

Engineering Research Center Proposed at TTC

by Paul J. Miller

The news out of Ruston, La., is focused on the proposal to the National Science Foundation to fund an engineering research center for the study of trenchless infrastructure systems.

If the proposal succeeds, the Trenchless Technology Center (TTC) label will be shelved. Its mission, however, will be expanded under the proposed name of the Center for Trenchless Infrastructure Systems or CeTIS, as it is being called.

The initial preproposal stage was crowded with 89 applications submitted to NSF. In April 1999, 29 applicants (about one-third) were selected to move on to the full proposal stage and TTC was one of them. In October, the center received notice that it was selected as one of seven site visits for in-depth study of the proposal. That site visit was completed in mid-February.

The next step, scheduled for March, is for a consultation with center representatives at NSF headquarters for further consideration of the proposal. It is anticipated that four or five of the seven finalists will be funded. Final selection decisions are expected by late May.

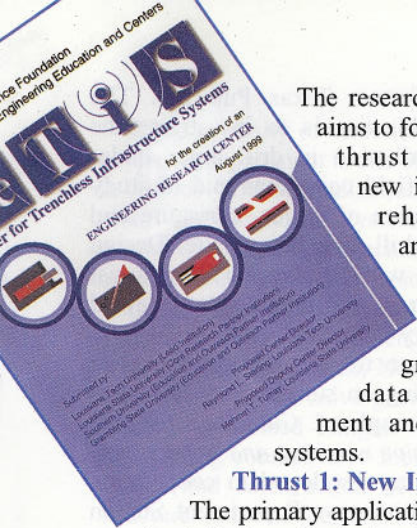
The proposal calls for \$16 million in funding over five years from NSF. To date, the center has raised more than \$15 million in matching funds and effort from the State of Louisiana, the participating universities and industry and municipal contributions. If approved, the grant is renewable for another five years.

As part of the needs statement supporting the proposal, center director Dr. Ray Sterling noted that more than 3.5 million miles of water and sewer pipelines exist in the United States, representing an investment in the trillions of dollars. Despite the extensive scope of the systems, they are "haphazardly organized, poorly documented and often neglected."

Beyond the existing systems, approximately 300,000 miles of underground utilities are installed annually with a market value of more than \$35 billion. Urgent needs exist in all sectors — wastewater, \$100 billion; water, \$80 billion; gas, 1.5 million-mile network; telecommunications, \$12 billion per national fiber network; and electric, 390,000 mile-network.



Director Ray Sterling discusses TTC research priorities with the Industry Advisory Board. Shown (from left) are Sterling, Leigh Cerda, City of Austin; unidentified participant; and Joe Barsoom, City and County of Denver.



The research proposal aims to focus on four thrust areas — new installation; rehabilitation and renewal; “seeing through” the ground; and data management and decision systems.

Thrust 1: New Installation.

The primary applications of new installation include directional drilling and microtunneling but may also include boring and pipe jacking. Environmental effects of construction, including safety issues, need to be reduced and risks of installation failure or ancillary damage should be decreased. Objectives for Thrust 1 include the development of systems for long-distance, low-force installation of pipes, conduits and cables; route optimization for new installation; understanding of soil behavior at the micro-structural level and its impact on construction; and materials tailored to trenchless installation requirements.

Thrust 2: Rehabilitation and Renewal Technologies. Goals include reliable location and performance assessment in existing pipelines. The materials systems need improvement in understanding the material properties, predicting performance modeling and understanding material degradation. Objectives include the development of advanced systems for locating existing utilities and for monitoring long-term behavior of the piping systems. Sensors and “smart materials” may consist of composite pipes with wireless sensors embedded in their walls to detect the condition of the pipe and relay information via a data up-link antenna to a computer data acquisition system.

Thrust 3: Seeing Through the Ground.

