METAL DETECTORS

Time Domain Metal Detection

The EM61-MK2 Metal Detector is a high power, high sensitivity metal detector suitable for applications in the detection of both ferrous and non-ferrous metal.

Based on the design principles of time domain electromagnetics, each system includes a single transmitter coil and two receiver coils. A primary magnetic field, generated by current supplied to the transmitter coil, induces eddy currents in nearby metallic objects. The induced eddy currents decay with time – at a rate that is dependent on the characteristics of the object – producing a secondary magnetic field with the same rate of decay. The time-decay of the secondary magnetic field generates a signal within each of the two receiver coils, thereby confirming the presence of metal.

Common applications, in several fields of geophysical practice, include the detection of environmental hazards such as drums and underground storage tanks; utilities and infrastructure; construction and industrial waste; and, unexploded ordnance (UXO).

Recent advances in design and application have enhanced system performance since the successful introduction of the original EM61 Metal Detector. Providing greater functionality and enhanced detection within a wider range of operating environments, the EM61-MK2 represents a superior choice for applications in the detection of buried metal.

EM61-MK2 Metal Detector

The EM61-MK2 Metal Detector provides multiple measurements of the decay of the secondary magnetic field associated with any metallic object. Data available from as many as four time gates – geometrically spaced in time from 216 µs to 1,266 µs – provide recognizable improvements in both detection and characterization.

The earlier time gates available with the EM61-MK2 improve the detection of smaller targets most significantly. The decay rate of the secondary field associated with smaller targets is relatively quick; measurements at early times, therefore, are required to ensure the detection of secondary magnetic field response that may not be available at later times.

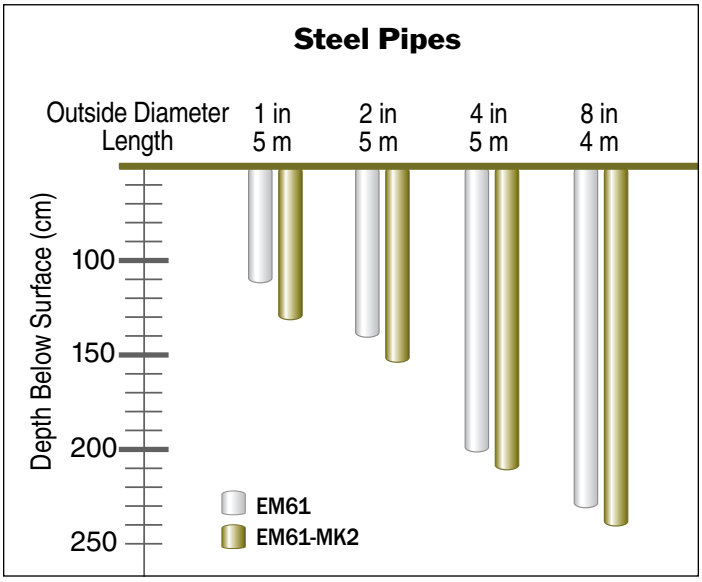

Figure 1: Depth of Detection for Steel Pipes

As an example, a 20 mm projectile (ordnance item), oriented horizontally, is not detectable with the original EM61; comparatively, the earliest gate of the EM61-MK2 can detect the same target at a depth of 8 cm (3 in.) below surface. A 20 mm cartridge, oriented horizontally, detectable at 3 cm (1 in.) with the EM61, can be detected to a depth of 38 cm (15 in.) with the EM61-MK2. (The same 20 mm cartridge is detectable at 68 cm (27 in.) when oriented vertically.)

Additionally, the early gates of the EM61-MK2 provide an increase in the response amplitude from any target, regardless of size, of two to five times the response from the original EM61. As a result, the depth at which any target can be detected is increased (*see Figure 1*).

A mid-range time gate is included to provide a response equivalent to the original EM61. Data from the mid-range gate allows for a comparison with, and/or the continuation of data sets generated with the original system.

A late time gate provides further description of the time-decay associated with any target – information for the development of an apparent time-constant to be associated with each target. The apparent time-constant data normalizes the complete time-decay to a single number. With the assumption that a unique apparent time-constant is associated with any target type, a simple level of discrimination becomes possible.

All data can be easily integrated with GPS data with support from the DAS70 Data Acquisition System (see facing page) and an optional GPS antenna mount.

In addition to many new features, the EM61-MK2 continues to provide the valuable benefits of features introduced with the original EM61, including a calculation of the 'differential' data – to reduce or remove the effects of noise associated with surface and near-surface metal – and a calculation of the apparent depth to the target.

Towed Arrays

For a substantial increase in productivity, particularly over larger areas, multiple EM61-MK2 (or EM61) systems can be configured as a single array, to be towed behind a vehicle. Data collection is supported by the DAS70-ML Data Acquisition System that can receive data from as many as six individual inputs simultaneously. With a maximum data collection rate of 30 records (total) per second, travel speeds up to 10 kilometers/hr are possible.

Land Use Risk Assessment

Any proposed land use within the boundaries of a current or former defense site reasonably requires an assessment of risk associated with the possible presence of unexploded ordnance (UXO). For the purpose of such a risk assessment, an EM61-MK2 survey was performed over a an active small arms range in Niagara Falls, Canada.

