test No. 8: Proximity Test between a Large Target near a Small Target (TC)

Summary of results

10. Following is a table illustrating how the four firms fared in the seven tests.

Equipment	Pass or fail test critical by itself	Pass or fail tests critical as a group			Tests for information purposes only		
	Test 2	Test 5	Test 6	Test 7	Test 1	Test 4	Test 8
Ceia Mil D-1	Pass	Fail	Pass	Pass	Data recorded	Data recorded	Data recorded
Ebinger 421 GC	Pass	Fail	Pass	Fail	Data recorded	Data recorded	Data recorded
Minelab F3	Pass	Pass	Pass	Fail	Data recorded	Data recorded	Data recorded
Schiebel ATMID	Pass	Fail	Pass	Fail	Data recorded	Data recorded	Data recorded

Table 2 – Results of Tests

11. All four firms passed Test No. 2. Full data can be seen in Annex B.

12. The metal detectors were then evaluated on their respective performance on the 'pass or fail tests considered critical as a group'. The results were:

a. Ceia: Pass
b. Ebinger: Fail
c. Minelab F3: Pass
d. Schiebel: Fail

13. This left only two technically qualified detectors.

14. The maintenance, ergonomics and operability aspects were assessed by means of a questionnaire completed by the deminers after approximately four days experience with each detector. The questionnaire was written and conducted in Khmer and will only be used for internal reference as there were no significant problem areas with any detector with the exception of battery life which the manufacturer's representatives are aware of. An English version of the questionnaire can be seen at Annex H.

15. In Reference [2] it was requested that all parties afford these trials the sensitivity grading of CMAC-IN-CONFIDENCE, and that each manufacturer would be given reports that contained their information only. In order to achieve this the report would need to be re-written for each manufacturer and the essence of the report would be lost or have little relevance. As each manufacturer had representatives at the trials who are fully aware of the performances of all detectors, the decision has been taken to send all parties the full report. CMAC maintains that this was an internal trial and respectfully requests the confidentiality of the report be upheld within this group.

Conclusions

16. In light of the positive comments from the manufacturer's representatives CMAC concludes this was a fair and impartial test in typical Cambodian conditions. The results show that while Minelab F3 and Ceia MIL-D1 passed the criteria, more emphasis was placed on Test 5: Compacted Soil Test lane than on Test 7: Wet soil lane. This put the Minelab F3 in the lead while the in-service Minelab F1A4 used for comparisons was as good as, and in some cases better than the Minelab F3. The next most suitable was the Ceia MIL-D1 followed by the Ebinger 421 GC, then Schiebel ATMID.

Recommendations

17- With reference to the conclusions drawn in paragraph 16, the following recommendations are made:

a. CMAC stay with the existing in-service Minelab F1A4 as the most suitable metal detector for Cambodian conditions.

b. CMAC investigate the procurement of sufficient quantity of Ceia MIL-D1 metal detectors to equip and train a platoon for operation and further extended evaluation with a view to adding this detector to the CMAC tool box.

Acknowledgements

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Jay Steed, Representative, Ebinger, QAsia Company Limited, Cambodia.

Hugh Graham, General Manager Countermine Division, Minelab Electronics

Propriety