The goal for this area is to “develop and verify novel, non- or minimally-invasive technologies for characterization of shallow urban geomeia.” The aim would incorporate the acquisition of data by improved GPR and sonar technology, along with probe penetrometers built into tunneling and directional drilling heads, linked into GIS/GPS communications systems. Real time soil characterization and underground image processing would be fed back to the control process for im-

proved accuracy in bore path selection and obstacle avoidance.

Thrust 4: Data Management and Decision Systems. The vision is to integrate data for the complete utility life cycle and for life cycle cost and asset management. The acquisition, processing and “synergistic combination” is needed by multiple agencies in the management of the systems. Shared information includes capital cost, socio-economic variables, rehabilitation, and repair or current status permits appropriate asset management by all the stakeholders.



Dr. David Hall, assistant professor of mechanical engineering, Louisiana Tech University, explains the testing facilities and protocol for the long-term testing program for pipe liners.

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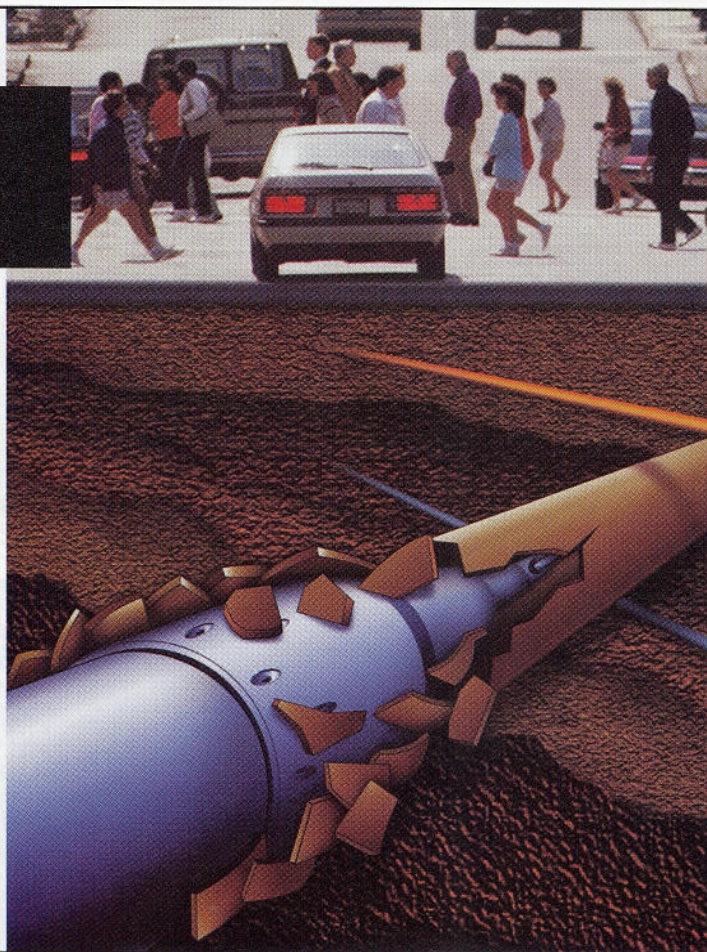
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The TTC has teamed up with cooperative university facilities to accomplish the ambitious 10-year research and development proposal. The core group consists of Louisiana Tech and Louisiana State University (LSU), each teaming with a local partner for educational research and outreach. Louisiana Tech and Grambling State University in nearby Grambling, La., would cooperate, as would Louisiana State and Southern University, both in Baton Rouge.

The research team from the core partner schools totals 35 faculty members from four engineering and science disciplines at Louisiana Tech and 10 departments and programs at LSU. Dedicated test beds and laboratories at the two institutions will provide the primary settings for the R&D program. The outreach partners offer seven additional faculty or instructors. In addition, liaison has been established with faculty members from six other institutions, from Colorado School of Mines

to the University of Southern Florida, to co-opt their specialties into the program.

