H1 Monitoring the Long-Term Applicability of Ground-Penetrating Radar Using Proxy Cadavers

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After attending this presentation, attendees will have a better understanding of the potential benefits of ground-penetrating radar (GPR) and its possible limitations in the search for clandestine graves.

This presentation will impact the forensic science community by providing guidelines concerning investigations utilizing GPR in searches for clandestine bodies interred over a year.

The goal of this presentation is to demonstrate the applicability of GPR in grave detection of cadavers that have been buried for a significant period of time (up to 24 months). By using GPR to monitor controlled graves with multiple burial scenarios, questions can be answered concerning the usefulness of this tool in the search for cadavers that have been interred underground longer than a year. Initial guidelines are offered for the forensic community concerning investigation utilizing GPR for clandestine body searches.

Controlled research using pig carcasses as human proxies has demonstrated that GPR is the best geophysical tool to employ when searching for clandestine bodies. Ground-penetrating radar provides the best resolution for subsurface imaging of all geophysical tools used on land. Additionally, the results are displayed in real-time, and information about depth and size of target can be inferred. This presentation continues the second phase of a larger research project involving the monitoring of controlled graves for a two year period and will focus on year two of data collection using a 250-MHz antenna.

The GPR unit used was a MALA RAMAC X3 M with a 250-MHz antenna. The data was processed using REFLEXW and GPR-SLICE computer programs. REFLEXW was used to display the transect data as reflection profiles, while GPR-SLICE was used to display the grid data as horizontal slices (plan view). These data were collected from a permanent grid measuring 11 m by 22 m containing eight graves total, buried in a spodic (Spodosol) soil. A total of eight graves were created: six represented different burial scenarios and containing a single pig carcass (*Sus scrofa*) each; the last two represented empty control graves. The eight graves were arranged in two rows with four graves in each row. Burial scenarios included a shallow empty control hole (dug at 0.5 m), a deep empty control (dug at 1.0 m), a shallow pig grave (0.5 m depth), a deep pig grave (1.0 m), a pig carcass buried underneath a layer of lime, a pig carcasses buried underneath a layer of gravel, a pig carcasses wrapped in a blanket, and a pig carcasses wrapped in a tarpaulin. The final four scenarios were buried at a depth of 1.0 m. Data were collected following both a west-to-east transect direction and a north-to-south transect direction with a transect interval of 0.25 m.

Over the first year of grave monitoring, salient grave reflections were observed for all of the scenarios containing a pig carcass. Conversely, the second year of grave monitoring showed decreased responses from the decomposing carcasses. By month 15, a number of burial scenarios had become difficult to detect; the shallow and deep carcasses, buried without additional grave items, exhibited the poorest resolutions. The graves with the best resolution were those with the carcasses either wrapped or covered. The scenario of the carcass covered with gravel exhibited the best resolution of all the scenarios. Of the wrapped carcasses, the tarpaulin exhibited greater resolution than the carcass wrapped in the blanket. The two empty control graves were important for the research by showing the difference between an anomaly produced by disturbed soil and an anomaly produced by an actual carcass. While the deep control grave exhibited a consistent response, it was at a lower level of the grave shaft, compared to the carcass anomalies, and was consistent with the location of the grave floor. Though the horizontal slices provided a grid view of the burials, less graves were detected compared to the resolution exhibited by the reflection profiles. It is therefore recommended that when performing clandestine body searches with GPR both imagery options should be utilized and the data should be processed in the lab before making any definitive conclusions concerning the location of potential targets. This project was supported by the National Institute of Justice, Office of Justice Programs, U.S. Department of Justice. The opinions, findings, and conclusions or recommendations expressed are those of the author(s) and do not necessarily reflect those of the Department of Justice.

Ground-Penetrating Radar, Controlled Graves, Geophysical Search Methods

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