

UltraTEM: One-Pass Detection & Classification

In August 2019, an UltraTEM towed-array system passed the hardware validation test at the DoD Advanced Geophysical Classification Accreditation Program (DAGCAP) test-site at Aberdeen Proving Grounds. The UltraTEM system, developed by Gap Explosive Ordnance Detection in partnership with Black Tusk Geophysics, is a multi-component multi-sensor system that uses time-domain electromagnetic induction (EMI) to detect and characterize buried metal. It can be deployed for both terrestrial and marine environments and is nominally comprised of the following four components:

- 1) A high-current transmitter connected to multiple transmitter loops mounted to the detection system;
- 2) Multiple three-component receiver sensor cubes;
- 3) An UltraTEM data acquisition system (DAQ) running BTField software; and
- 4) A position and attitude system for tracking the position and orientation of the sensors.

The UltraTEM represents a next generation EMI sensor that provides Advance Geophysical Classification (AGC) capabilities. The system has a number of unique characteristics when compared to sensors already validated by DAGCAP including: (1) large transmitter coils and high transmitter dipole moment for increased detection depth performance; (2) extremely rugged and reliable electronics with precision time synchronization of all sensor streams to the pulse per second (PPS) from an integrated GPS receiver; (3) a wide swath width for rapid coverage of large areas; and (4) the ability to work in a one-pass detection and classification mode rather than the two pass mode currently used for AGC. The one-pass approach has the potential to significantly reduce the costs and financial risks of UXO remediation as survey costs are only weakly dependent on the number of anomalies per acre. The cost advantages of the one-pass approach are highlighted in the scenario over-page where the costs of clearing a 100-acre contaminated site with one and two-pass approaches are compared.



UltraTEM for rugged survey sites

Not all sites are amenable to the deployment of a towed-array system. The UltraTEM can also be configured as a push-cart or person-carried system. In that case a single transmitter loop (1.8 m x 1.0 m) and six sensor cubes are used to ensure that coverage rates are high (typically 2 to 4 acres per day).



Cost benefits of the One-Pass approach

Below we compare the costs of different approaches for clearing a 100 acre site. The most common approach to implementing AGC at the present moment is to use a two-pass approach with the first detection phase either involving a fast survey with an EM61 sensor or a slower survey with a MetalMapper 2x2 system. The first method is cheaper for low anomaly densities but becomes very expensive at high anomaly densities. Both the one- and two-pass approaches that integrate an UltraTEM system are cheaper. The one-pass approach is significantly cheaper at high anomaly densities as survey-time is independent of density.

Costing assumptions

100 acres
300 anomalies per acre
30,000 anomalies
8 acres/day for EM61
8 acres/day for UltraTEM (DGM)
4 acres/day for UltraTEM (AGC)
1 acres/day for MM2x2
200 anomalies/day for MM2x2
66% clutter rejection for MM2x2 & UltraTEM in DGM mode