The municipal forum program established two years ago at TTC will provide a primary channel for technology transfer from CeTIS. The forum involves approximately 110 municipalities participating in six different forums. In addition, an annual research conference is planned to disseminate results.

Present Research

Current research programs at the center will continue and be incorporated into the CeTIS proposal if it is funded. If not selected, the programs will carry on to establish their findings for the industry.

One such program is the *evaluation of HDD drill steel* in mini-horizontal directional drilling. The program has been funded by the Louisiana Board of Regents Support Fund and by industry partners Seam-Mac Tube LLC, Advanced Directional Drilling Systems Inc.,



A lab director examines pressure controls for the pipe lining array.

and the former Texas Pup Inc. The primary objective is to investigate the stress distribution in drill pipes under simulated field conditions and to study the interaction of torque, curvature and thrust on drill pipe fatigue life. Design guidelines will be developed to assist manufacturers and contractors to avoid unnecessary failure.

A program to research the results of pipe bursting on surrounding structures has been completed. *Guidelines for pipe bursting, pipe ramming and impact moling* are being developed in cooperation with the Waterways Experiment Station of the U.S. Army Corps of Engineers, Vicksburg, Miss. The document will parallel the guidelines developed during the Construction Productivity Advancement Research program (CPAR) that produced guidelines for microtunneling, mini-HDD, CIPP and fold-and-formed pipeline rehabilitation techniques.

Research into improved accelerated testing models for short-term and long-term buckling of pipe liners through experimental calculations is underway through an NSF grant of \$280,000. The three-year program aims to test a time/temperature super-position for determining the creep and buckling characteristics of pipe rehabilitation materials.

The *long-term liner testing* continues in improved new facilities in Bogard Hall on the Louisiana Tech campus. Dr. David Hall directs the testing program and statistical analysis of the labs.

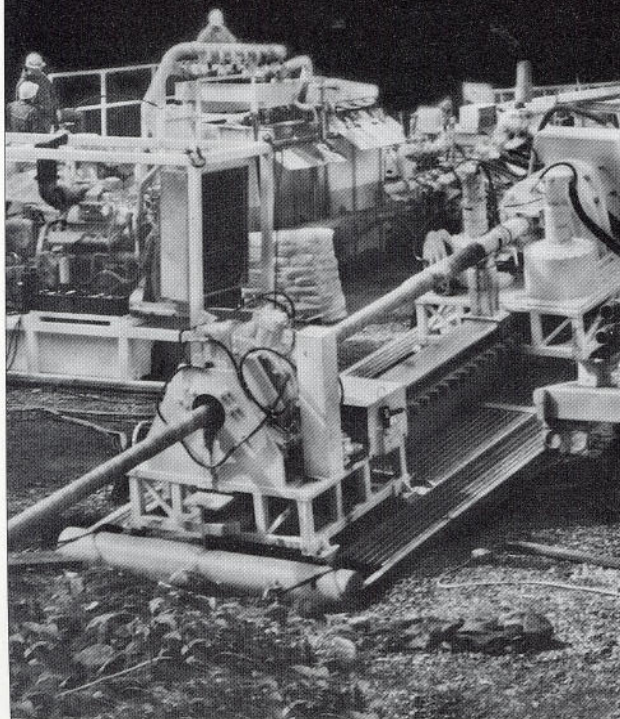
A statement of need for *underground utility location* has been developed and released for public review. Undertaken in cooperation with the Federal Laboratory Consortium, the statement was developed to familiarize researchers with the operational and cost constraints under which the equipment must perform. The next step in the program is for the Federal Laboratory Consortium to analyze responses to the needs statement and conclude what additional steps should be undertaken in research and development.

The advocates of trenchless research and development at Louisiana Tech University are keeping their fingers crossed for approval of the ambitious engineering research program. But whether the center is known as TTC or CeTIS, it is certain that substantial R&D advances will continue to come from their efforts.

This report is based on Paul J. Miller's participation with the Industry Advisory Board of TTC and the CeTIS site visit.

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