



**US Army Corps  
of Engineers®**  
Engineer Research and  
Development Center

# FURY: An Underground Tank Inspection System

**Problem**

Nationwide, the Department of Defense (DOD) is estimated to have over 30,000 underground storage tanks (USTs); the Army alone has more than 20,000. Federal regulations (40 CFR 280-281) require that all these tanks be brought into regulatory compliance to avoid environmental contamination. However, replacing all existing USTs is prohibitively expensive. Cost-effective, reliable assessment methods are needed to support informed decisions on UST management—especially in determining alternatives to replacement such as tank lining and external cathodic protection.

**Description of  
Research**

The Construction Engineering Research Laboratory (CERL), via a Cooperative Research and Development Agreement (CRaDA) with RedZone Robotics, Inc., of Pittsburgh, PA., is developing FURY, an automated robotic inspection system for internal examination of USTs that store various types of fuel. Under a protective blanket of inert gas, the robot enters the tanks through an existing riser (minimum 4-in. diameter) and navigates both the end caps and cylindrical wall area on magnetically coupled wheels. The robot uses an ultrasonic transducer to make numerous measurements of the tank wall thickness. The ultimate goal of this research is to produce a submersible FURY that will operate in tanks containing fuel, while the headspace is filled with a protective blanket of inert gas, thus avoiding interruption of normal operations. Funding to perform the necessary safety certification for this type of duty is being sought.

The FURY prototype has also demonstrated its feasibility to examine the condition of other types of metal structures. For example, a large number of sheet pile bulkheads along U.S. inland waterways are now approaching the end of their design lives and require condition evaluations.

FURY will offer an economical alternative to the conventional four-man diver survey method currently used to evaluate sheet piling. FURY was used in August 1998 to assess the corrosion condition of 12 selected underwater sites of the sheet pile bulkheads along the Cuyahoga River in Cleveland, OH. This test showed that FURY has the potential to: (1) cut inspection costs by at least one-half, and (2) take over a 100 times as many measurements in the same time as current evaluation techniques. This test also identified that the corrosion product or scale on 50+ year-old sheet pile is very adherent and much different from the minor mill scale found inside USTs. Redesign of the scrapers and brushes currently on FURY as well as its waterproofing will be necessary before it can be used for widespread



sheet piling evaluations. Since FURY is a sensor delivery system, it offers an opportunity to do various types of remote sensing, such as measuring corrosion potential and corrosion rates, or assessing the degree of zebra mussel infestation. These and other possible uses are under evaluation.

**Expected Products**

This research will produce a commercially available automated robotic inspection system for USTs that store various types of fuel. A submersible version of FURY will allow inspection of filled tanks as well as of other types of metal structures.

**Potential Users**

FURY promises to have broad application within the DOD (Forces Command [FORSCOM] installations alone have 400+ USTs), and in the private sector. International customers in locations where USTs are even more commonly used than in the United States have already expressed an interest acquiring the commercially available tank-inspection product when it becomes available.

**Projected Benefits**

FURY will perform internal UST inspections faster and with less labor than existing procedures, without interrupting normal operations. A typical FURY inspection will take about a half day (as compared to 2-5 days for current methods), and will not disrupt normal operations. The remotely operated robot eliminates the worker hazard and complications associated with in-tank inspection procedures—FURY dispenses with the need to empty, purge, unearth, cut, enter, desludge, grit-blast, vacuum, visually and manually inspect, and restore the tank after inspection.

FURY complies with the American Society for Testing and Materials (ASTM) Standard G158-98(2004) for assessing the condition of buried steel tanks. Data from the inspection will allow DOD installations to make informed choices concerning tank replacement or upgrade, and will also help managers set priorities/schedules for work on USTs based on more accurate condition information. FURY can then be used periodically to do preventative maintenance inspections in satisfying Environmental Protection Agency (EPA) requirements.

**Program Manager**

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