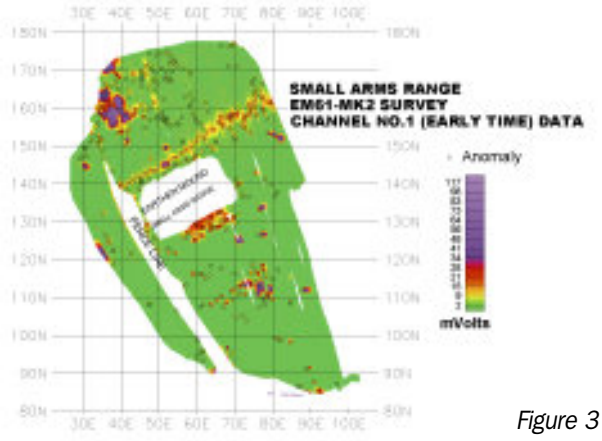

Figure 3

A review of the collected data reveals the increased sensitivity of the early time data (*Fig. 3*) relative to the late time data (*Fig. 4*), particularly to the smaller targets encountered at a small arms range. The anomaly "picks" from the early time data are indicated on the late time data for reference.

Further, a NE-SW oriented utility line, clearly delineated at early times, is not evident in the late time data.

A histogram of the calculated apparent time-constant associated with each anomaly is presented in *Figure 5*. With the assumption that any target type will present a unique apparent time-constant,

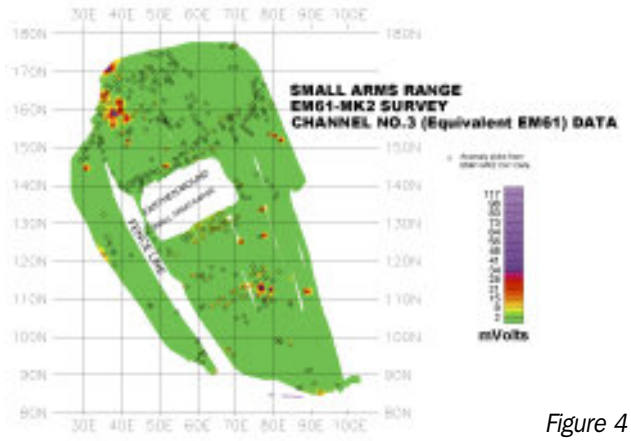

Figure 4

the presence of five or six separate target groups becomes evident. This information, combined with a representative intrusive sampling program, provides valuable assistance to the risk assessment analysis.

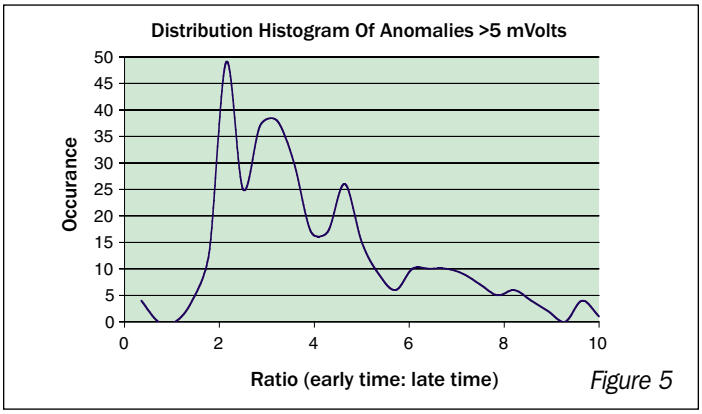

Figure 5

EM61-MK2 Technical Specifications

MEASURED QUANTITY	Four channels of secondary response in mV	
EM SOURCE	Air-cored coil, 1 x 0.5m size	
CURRENT WAVEFORM	Unipolar rectangular current with 25% duty cycle	
EM SENSORS	Bottom coil:	Air-cored coil, 1 x 0.5 m in size, coincident with EM source
	Top coil:	Air-cored coil, 1 x 0.5 m in size 30 cm above main coil
MAXIMUM OUTPUT	10 000 mV	
DYNAMIC RANGE	18 bits	
TIME GATES	Four gates of bottom coil response only, centered at 216, 366, 660 and 1266 µs; or, three gates of bottom coil response at 216, 366 and 660 µs, with one gate of top coil response at 660 µs.	
SYSTEM CONTROLLER	***Allegro*** field computer with 486 AMD processor; 16-line LCD display with 24 characters per line.	

ACQUISITION SPEED	Up to 16 records (4 time gates per record) per second
DATA STORAGE	24MB solid state memory for up to 1 000 000 records
POWER SUPPLY	12 V rechargeable battery for 4 h continuous operation
OPERATING WEIGHT & DIMENSIONS	Backpack: 8 kg; 60 x 30 x 20 cm Coil Assembly: 14 kg (23 kg in trailer mode) Bottom: 100 x 50 x 5 cm Top: 100 x 50 x 2 cm
SHIPPING WEIGHT & DIMENSIONS	38 kg (70 kg with trailer option) 112 x 61 x 26 cm (Box 1; harness mode only) 54 x 59 x 63 cm (Box 2; with trailer option)

Environmental Equipment & Supply

For further information contact: Environmental Equipment & Supply
Fax: (717) 901-8114 Tel: (800) 739-7706 (717) 901-8891
491L Blue Eagle Ave. Harrisburg, PA 17112
Web: www.envisupply.com E-mail: sales@envisupply.com