A Tale of two sensors: A side by side COMPARISON
 of two AGC SENSORS across challenging terrain

*Jessie Powers, Tetra Tech, Inc., Boston, MA*

*Brett Yarborough, Tetra Tech, Inc., Dallas, TX*

*Eric Kirwan, USACE, Fort Worth, TX*

Tetra Tech performed dynamic Advanced Geophysical Classification (AGC) surveys in 19 individual, non-contiguous grids totaling 5 acres using both a White River Technologies, Inc. (WRT) APEX advanced electromagnetic induction (EMI) sensor and a Geometrics MetalMapper2x2 (MM2x2) advanced EMI sensor. Both sensors were coupled with a Kaarta Stencil-2 simultaneous localization and mapping (SLAM) positioning system because global positioning system (GPS) coverage is denied by dense tree canopy across most of the project site. Grids were initially mapped with the MM2x2, with the intention of performing follow-up cued surveys at derived targets. After completion of the dynamic survey, however, the MM2x2 experienced hardware problems requiring manufacturer repair. Unavailability of replacement MM2x2 sensors coupled with projected extended repair times required an alternate solution to maintain project progress. New SLAM point clouds were collected to reflect changes in seasonal vegetation and APEX was used to collect data supporting one-pass classification, thus eliminating the need for follow-up cued surveying. Preliminary results from the MM2x2 survey of the 19 grids indicated a higher target density than originally estimated from older data using standard geophysical sensors. Mapping the grids with both sensors facilitates a direct comparison of site preparation requirements, survey production rates, sensor accessibility and maneuverability in challenging terrain, and derived target counts.

Deployment of the two systems required some adjustments to fieldwork. First, the APEX system required additional vegetation reduction to accommodate the platform height of 10 centimeters (cm), compared to the MM2x2 platform height of 26cm. Due to the increased weight and size of the APEX sensor, a utility terrain vehicle was also employed to safely and efficiently transport the APEX between grids. Collection of data to support one-pass classification is inherently slower compared to dynamic surveys with planned follow-up cued surveys. WRT procedures require dynamic one-pass collection speeds to remain ≤0.5meters/second (m/s). The MM2x2 survey was completed at ≤0.7m/s. Additionally, the APEX is larger and heavier than the MM2x2, so operator fatigue increases with APEX, especially in challenging terrain. The APEX in-field navigation options supported by APEXCOM software, however, allow flexible data collection in any survey line orientation and pattern the operator deems most efficient. This feature allows the operator to adapt real-time to changes in slope direction or obstructions, rather than collecting along pre-determined survey lines, and thus significantly reduces the time spent returning to the survey area to fill coverage gaps.

With approximately 4,500 targets from the MM2x2 survey, the expectation was that APEX data could be collected in less time than that required for cueing all targets. Additionally, 0.04 acres of saturated response areas (SRAs) were delineated in the MM2x2 data. The APEX one-pass data produced 7,941 targets, with 885 sources classifying as digs. This increase of approximately 77% from the MM2x2 target count is understandable considering the lower sensor height and increased transmit current of the APEX relative to the MM2x2. No SRAs were delineated in the APEX data. When grids containing SRAs are excluded from the comparison, the increase in APEX targets is 38% compared to MM2x2 targets.

The comparison of achieved data coverage showed the MM2x2 averaged <0.01 acre more coverage than the APEX across all 19 grids. Dynamic production was 0.01 acre/hour faster with the MM2x2 over the APEX. The time accrued for additional vegetation reduction, recollection of SLAM point clouds and slower dynamic one-pass data collection was equivalent to the projected time required for cued data collection of 4,500 targets on this project.