SwRI®

Southwest Research Institute

High-Resolution Defect Imaging in Tank Bottoms

Using Guided Wave Magnetostrictive Transducer Arrays

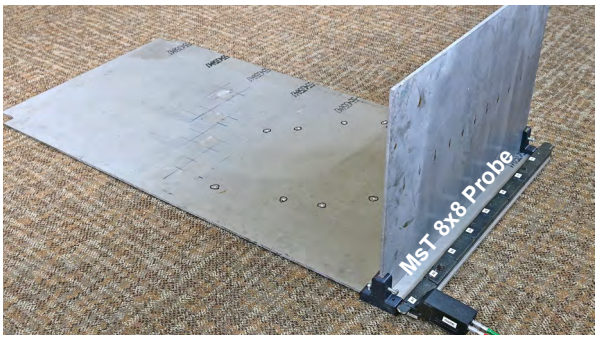
Southwest Research Institute® (SwRI®) has developed a new system for imaging defects in large structures such as tank walls, aerospace fuselages, and ship hulls. The system was initially developed to inspect above-ground storage tanks from the tank skirt (chime) on the tank exterior.

The MsT 8x8™ system consists of:

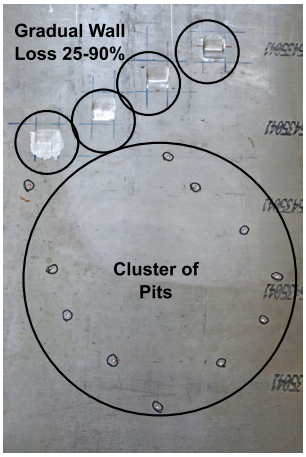
- Multi-segment magnetostrictive transducer probe
- MsSRv5™ guided wave instrument
- Integrated signal multiplexer
- Full matrix capture (FMC) acquisition software
- Advanced analysis methods, including the synthetic aperture focusing technique (SAFT) and total focusing method (TFM)

The system was tested on various mockups representing tank bottoms to demonstrate its functionality. One mockup was a 0.25 inch (6.4 mm) thick aluminum plate representing the tank floor and a second attached vertical plate representing the tank wall. The bottom plate had a series of anomalies introduced, including 4 mm diameter 25% deep drilled holes and gradual wall loss defects, with maximum wall loss of 25% to 90%.

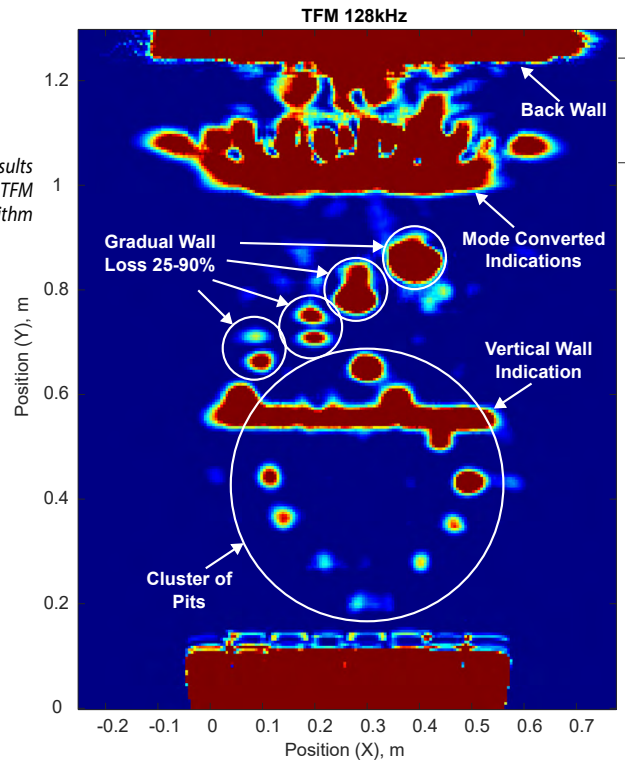
The probe demonstrated outstanding sensitivity to simulated pitting corrosion and gradual wall loss defects, as well as the ability to map the defect locations.



