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# Guided Wave Systems for Screening Structural Health Applications

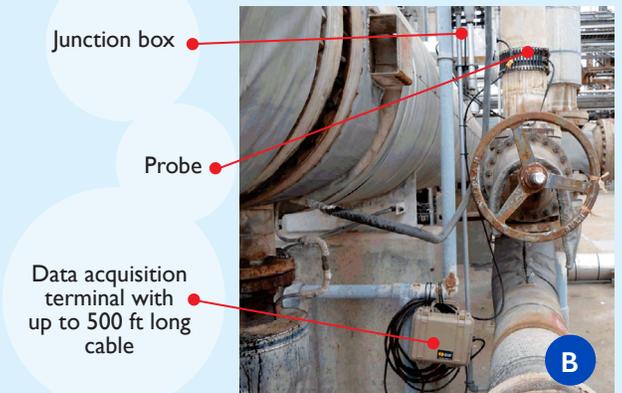
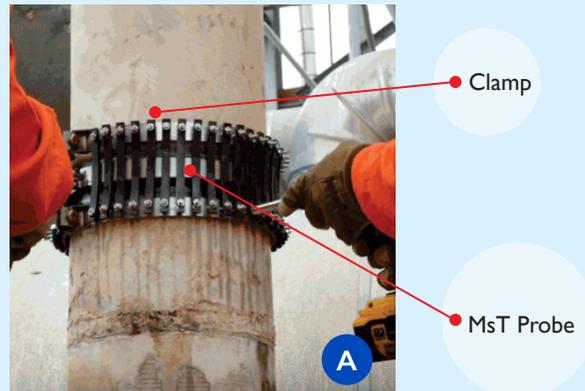
Nondestructive evaluation for long-term structural health monitoring (SHM) of pipes can be challenging due to their often restricted access points. Southwest Research Institute® (SwRI®) has developed a magnetostrictive transducer (MsT) guided wave-based probe to examine long lengths of pipeline from a single position. The technology allows for a more thorough inspection for pipeline structural health.

The guided wave probes are installed permanently on a pipeline, establishing baseline data, collecting new data online, and tracking condition changes. The MsT transducer's components are molded into high-temperature composite materials to protect them from heat and corrosion. The MsT transducer includes an iron cobalt (FeCo) strip, a coil wound around the strip, and a belt of small rare-earth magnets to achieve the uniform and self-sustained magnetization required by the probe.

