
SURROGATES FOR DE-MINING EQUIPMENT EVALUATION AND DE-MINER TRAINING APPLICATIONS



PMA-1 Mechanical Reproduction Mine

BACKGROUND

Amtech Aeronautical Limited has developed Mechanical Reproduction Mines (MRM's) or surrogates for several anti-personnel mine types. Designed to realistically model the physical shape, size, fuse principles and trigger force characteristics, the surrogates provide an important tool for evaluating the effectiveness of mechanical assistance equipment in mine clearance operations and for training de-miners. The surrogates were developed to the demanding requirements of the Canadian Centre for Mine Action Technologies (CCMAT).

CCMAT, co-located with Defence Research Establishment Suffield, has a mandate for studying how technology can be used to improve humanitarian de-mining conditions in countries that have an anti-personnel mine problem. CCMAT's interest in mechanical assistance systems for land mine clearance is motivated by the need to find existing or new technologies that are effective for land mine clearance. Mechanical assistance systems will markedly increase the clearance rate while reducing the risk of injury to de-miners through the use of machines that prepare and condition an area for de-mining. This kind of preparatory and conditioning work can include the removal of trip wires and brush overgrowth and the softening of the soil.

Equipment evaluators must consider several factors such as system mobility, power and performance against a variety of buried anti-personnel land mines. However, to obtain statistically significant results, it is necessary to use a sufficient number (several hundreds) of mines. The use of that many real mines creates significant logistical and safety challenges. The Mechanical Reproduction Mines address these concerns while preserving a high degree of fidelity in terms of land mine mechanical and physical characteristics.

SURROGATE DESCRIPTION

Surrogates have been developed for a number of anti-personnel mine types including the PMA-1, PMA-2, PMA-3, PMN, and Type 72A mines. Other types of anti-personnel as well as anti-tank surrogates are being considered for future development.

Physically similar in terms of shape and weight to the real mines, the surrogates faithfully simulate the fusing principles and trigger force characteristics and conditions under which the real mines will activate. In this way, the surrogates behave realistically when exposed to a variety of mechanical assistance and clearance equipment and technologies. This similarity has been established by extensive testing under carefully controlled conditions and by comparison with the measured fusing characteristics of the real mines.

The surrogates are designed to be buried for lengthy periods of time under a broad range of environmental conditions. Each surrogate type is uniquely identified and can be remotely interrogated under a variety of burial depth and soil conditions. The interrogation permits verification of the functional state (active or tripped) of the surrogate and its location. The surrogate does not require any electrical power source which ensures its long in-ground and shelf life.

HIGH VOLUME TOOLING

Extensive effort has been directed towards the design of injection moulding tooling for the surrogate components. In this way, higher volume, lower cost production of each of the surrogate types is possible permitting the cost-effective set-up of large surrogate mine fields. Multiple tests are also possible at reasonable cost.

SURROGATE READER/IDENTIFICATION MODULE

A key element of the surrogate system is a hand-held reader that can be used to log the location of the surrogates and verify their functional state. The same reader can be used to collect data on a surrogate mine field after a clearance operation thereby determining which surrogates have been triggered.

The data logged by the reader can subsequently be downloaded to an analysis computer for post-test processing and display. In this way, the performance of mechanical assistance and clearance equipment and methods can be statistically evaluated and compared. Mechanical assistance and clearance efficiency and performance can be objectively quantified.

APPLICATIONS

Mechanical Reproduction Mines can be used in a number of distinct ways, including the following:

- Set-up of surrogate mine fields for equipment and technology evaluation purposes.
- Development of more optimal techniques for the use of clearance equipment.
- Training of de-miners in the effective and safe use of clearance and detection equipment.

The realism of the fuse and physical characteristics of the surrogates provides for realistic response under safe and controlled conditions. The surrogates are a high fidelity, unique, inexpensive and safe training and evaluation solution.

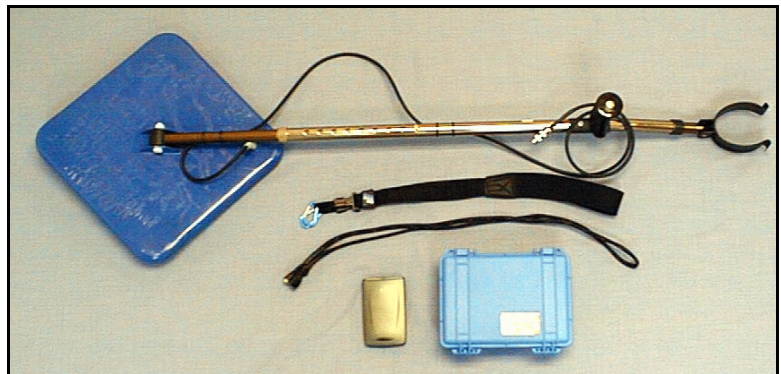
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PMA-2 Mechanical Reproduction Mine



Reader / Identification Unit

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