## A132 The Use of Ground Penetrating Radar (GPR) in the Search for Remains of Missing United States Servicemembers

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**Learning Overview:** After attending this presentation, attendees will understand the potential benefits and limitations of GPR technology when utilized for the location and recovery of buried human remains.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by increasing knowledge of: (1) the potential applications of GPR to forensic archaeological field problems; (2) specific limitations of this technology, as illustrated in two test cases; and (3) recommendations for critically evaluating and implementing strategies for forensic archaeological GPR use.

Among forensic archaeological remote sensing tools, GPR is arguably the most well-known and the most subject to public misperception, due in large part to its unrealistic depiction in popular media. The technology has great potential; however, the practical application of GPR is complex, and our realistic understanding of its limitations is skewed by the tendency for positive results to be reported, while negative or ambiguous results remain unpublicized.

The Defense POW/MIA Accounting Agency (DPAA), tasked with searching for, recovering, and identifying the remains of missing United States servicemembers from past conflicts, has employed a variety of remote sensing technology for decades. Results using GPR have been equivocal.[1,2] Two of the primary recommendations based on analysis of previous field tests were the need to utilize post-processing software and to conduct further tests in a variety of field conditions. DPAA has recently had the opportunity to perform these recommendations with the acquisition of new equipment: two GSSI UtilityScan® GPR kits, including 350MHz antennae; associated data collection tablets; and RADAN® software. Basic but intensive training on this newly acquired equipment was completed, led by a GSSI representative.

The first case study presented involves data collected at the Manila American Cemetery in the Philippines. Graves of unidentified United States servicemembers exhumed to date at this cemetery have presented challenges involving unexpected placement configurations and depths. The purpose of employing GPR at this cemetery was to assess the potential for the equipment to refine DPAA's exhumation strategy by identifying casket configurations and depths prior to digging. Data were collected over dozens of graves, ten of which were exhumed directly thereafter. Soil composition, casket configuration, and depth were thus confirmed immediately after GPR data collection. Data were examined both in "real-time" and through subsequent analysis using RADAN® software. Results in the Manila American Cemetery were negative. In all but one grave location, GPR was unable to detect anomalies below a depth of approximately 70cm; thus, none of the 1.7 meter$^{+}$-deep steel caskets were detectable prior to exhumation. The likeliest explanation for these results was the soil's high moisture and clay content.

The second case study involves data collected at a large (~70-meter x 30-meter) site on Guadalcanal, Solomon Islands, believed to contain field burials of eight United States servicemembers. The site is associated with a World War II-era sketch map that roughly delineates purported burial locations. The site is slated for excavation in the near future. The purpose of employing GPR in this case was to predict grave locations and thus reduce the amount of block excavation ultimately necessary to recover the remains. High-priority excavation targets would be those in which a correlation is found between GPR-detected anomalies and map-indicated graves. Data were collected in grid format over the entire 70m x 30m site area. Data were examined both in "real-time" and through subsequent analysis using RADAN® software. In this second case, results were ambiguous. While numerous subsurface anomalies were detected with GPR, no clearly defined loci were pinpointed to indicate graves with confidence, and a comparison of the GPR data with the historical map does not present obvious correspondences. The likeliest explanation for these results rests on interference from scattered household trash, rocks, roots, and distortion introduced while managing the data collection equipment over relatively rugged terrain.

GPR technology is complex, a variety of factors can impact results, and data interpretation is not always straightforward. While GPR can help to develop and refine excavation strategies, it cannot necessarily be used as an exclusionary tool. Particularly in forensic archaeological contexts, the possibility of false negatives and false positives must be considered.

**Reference(s):**

1. Buck, Sabrina C. *Remote Sensing for the Rest of Us*. Paper presented at 66th Annual Meeting Society for American Archaeology, New Orleans, LA. April 2001.
2. Buck, Sabrina C. 2003 Searching for Graves Using Geophysical Technology: Field Tests with Ground Penetrating Radar, Magnetometry, and Electrical Resistivity. *Journal of Forensic Sciences.* 48(1):5-11.

**Ground Penetrating Radar, Forensic Archaeology, Buried Human Remains**