

RFID:

Going Below the Surface

By Linda Duffy

A tremendous amount of effort is focused on collecting data about the Earth's surface using satellites, airplanes, terrestrial mobile mapping units, total stations and many other devices. Even land areas under water are measurable up to a certain depth. It is reasonable to say that we are at the point where nearly everything aboveground is mapped. The missing piece is what lies below the ground. When complete underground infrastructure mapping occurs, we will truly have a fully mapped 3D world.

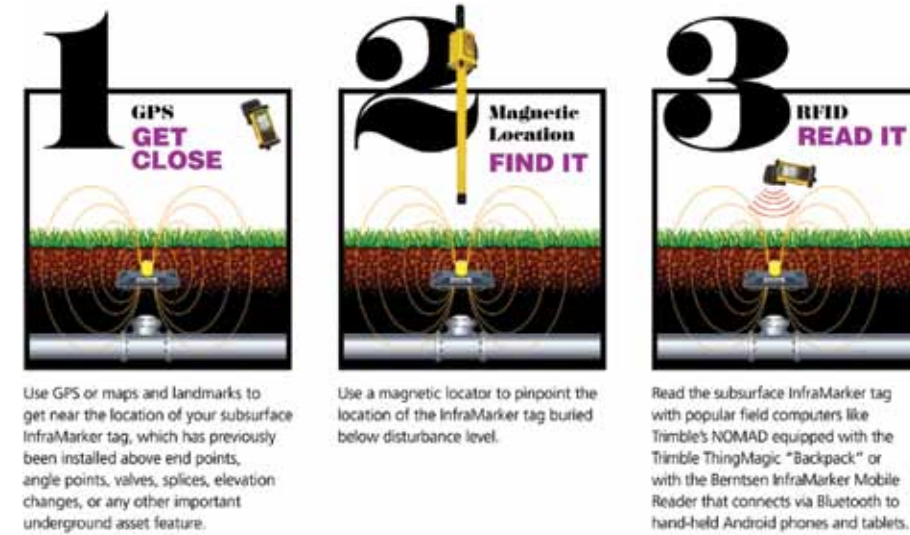
Locating underground infrastructure is often technically challenging, time-consuming and prone to errors due to non-existent or inaccurate as-built records. Due to the sensitive nature of utilities, mistakes can be very costly in terms of service outages, as well as dangerous to workers and the public. As Radio Frequency Identification (RFID) technology has improved over

recent years, it has become a viable option for improving the accuracy and reducing the time it takes to locate many kinds of underground infrastructure, including gas pipelines, electric lines, sewer pipes, fiber optic phone lines and water lines.

RFID is most frequently associated with transmitting information about people, animals or objects via radio waves. Current applications vary widely from monitoring the activities of elephants at a zoo to collecting highway tolls with an E-ZPass. Since radio waves travel through most non-metallic materials, RFID tags can also be buried and used for identifying underground objects. Every passive RFID tag has a unique serial number and can be customized to include information such as type of utility, asset type, marker depth, utility depth, nearby utilities, intersections and hazards. Applications where RFID tags are combined with sensors that identify physical factors such as concrete deterioration, moisture and radiation are also in the development phase.

The 3D World Includes Underground Infrastructure

According to Berntsen International, based in Madison, Wis., RFID represents the next extension of tools for the survey profession to meet the demand for mapping new and existing underground infrastructure. Berntsen has been serving the surveying profession for the last 40 years, so it has firsthand knowledge of the importance of adopting new products to stay competitive. Known for the quality and accuracy of its infrastructure asset marking solutions, Berntsen has played a vital role in mapping the world, as its products



The InfraMarker system involves a three-step process to locate underground assets. Photo courtesy of Berntsen International.

have been used by corporations and government agencies in nearly 100 countries. Berntsen has acquired multiple patents and has other patents pending. It also won an award in 2013 from the Society for Information Management (SIM) for a study on "Improving Disaster Management by Digitizing Utility Facility Objects," written in collaboration with Auburn University.

"In an effort to keep abreast of developing technology and make new products available to our customers, Berntsen is delving into underground mapping, an activity that has typically been labor-intensive and plagued by inaccuracy," said Mike Klonsinski, the director of business development for Berntsen. "The increasing emphasis on location-based information to improve safety and reduce costs is well-suited to RFID technology. Surveying work is not just about static maps anymore. Information that describes every location point, above and below ground, is very important and RFID technology is able to provide that information."

"Berntsen offers a product called InfraMarker that provides the ability to mark and locate underground utility infra-



The RFID Infrastructure Marking (InfraMarker) System may be used to locate many types of underground assets, including gas pipelines and sewer pipes. Photo courtesy of Berntsen International.

structure and other land assets such as rights of way, hazardous waste sites, and mineral explorations sites using RFID," continued Klonsinski. "The InfraMarker device consists of a permanent magnet and an RFID tag that has been designed to withstand adverse environmental conditions. A magnetic locator device is used to find the InfraMarker, and then a hand-held RFID reader receives the information stored on the RFID tag to identify the underground asset."

RFID technology has improved to the extent that tags can be reliably read at a depth below disturbance level, and further development continues in that area. Ideally markers are placed during new construction or during retrofit or maintenance work. For existing infrastructure, soil is extracted to expose the target area using high pressure air or water. Typically markers are placed at points of major elevation or direction changes or at pipeline intersections. The magnet and the tag should last practically forever. When assets are located in a congested area that requires frequent changes to underground infrastructure or in a disaster situation when the surface markers are destroyed, there is potentially large cost savings in time and labor using RFID.

"Imagine the aftermath of a hurricane



GPS, maps and landmarks are used to get close to the buried InfraMarker magnetic RFID tag which is found with a magnetic locator. Photo courtesy of Auburn University Geospatial Research and Application Center.

where coastal utilities have been buried and damaged, and the crews are responsible for locating and repairing those assets, preferably quickly and safely," said Bill Rushing, the vice president of research and development at Berntsen. "The technology used in aboveground RFID tags on assets such as light poles and fire hydrants is just as feasible for marking underground assets."

"The ability to map above and below ground infrastructure supports the goal of full asset management for utilities, corporations and government agencies," continued Rushing. "RFID tags placed in the ground can communicate the location of underground assets and link that information to the same GIS and asset management systems that are prevalent for managing above ground assets—saving time, cost, and even lives. Some day underground 3D maps will be as commonly used as surface 3D maps."

Linda Duffy is president of Apropos Research, an independent market research firm that provides market research and marketing communications services to the geospatial and remote sensing community.