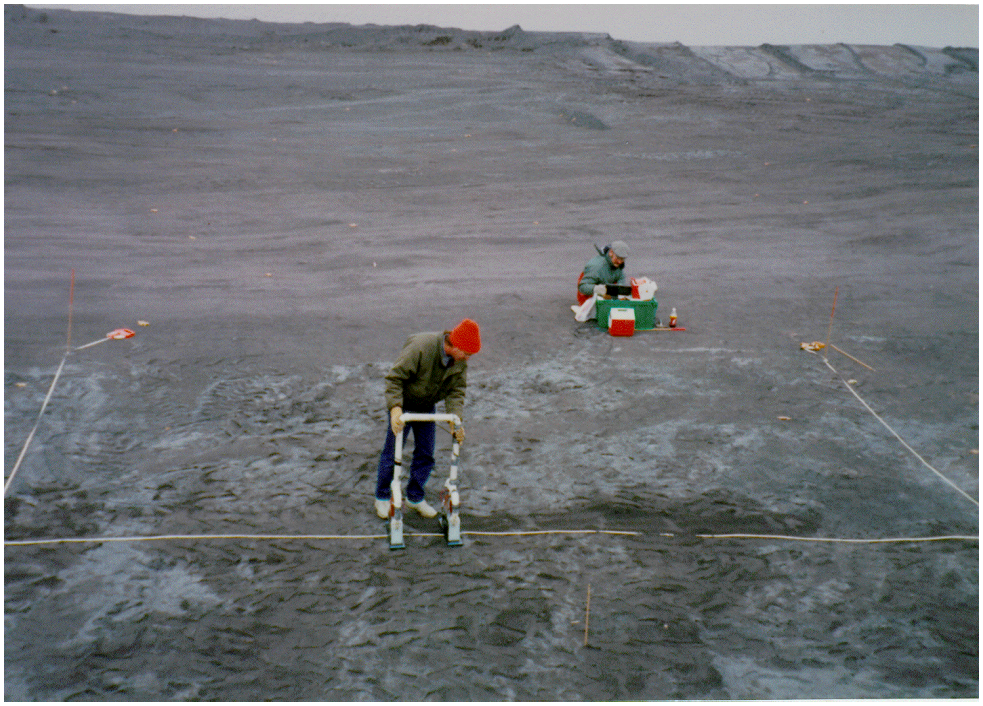
# PROJECT PROFILE

## THREE-DIMENSIONAL GROUND PENETRATING RADAR RESEARCH PROJECT

Ground penetrating radar (GPR) is one of the most commonly applied geophysical techniques for imaging the subsurface with the purpose of locating and mapping buried waste, tanks, utilities, voids, etc. as part of environmental or geotechnical site assessments. In areas where sufficient ground penetration can be achieved, GPR can provide a detailed picture of the subsurface without disturbing the ground. The most common way of acquiring GPR data is to tow a radar antenna slowly over the ground surface and thus obtain profiles that can be interpreted as cross sections.

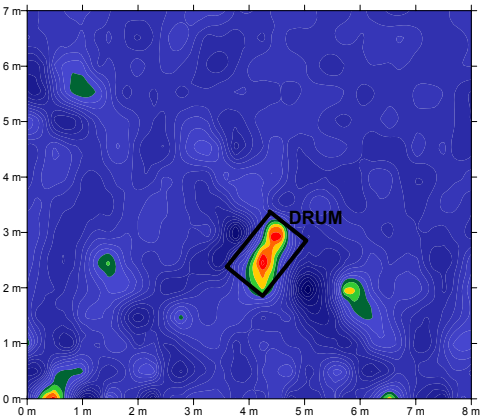


*Acquisition of the 3-D GPR data set using a pulseEKKO IV Digital Recording System with 200-MHz antennas. The work was performed in an old copper mine tailings area.*

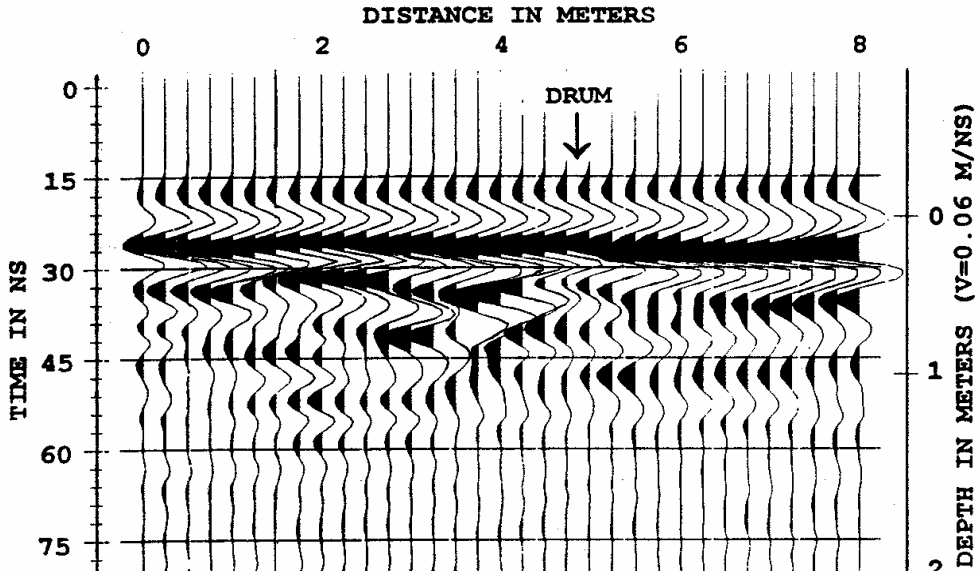
One of the primary difficulties with application of the GPR technique is interpretation of the generated data. GPR profiles commonly reveal so many subsurface features that it can be difficult to interpret what they all represent. It is frequently difficult to correlate an anomaly on one profile line with a similar anomaly on another profile line and be certain that the two features represent the same object.

D'Appolonia working in association with the Michigan Technological University conducted research to improve the interpretability of the GPR method. Our research focused on obtaining three-dimensional data sets that can be interpreted in terms of horizontal slices of the ground, rather than as vertical profiles.

To illustrate this concept, the vertical profile obtained over a buried 55-gallon drum can be compared to a time slice obtained from the 3-D data set obtained over the same buried drum. The profile obtained over the drum is affected by the drum, but the interpretation is ambiguous. By contrast, the 22-ns time slice from the 3-D data set clearly shows the position of the drum and distinguishes the drum anomaly from other reflections originating from the soil.




*22-ns time slice (at about 1-m depth) of same buried drum from 3-D GPR data set.*




*Conventional 2-D GPR profile over buried 55-gallon drum (Although conditions were favorable for detection, unambiguous interpretation is difficult from a 2-D profile.)*

D'Appolonia continued this research through an Expedited Site Characterization (ESC) contract with the Ames Laboratory at Iowa State University. The work for the ESC was funded by the Department of Energy (DOE). Future research planned by D'Appolonia will be directed toward obtaining 3-D GPR interpretations in real time.