Hydroscope Provides Water Line Asset Management

by Ron Tenove

Water utility owners and operators are increasingly challenged to manage their assets within reduced or constrained capital budgets. At the same time, the extensive buried infrastructure of predominantly cast iron and ductile iron piping is rapidly approaching a condition where costly corrosion failures are increasingly frequent.

Management, design and construction personnel require in-situ information on pipe condition to pinpoint "weak" links and determine pipe rehabilitation or replacement schedules. Edmonton, Alberta-based Hydroscope, Inc. has recently unveiled new technology that the company said can provide a cost-effective method to evaluate line condition of cast iron and ductile iron pipe, including mortar-lined and epoxy-lined pipelines.

Engineering research by a Canadian non-destructive examination and testing company, Russell Technologies, Inc. (RTI), has yielded a new tool, the Hydroscope, which provides direct, continuous measurement of water pipe wall thickness.

Hydroscope, Inc. is a joint venture company of Russell Technologies and Trenchless Infrastructure Technologies, Inc., Albuquerque, N.M. RTI, led by Dave Russell, has provided non-destructive examination services throughout North America and internationally since 1972.

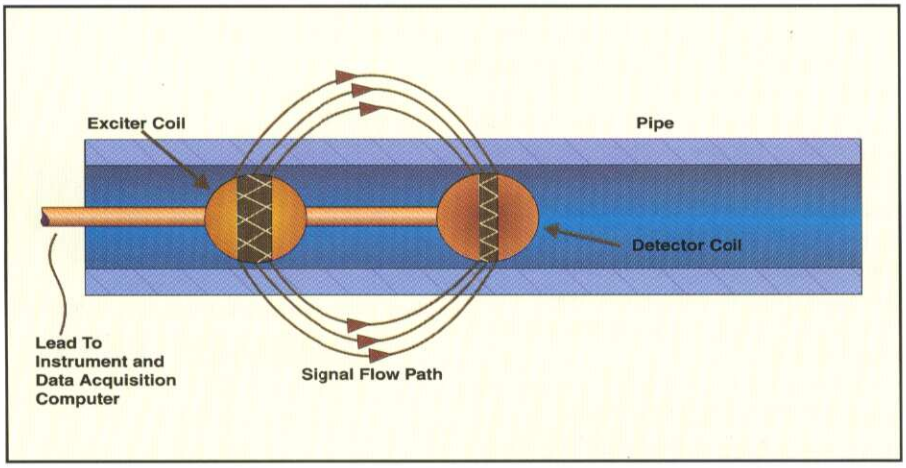
Utilizing remote field technology, the technology measures changes in induced electromagnetic field phase and amplitude that can be correlated to wall thickness loss. Applying sophisticated analysis software, Hydroscope operators can generate accurate on-site information identifying variations in wall thickness.

The Hydroscope is currently available for 6 and 8-in. diameter pipe; 10 and 12-in. models should be available this summer, the company said.

A demonstration of the Hydroscope at the UCT '97 show, held in Houston in January, generated a great deal of interest from water utility operators, consulting engineers and contractors.

The City of Houston carried out Hydroscope testing of 500 ft of 6-in. cast iron water main adjacent to the conference center, which was scheduled for replacement on the basis of age of service. The Hydroscope results were provided to the city to supplement pipe evaluation and replacement schedules.

Hydroscope employees have conducted tests of the new system in more than 50 pipelines worldwide.



The tool consists of a remote field probe with two coils—an exciter and a detector.

Pipeline Condition in North America

There are approximately 960,000 miles of water line in North America. Cast iron and ductile iron comprise more than 70 percent of that pipe, most of which is 30 to 80 years old and reaching the end of its service life. The current buried pipe replacement rate is in the order of 0.5 percent per year; however, escalating maintenance and serviceability costs are widespread. The American Water Works Association (AWWA) has developed a comprehensive database that suggests emergency water main breaks are occurring at an average of once per 3.7 miles of line per year. This points to pipe replacement programs upwards of 2 percent of line length annually. Extrapolating AWWA data, it is estimated that North American municipalities will spend in excess of $500 million on emergency water main repairs each year.

Prior to 1994, no technologies existed to make direct measurement of wall con-

dition along a section of buried pipe, with the exception of costly "digs" to expose the pipe at a spot location.

A 1992 AWWA Research Foundation study spurred development of the Hydroscope. The study assessed technologies capable of in-situ measurement of the physical integrity of buried water main. Only four technologies had sufficient potential to be selected for laboratory and field testing: acoustic emission, remote field technology, flux leakage and ultrasonic thickness measurement. Remote field technology proved the most promising and was recommended for development in the testing of municipal water mains. Russell Technologies undertook a substantial research and development program from 1992 to 1994, resulting in the Hydroscope tools and analysis methodologies.