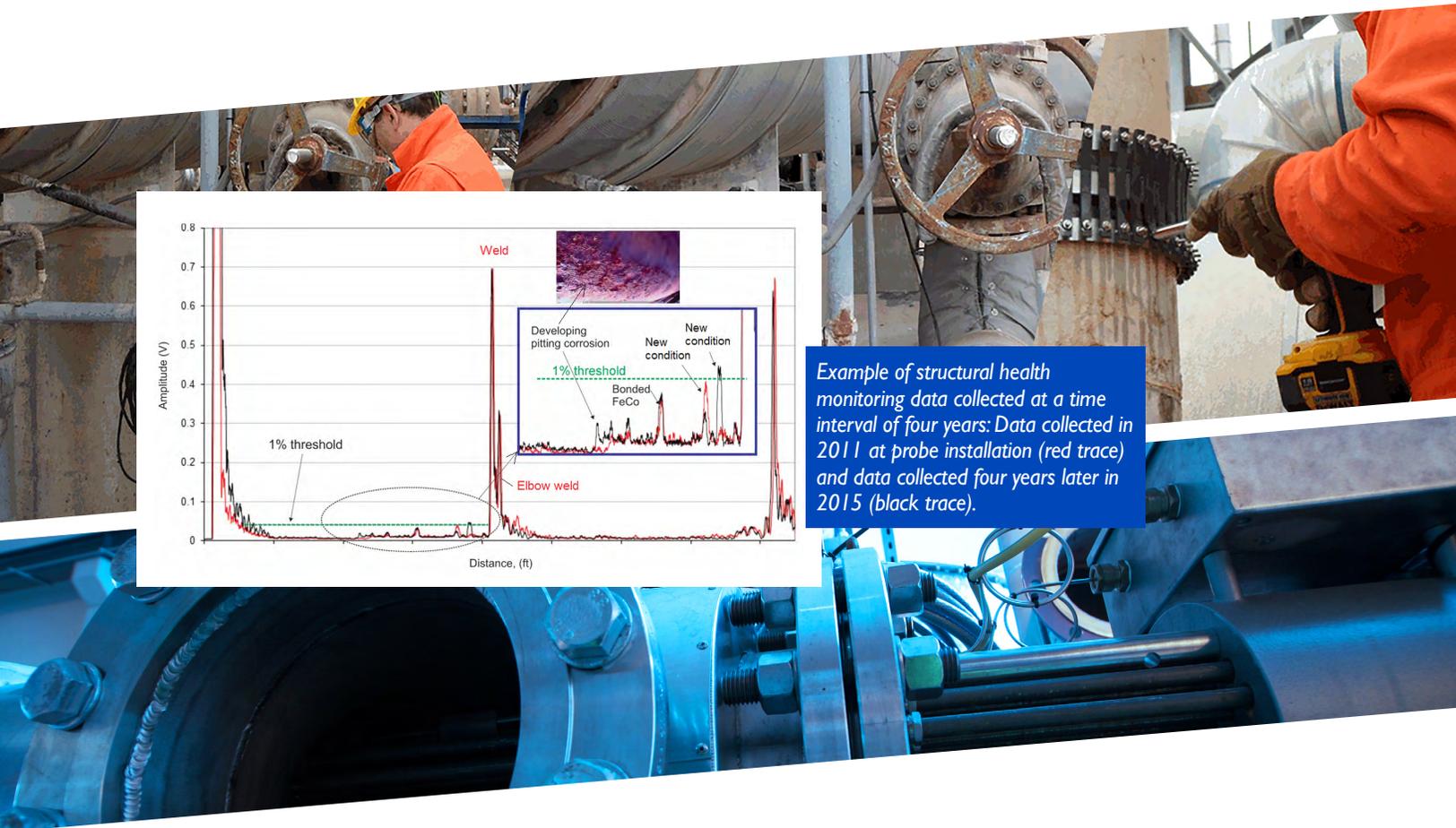
The MsT technology was successfully analyzed on pipes at temperatures up to 200°C and over a wide range of conditions, including thermal cycling. Test frequencies ranged from 30-250 kHz. Additionally, custom probe designs were successfully tested on a mock-up pipe at temperatures up to 500°C.

Installing the MsT probe includes placing a protective coating on a pipe surface for corrosion resistance and clamping the probe to the pipe. An epoxy-filled acoustic membrane was positioned between the MsT and pipe to accommodate for surface roughness and to eliminate moisture penetration under. All acoustically critical interfaces are connected to each other using a dry coupling method (mechanical force supplied by an external clamping mechanism) to ensure long-term reliability.

Comparing current data to a set of baseline data shows changes in the waveform that are caused by corrosion. In addition to the waveform comparison, a baseline stretching and subtraction algorithm is utilized to eliminate pre-existing conditions such as weld and geometry indications as well as multiple reflections. This helps to identify pipe condition changes in areas such as welds or pipe supports.



Probe installation on a pipe at elevated temperature: a – MsT probe with clamping device; b – structural health monitoring hardware including probe, junction box and data acquisition terminal; c – Data acquisition process using MsS instrument.



We welcome your inquiries.  
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[swri.org/magnetostrictive-sensor-based-guided-waves](http://swri.org/magnetostrictive-sensor-based-guided-waves)

## SOUTHWEST RESEARCH INSTITUTE

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