MsT 8x8 positioned on the mockup outside the vertical wall

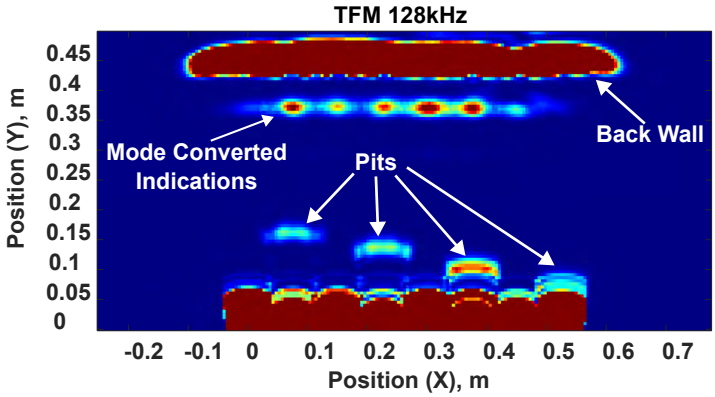


Locations of gradual wall loss anomalies and simulated pitting

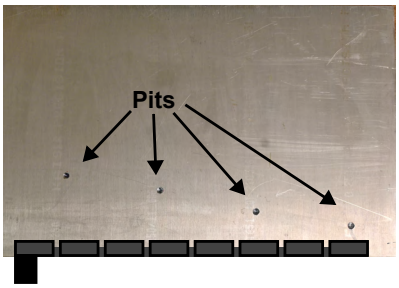


Processed results utilizing the TFM algorithm

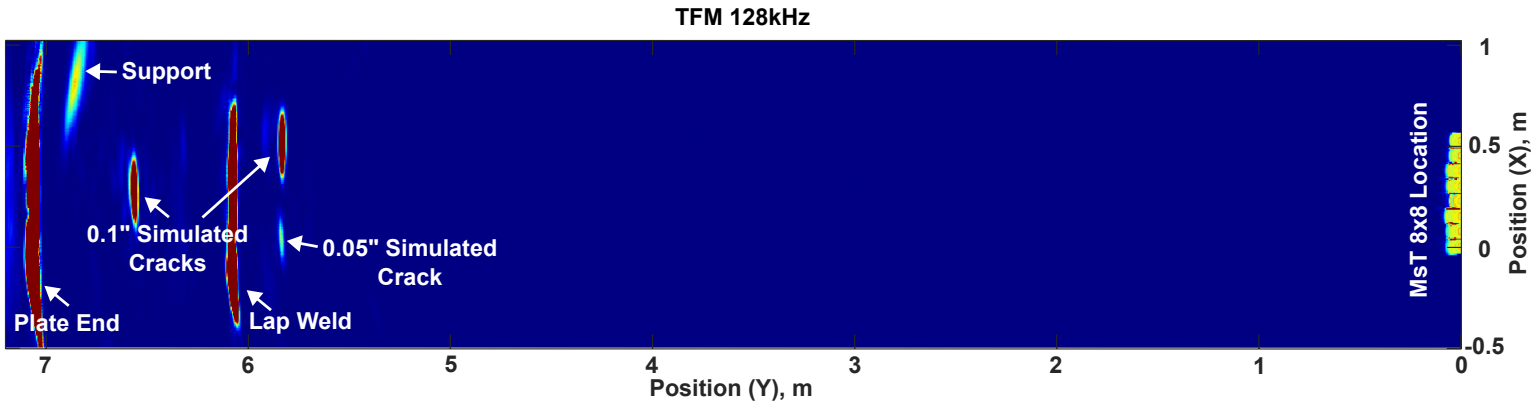
The system was also evaluated on defects located between 2 and 280 inches (5 cm to 7.1 meters) from the MsT 8x8 probe in two plates, each 0.25 inch (6.4 mm) thick. The objective was to demonstrate the ability of the probe and processing algorithm to detect anomalies near the sensor as well as anomalies located at a far distance.



Detection of defects located close to the MsT 8x8" probe with 2 inch (5 cm) minimal distance



Mockup showing layout of defects close to the probe and probe position



Detection of defects located farther from the probe

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