The tool is a remote field probe consisting of two coils—an exciter and a detector. In simple terms, the exciter generates a magnetic field that passes out and then in through the pipe wall; with each pass the strength of the signal is reduced and the transit time increased. Pipe wall anomalies affect the field strength and time of travel. Using sophisticated instrumentation and analytical software, changes in amplitude and phase can be correlated with wall loss.

For the testing of water mains, remote field technology has the following advantages:

- penetration of thick-walled, non-homogenous pipe
- equal sensitivity to internal and external flaws
- detection of graphitization
- tests through scale and mortar or plastic linings
- registers hardware such as valves, joints and tees
- wet or dry operation
- rapid tool travel in the line.

The tool consists of a train of sealed pressure modules with flexible U-joints and connected via a 3000-ft wireline to a host computer above ground. Mechanical adaptation of the tool for efficient launch into the water main through hydrants eliminates the need for costly excavation to access small diameter pipe. The tool traverses right-angle bends and is propelled through the pipe by water pressure or winching through a dry line, at speeds up to 35 ft per minute. Modules are equipped with centralization brushes, which do not significantly disturb internal scale.

Field Tested

The Hydroscope has been field tested in a variety of water main conditions in Canada, Australia, England and the southern United States. The most extensive testing has been in Edmonton through a strategic alliance with Aqualta, the municipal water corporation, where operating experience during the 1994-96 summer seasons has guided refinements to tool design and instrumentation. The tests took place in 10 pipelines of lengths of 150 to 600 yards, said Hydroscope vice president Larry Staples.

"Aqualta dug up the pipes and hauled them to their yard, where they were sandblasted and then compared what the Hydroscope had predicted with the detailed visual observation," Staples said.

The tests were a success for all parties involved, he added. "The City of Edmonton has been a tremendous partner. Edmonton water utilities officials are very interested in this technology that will carry them to the next level of managing their remaining cast iron assets."

The Hydroscope tool has a number of value-added applications centered around providing knowledge, not just test data. The design of a field investigation program can be a critical component in value analysis of the water distribution system where the financial and operational benefits associated with extended pipe service life are evaluated relative to the risks of unexpected pipe failure. The risk factors will vary considerably dependent on public demand for uninterrupted water supply, minimal exposure to loss and safety due to emergency water main breaks and proper fiscal management of a rate-based service.

The management team of owners and engineers can effectively apply Hydroscope technology in the following areas:

- asset acquisition condition surveys
- controlled failure risk management
- evaluation of rehabilitation methods
- enhanced water conservation measures
- maintenance budget planning and optimization
- capital budget forecasting
- utility rate pricing factors
- asset management.

As water utilities are privatized or otherwise required to operate with reduced capital budgets, reliable in-situ information on pipe wall condition is becoming increasingly valuable. Hydroscope, Inc. is presently exploring a range of business opportunities including equity participation in water line asset management projects to share in the dividends of buried water main infrastructure.

Hydroscope operates both directly and through licensees in Australia, Canada and parts of the United States. Expansion plans include Great Britain, the eastern United States, and South America.

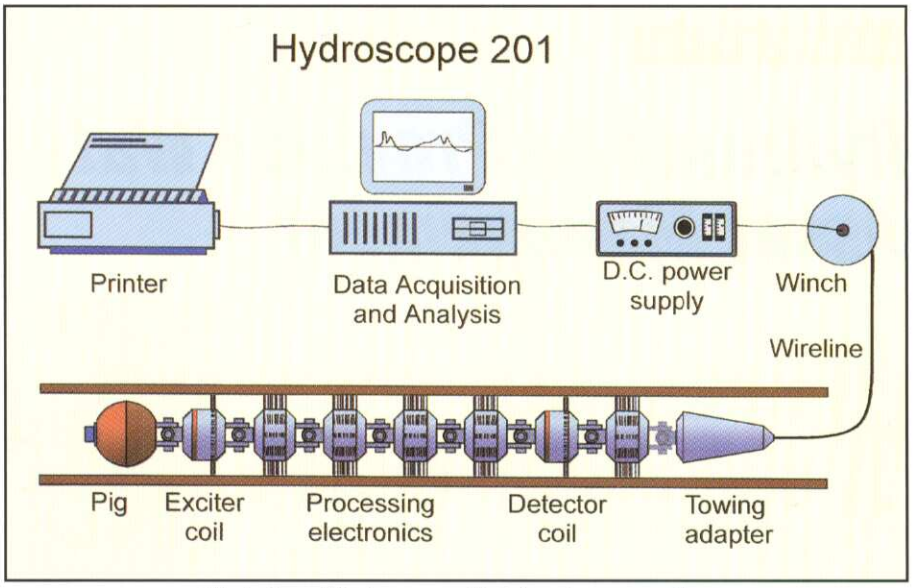


Illustration of Hydroscope with data system connection.