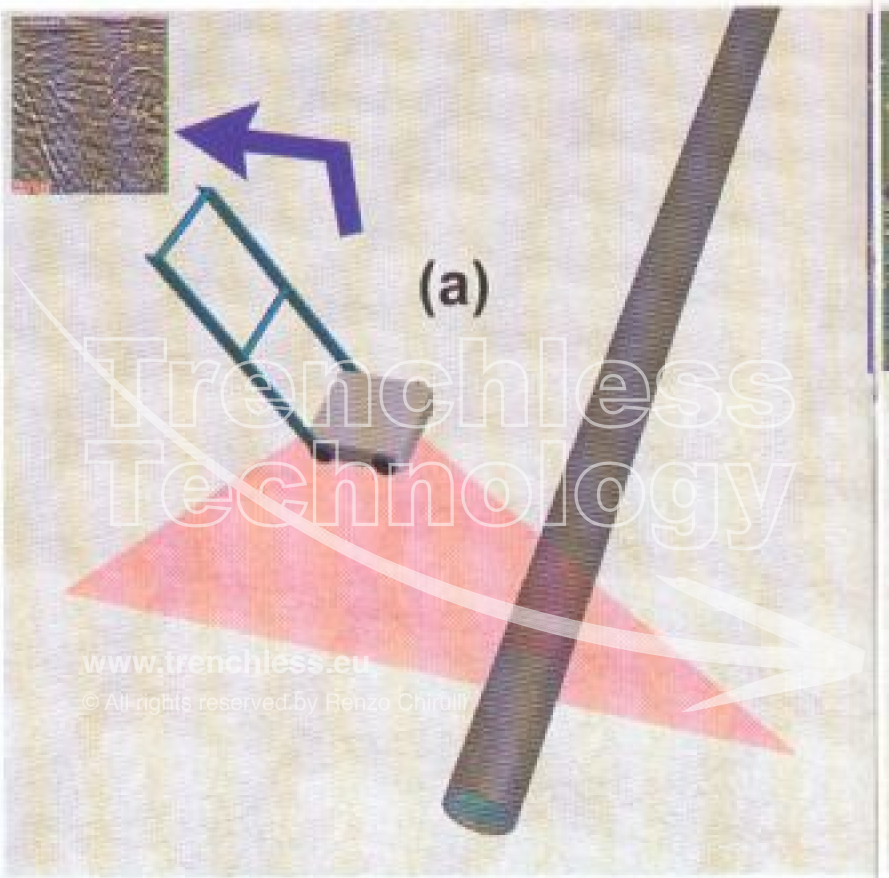
New Generation Radar Systems

by Renzo Chirulli



The general opinion in the United States and Europe is that one of the main technical problems that we need to overcome in many trenchless applications is the detection and the mapping of existing utilities.

The cause of many accidents during directional drilling installations is a lack of knowledge of the subsoil conditions. Some companies running the technology utilities networks don't trust trenchless applications because of the lack of knowledge of the subsoil that often accompanies this kind of application. Frequently, we deal with companies that do not know either the structure in detail or the geometry of the technological networks that they run.

A multitude of engineers and researchers are exploring effective solutions to this problem. Sometimes the proposed solutions are questionable and with difficult application.

In a recent article *(Trenchless Technology,* December 1999), Steven R. Kramer listed 21 trenchless ideas for the 21st Century. Someone suggested adding to this list the realization of device able to reconstruct 3-D subsoil maps — an opinion shared by many in the industry.

The solution to the problem not only lies with the availability of certain devices, but also from thorough collection procedures and comparison of other data available on the existing underground utilities networks.

With a device to create 3-D subsoil maps, it is not difficult to imagine a validation procedure of these maps, based on the comparison made with the data on existing utilities from surface surveys, from existing projects and from information supplied by utility maintenance technicians.

