

Buried metal detection is most frequently carried out with sophisticated geophysical techniques, that provide improved depths of exploration and object discrimination in comparison to conventional inductive metal detectors. Frequent targets for metal detection surveys include underground storage tanks (UST), drums, pipelines, unexploded ordnance (UXO) and hazardous metal waste. Geophysical techniques frequently employed for metal detection include magnetometer, ground penetrating radar and time domain electromagnetometer.

Time domain EM systems such as the Geonics Limited EM61 series provide a powerful, effective means for rapid and accurate detection of buried metal objects. The EM61 has advantages over magnetometers that include much better lateral location accuracy, greatly simplified survey interpretation, more accurate target depth calculations, excellent cultural rejection, and detection of both ferrous and nonferrous targets. The magnetometer method may however, be utilised to explore for metallic objects at depths that exceed the nominal 3 to 4 metre maximum depth range of the EM61. The EM61 technique has advantages over ground penetrating radar that include greater penetration in conductive soils, faster operating rates and comparable spatial resolution.

The Geonics EM61 consists of a coincident transmitter and receiver coil, that pulses 150 times per second and measures during the off-time between pulses. Between each pulse, the EM61 waits until the response from the conductive earth dissipates, and then measures the prolonged buried metal

response generated from eddy currents in any metallic objects. The instrument is designed to isolate the signal generated by metallic objects from the response due to the electrical conductivity of the ground. The instrument is designed for high horizontal resolution and rejection of the influence of metal objects to the side of the instrument. As a result it is relatively insensitive to interference from nearby surface metal such as fences, etc. and as such it can be used on sites with known metal features and metallic debris. A highly portable hand-held version of the transmit-receive coil system is available.

The EM61 is capable of high rates of survey production and is utilised either in the wheel mounted mode for open areas or in the one-man portable configuration. In practice, grids are established with a maximum line spacing of two metres in order to detect smaller targets such as buried tanks or drums. An odometer is used for positioning in the wheel mounted mode, and grid stations are used in man portable mode. In some cases, an integrated GPS system may be used for automated positioning information. The data are provided by the instrument in millivolts, which are logged digitally and can be downloaded to a computer for processing.

The figure below illustrates the results of an EM61 survey to locate buried underground storage tanks. The survey clearly delineated the location of two, 8000 gallon fuel tanks that were buried parallel to the edge of an existing building. The effect of rebar is also evident in the anomalous concrete pad immediately east of the building.

