RESULTS OF AN AIRBORNE VERTICAL MAGNETIC GRADIENT DEMONSTRATION AT THE FORMER KIRTLAND PRECISION BOMBING RANGE, NEW MEXICO

WILLIAM E. DOLL
Battelle Memorial Institute
105 Mitchell Road, Suite 103
Oak Ridge, TN 37830
(865) 483-2548
dollw@battelle.org

CO-PERFORMERS: T. J. Gamey, J. R. Sheehan, L. P. Beard, and D. T. Bell (Battelle)

Vertical gradient configurations in magnetometer systems are common, and these are routinely used in ground-based unexploded ordnance (UXO) investigations. For boom-mounted airborne surveys, these configurations have the additional advantage of eliminating much of the rotor noise.

As a result of the successful prototype tests, Battelle developed two vertical magnetic gradient systems, and has completed several surveys with them. Both systems incorporate an integrated GPS-inertial navigation system for improved monitoring of aircraft orientation. The first is the VG-16 system, a 16-sensor (8 gradiometer) system with 12m swath width and 0.5 vertical separation between magnetometers. The second new system is the VG-22, a 22-sensor system with 7 gradiometers (14 magnetometers) deployed at 1m horizontal separation in the forward array, and two gradiometers in each side boom. With 6m swath width, VG-22 is intended for sites where greater resolution and sensitivity are required. Data acquisition and processing rates for the VG-16 are equivalent to those for the Arrowhead total field system, while the VG-22 requires roughly twice as much time to survey an equivalent area.

In addition to an assessment at Battelle’s West Jefferson Ohio test site for airborne UXO systems, both VG-16 and VG-22 were validated at a blind test grid established by ESTCP at the Former Kirtland Precision Bombing Range (FKPBR) wide area assessment (WAA) site in New Mexico. The 88 seeded test items included 155mm, 105mm, 81mm, 60mm, 57mm, and 40mm ordnance distributed over a 521-acre site. Performance results were compiled by the Institute for Defense Analysis (IDA). Overall, VG-16 detected 67% of the seeded items, while VG-22 detected 90%, including 100% of the 40mm and 80% of the 57mm. Mean miss distances were 0.44m for VG-16 and 0.30m for VG-22. Both systems fell short in detecting 60mm, which were missing nose cones and tail fins. We conducted a review of the blind seed results after receiving the IDA analysis. This showed that most of the missed items produced distinct anomalies in the VG-22 data set and would have been detected had a lower picking threshold been selected. This would raise the Pd to 98% for VG-22, but would require approximately 10,500 picks, compared to 6400 picks (12 anomalies per acre) in the original VG-22 dig list.

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