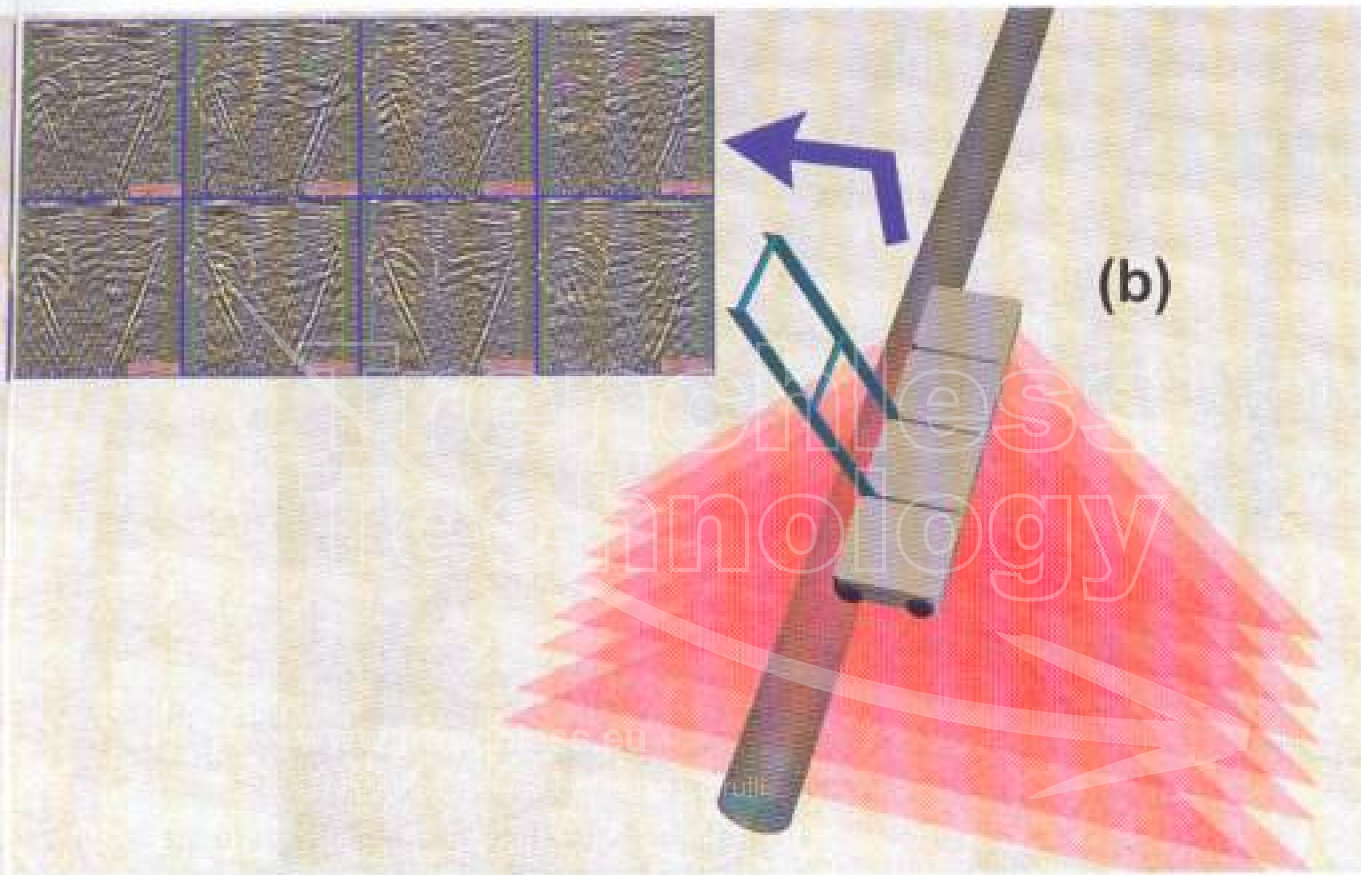
The primary stumbling block, however, has been the realization of the mapping device. But IDS Ingegneria dei Sistemi Spa, an Italian company specializing in radar systems for aerospace and military applications, may have solved the problem with the development of the Radar RIS/MF system.

IDS designed the Radar RIS/MF system in partnership with Telecom Italia. The system not only has detection capacity of 95 percent, but it is also able to achieve subsoil mapping. RIS/MF is the first real radar system devoted to utilities detection, subsoil mapping and soils recognition.

There are more and more companies running utilities networks that recommend in their technical specifications the use of RIS/MF. RIS/MF is able to perform a 3-D radar survey using two different frequencies (200 and 600 MHZ) in order to optimize the trade off between signal penetration and resolution. Unlike the traditional ground penetrating radar (GPR) systems, RIS/MF systems are equipped with an array of multifrequency antennae, which allow data collection from eight different channels.

The processing and interpretation of radar signals is assisted by dedicated software, which allows not only the automation of the majority of the interpretation phases but also increases produc-

Using the RIS/MF system, an operator can view both the radar image (left) and a tomographic view.



Unlike traditional ground penetrating radar systems (A), RIS/MF systems (B) are equipped with an array of multifrequency antennae, which allow data collection from eight different channels.

tivity of the radar surveys.

But the system is not devoted only to utilities detection. Thanks to extended database capabilities and integration with a CAD environment, depth and position of the utilities are transferred to a cartographic map. Additional information, such as position of manholes, can be added and a cross-section of the site can be automatically obtained.

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Finally, information about ground properties can be extracted from radar data. In other words, soils can be classified according to their level of drillability.

The result is represented by a 3-D subsoil map in which all data referring to the utilities for a specific survey area are integrated — not only the ones obtained with the radar survey. A map configured in such a way can allow the design and realization of trenchless activities, minimizing the risk of interference with existing utilities.

Since 1997, RIS/MF systems have surveyed along city streets for more than 350 miles (560 km), covering 1.8 million sq yd (1.4 million sq m) of surface area. In Milan, where crews have been busy installing more than 1,200 miles (1,920 km) of cable, RIS/MF systems, together with plans available from the utilities companies and information provided by the utilities maintenance technicians, have helped decease the accident rate related to directional drilling by 80 percent. Other projects in the densely populated city have seen the accident rate drop to zero.

These and other experiences demonstrate the value of this approach for utilities detection, subsoil mapping and soils recognition.

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