GROUP OF GOVERNMENTAL EXPERTS OF THE STATES PARTIES TO THE CONVENTION ON PROHIBITIONS OR RESTRICTIONS ON THE USE OF CERTAIN CONVENTIONAL WEAPONS WHICH MAY BE DEEMED TO BE EXCESSIVELY INJURIOUS OR TO HAVE INDISCRIMINATE EFFECTS

CCW/GGE/VII/WG.2/WP.2
10 March 2004

Original: ENGLISH

Seventh Session
Geneva, 8-12 March 2004
Item 8 of the revised provisional agenda

Working Group on Mines Other Than Anti-Personnel Mines

Landmine detection Technology

By Australia

INTRODUCTION

1. Recent plenary discussions and Working Papers presented to the Working Group on Mines Other Than Anti-Personnel Mines (MOTAPM) have argued that emerging detection technologies may negate the requirement for MOTAPM to contain a minimum of 8 grammes of iron, in order to be detectable. However, an analysis of current and emerging detection technologies conducted by the Australian Army, in conjunction with the Australian Defence Science and Technology Organisation, has found that Metal Detection is likely to remain an essential element of all cost-effective individual mine detection methods for the foreseeable future. The aim of this paper is to outline the relative merits of the leading technologies in mine detection, and demonstrate the ongoing importance of inclusion of a detectability standard (agreed as 8 grammes of iron) in all future MOTAPM proposals.

EMERGING TECHNOLOGY AND PROCEDURES

2. The most promising countermine systems currently in development aim to exploit the benefits of sensor fusion. Sensor fusion involves combining the output from a number of sensor types in order to offset the limitations of an individual sensor type.

Landmine Detection Technologies for Sensor Fused Systems

3. **Metal detectors**. Metal detectors will remain a fundamental component of multi-sensor detection systems, due to their low cost, ease of use, and sensitivity and reliability in all weather and soil moisture conditions. The common limitation of metal detectors is the need to be within close proximity of the mine, and that they cannot discriminate between mines and metal debris. However, by incorporating other sensors in a multi sensor system, they can now reduce false alarms caused by metallic debris.

4. **Ground penetrating radar (GPR)**. GPR operates by transmitting an electromagnetic signal into the soil and detecting a target reflected signal at the receiver. One of the problems with GPR is that the reflected signal can be caused by roots, rocks and hollows within the soil.

5. **Thermal Imagery.** Mines generally retain or release heat at a rate different from their surroundings. Thermal infra red detection uses thermal imagery (TI) to detect the heat differentials between the buried mines and the surrounding soil. This technology has strong potential for stand-off detection, however, it is limited by high daytime temperatures which shield underground temperature differentials. However, despite its apparent limitations, the availability of forward looking infra red (FLIR) systems and the continued refinements in detector sensitivity, using automatic target recognition, may enable this technology to be employed in detection of mined areas, if not detection of individual mines.

6. **Thermal Neutron Activation (TNA)**. TNA relies on accelerating the nitrogen nuclei contained in explosives, causing them to emit specific gamma-rays which can be used to detect the presence of a mine. Several countries are experimenting with this technology, however, at this time the system is slow, heavy and produces a radiation hazard. Consequently, it is unlikely that a viable TNA sensor will be available in the near future.

7. **Nuclear Quadrupole Resonance (NQR)**. NQR involves the use of an electro-magnetic pulse to excite nuclei within a substance. The excited nuclei emit a signature resonance that can then be compared to a signature library to identify specific chemicals. However, NQR remains slow to detect TNT and cannot be used to detect metal cased mines, and is therefore considered immature at this stage.

8. **Artificial Chemical Vapour Sensors**. Advances in the understanding of olfaction are leading to the development of artificial chemical vapour sensors that attempt to replicate the ability of dogs to detect chemical odours from buried mines. Several militaries are pursuing research targeted at detecting mines through odour sensors based on antibodies. However, a viable real-time product from this technology is not expected in the short term.

9. The emerging mine detection technologies outlined in this paper can be classified according to their maturity, cost, and complexity, summarised below in Table 1.

SENSOR TECHNOLOGY	MATURITY	COST & COMPLEXITY
Metal Detection	Available	Low
Ground Penetrating Radar	Near	Medium
Thermal Imagery	Near	Medium
Thermal Neutron Activation	Mid	High
Nuclear Quadrupole Resonance	Far	High
Artificial Chemical Sensing	Mid	High

Table 1: Maturity, Cost and Complexity of Emerging Landmine Detection Technologies

CONCLUSION

10. From this brief examination of emerging detection technologies, it is evident that there is no technology solution available in the near term which will negate the humanitarian requirement for all MOTAPM to be detectable using Metal Detection technology.