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ARRAYED SIGNAL PROCESSING FOR COLLECTION AND DEPICTION OF SUBSURFACE UTILITY DATA

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ABSTRACT: This paper describes two "arrayed-sensing" 3-D technologies, Radar Tomography (RT) and Arrayed Inductive Receivers (AIR). In the associated presentation, attendees will receive a detailed description of these technologies and see sample data from several projects.

The technical principle underlying RT and AIR is Geophysical Diffraction Tomography (GDT). GDT is a means of deriving the position of buried (or submerged) objects or features by using an array of antennae to interpret signals passing through the earth (or water). GDT was originally used for petrochemical, archaeological, and paleontological exploration in the late 80's. In 1994, GDT was directed into the utility industry with RT's invention.

RT uses a mobile array of ground-penetrating radar (GPR) antennae (9Tx/8Rx), which is tracked by a laser total-earth station while creating one GPR trace for each of 16 channels every 4-5 inches. The data is then processed to create 3D "slice-motion" imagery. Utility lines and other relevant features are extracted from the imagery and used to render CAD plan/profile drawings. This information is used by design engineers to create "conflict-free" construction plans.

By comparison, AIR is a much newer system that uses an array of electromagnetic receivers, the same geo-positioning method, and data-(vs. image)processing software. Unlike RT, AIR can only see conductive features, but has virtually unlimited penetration depth. The two systems are complementary. Recognizing this, USDOT/OPS commissioned WTI to create a "dual-array" system.

These technologies create highly accurate (2-5" x/y/z) information at a per-area cost well below that of "comparable" technologies, as demonstrated by several projects.