**Feature Article 2**

**MINEHOUND™ Detector System**

The UK Department for International Development (DfID), in collaboration with the German Foreign Ministry (Auswärtiges Amt), contracted ERA Technology of the UK to carry out extensive field trials in Cambodia, Bosnia and Angola of an advanced technology, dual sensor, and hand-held landmine detector system called MINEHOUND™. This detector combines a metal detector with a Ground Penetrating Radar (GPR). The aim is to reduce the false alarm rate by at least 2:1, which will make a significant difference to the efficiency of demining operations. The Mines Advisory Group (MAG) of the UK assisted with the trials in Cambodia and Angola and Norwegian Peoples Aid (NPA) assisted in Bosnia.

Trial versions of MINEHOUND™ were built and used as a follow up detector, after existing standard operational procedures had been applied to the mine affected areas. At no stage during the trial were the dual sensor detectors operated as primary detectors.

The main objectives of the project were to:

- Determine (document against ground truth) the performance of the dual technology detector, in terms of detection and false alarms, in trials in Cambodia, Bosnia and Angola.
- Determine the potential improvement in efficiency of demining operations.
- Review and report on the trials, including both quantitative performance data and qualitative feedback from the deminers.
- Assist the further development of the technology to production.

ERA Technology Ltd (UK) and Vallon GmbH (Germany) have designed and built MINEHOUND™, which incorporates state-of-the-art technology in landmine detection. Fifteen units were built for the trials and five units were shipped to each country for the period of the trials. Both MAG and NPA provided excellent support for the trials, which could not have succeeded without their practical assistance in logistics, site preparation and committed support from the deminers and their supervisors.

The trials were overseen by representatives of the International Test and Evaluation Programme (ITEP), which includes Belgium, Canada, the Netherlands, Sweden, the UK, Germany, the United States, and the European Commission. The trials of pre-production units in live minefields began in August 2005 and continued through to February 2006.

The trials took place over an 8-week period in each country. The performance of MINEHOUND™ was assessed in live minefields and compared against the existing, in-service, metal detector. MINEHOUND™ was not used for actual clearance but its performance was recorded for analysis. The deminer used the existing, in-service, metal detector to detect potential targets and, having found one, used MINEHOUND™ to determine whether metal was also indicated and what was the GPR response of the target. When the signal had been investigated, the deminer recorded the type and size of target, as well as its depth. The results were recorded and a database of MINEHOUND™ performance in a live minefield was built up.
On arrival at the minefield the ERA team, and ITEP representatives, worked with the NGO to clear suitable areas. One lane was created for calibration and two lanes for the blind tests. The deminers’ performance was also assessed weekly using a 12m “blind lane”. Using specially designed targets both deminers and ITEP staff carried out blind tests. The calibration targets were comparable in size and content with a PMA2 mine and were buried at depths up to 10 cm next to metallic clutter of various sizes. In every blind test lane an equal number of calibration targets and clutter were emplaced. The training sites were established close to the live minefields.

The conditions in Cambodia were hot and the ground was frequently waterlogged. The soil was also heavily mineralised and these conditions provided a demanding test.

In the live minefields in Cambodia, the deminers, using the Schiebel ATMID, recorded a total of 1,143 detections of which 13 were mines. However using MINEHOUND™, the deminers detected all the mines and only 210 suspect readings requiring further investigation, giving an overall reduction of better than 5 to 1 in terms of clutter rejection.

In the live minefields in Bosnia, two deminers, using the CEIA MIL D1, recorded a total of 1069 detections of which 7 were mines. Using MINEHOUND™, the deminers detected all the mines and only 142 suspect readings requiring further investigation, giving an overall reduction of better than 7.4 to 1 in terms of clutter rejection. In the blind lanes in Bosnia over the 8-week trial period the deminers achieved an averaged Probability of Detection (PD) of 92.5% and an average reduction in false alarms of 1.89:1. However by the last week of the trial the averaged PD had risen to 95.5%.

In the suspect minefields in Angola, four deminers encountered a total of 1,153 detections none of which were mines. Using MINEHOUND™, the deminers detected 272 suspect readings requiring further investigation, giving an overall reduction of better than 4.24 to 1 in terms of clutter rejection. In the blind lanes in Angola over the 8-week trial period the four deminers achieved an averaged Probability of Detection (PD) of 92.5%. However, by the last week of the trial the PD had risen to 98% and the reduction in false alarms to 4.6:1 illustrating an improved performance of the deminers over time.
6-week trial period, the deminers achieved an averaged PD of 96.5% and an average reduction in false alarms of 3:1. However by the last week of the trial the averaged PD had risen to 100%.

In the minefield in Luau the deminers encountered 106 detections of which 3 were mines. Using MINEHOUND™, the deminers detected all the mines and 14 suspect items giving an overall reduction of better than 7.57 to 1 in terms of clutter rejection.

The trials did not record the time taken by the deminer to search, mark and excavate targets, but it is useful to visualise the impact in time that the reduction in false alarm rate can make. With a 5:1 reduction in false alarms a deminer using MINEHOUND™ can achieve in one day what a deminer using a metal detector would achieve in a week, or one deminer can achieve the same output as 5 deminers today. Of course this assumes a number of things including a vegetation free area as one deminer cannot cut the vegetation of 5 deminers as fast. However, if the ground can be prepared for him with a brush cutter for instance, the statistical returns can be achieved in areas of vegetation overgrowth as well.

These statistics should be of relevance for management planning today.

**Summary**

- All the trial objectives were achieved.
- Over 3,000 signals in live minefields were recorded.
- **ALL** the mines encountered in live minefields were detected by deminers using MINEHOUND™.
- In live minefields an overall improvement of greater than 5.4:1 in the reduction of false alarms was obtained compared with the in-service metal detectors.
- Working in a live minefield and following up the in-service detector with a new technology was effective and safe.
- The time to train experienced deminers was measured in hours.
- The feedback from the trials showed that the dual detector was effective.
- The deminers contributed to optimising the production design with valuable feedback.

MINEHOUND™ is now being jointly prepared by ERA Technology and Vallon GmbH for product release in late 2006.