



GUIDED WAVE TESTING: NOW FINDING A NEEDLE IN A HAYSTACK

Guided wave testing, or GWT, uses low-frequency ultrasound operating between 20-150kHz compared to the MHz frequency range for conventional ultrasonics used for thickness checks. This allows the ultrasound to be broadcast away from the tool and axially along the pipe in GWT. When this broadcast ultrasound encounters a change in cross-section, the change in acoustic impedance of this region causes an echo of sound to return to the tool for detection. Using the welds on a pipe for calibration and comparing amplitudes of other signals to these welds, it is possible to indicate the severity of any corrosion detected. Moreover, using additional advanced methods such as C-scan imaging techniques and, in Eddyfi Technologies' case, a unique secondary

focusing method, it is possible to give angular positioning and circumferential extent.

Most experience and use of guided waves have been for Long-Range Ultrasonic Testing (LRUT). Lower frequencies (20-50kHz) are used for screening pipelines with ranges greater than tens of meters achieved. These methods and the procedures for this type of inspection are well established and implemented within industry with global standards published, including international standards such as ISO 18211. However, guided waves are for more than just LRUT, as demonstrated in this application for drill riser inspection.

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THE CHALLENGE

Explore the applicability of a long-range ultrasonic testing solution for shorter ranges such as weld to weld or flange to flange inspection.

2

THE SOLUTION

An improved tool and signal-to-noise enables improved sensitivity, detectability, and positioning of defects, making assessment over a shorter range possible.

3

THE BENEFITS

The principle and sensitivity are transferable to other pipe sizes and materials as a potential solution for consideration to other important inspection challenges within other industries.

The Challenge

This application explores the use of guided waves for Medium-Range Ultrasonic Testing, or MRUT, where frequencies in excess of 100kHz are employed. At these frequencies, there is improved resolution due to the shorter pulse length of the ultrasound transmitted. An improved tool and signal to noise allows for improved sensitivity, detectability, and positioning of defects, making inspection over a defined shorter range possible, for example, weld to weld or flange to flange inspection where test lengths are up to 15 meters (50 feet) depending on conditions.

A client provided a calibration pipe used for the pretesting of NDT inspection equipment for drill riser testing. The pipe was

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114-millimeter (4.5-inch) diameter schedule 80 wall thickness (8.56mm/0.337in). The length of the pipe was 1.83 meters (6 feet) and had eight 1.5-millimeter (1/16-inch) drilled holes at 45° different angular positions and 76-millimeter (3-inch) separation along the pipe. There was a thinned area of pipe where thickness had been reduced by a maximum 1.5 millimeters (1/16 inches) gradually over a 76-millimeter (3-inch) length. A schematic and photograph of the test pipe are shown in Figure 1.

A close-up of the defects included in the pipe is given in Figure 2, showing the diameter of the holes and the thinned area.



Figure 3: Sonyks instrument with the Piezo tool on site



Figure 4: Sonyks Magneto-tool for 100mm/4in diameter pipe and 128kHz test frequency. The tool is lightweight, low profile and can be quickly installed.

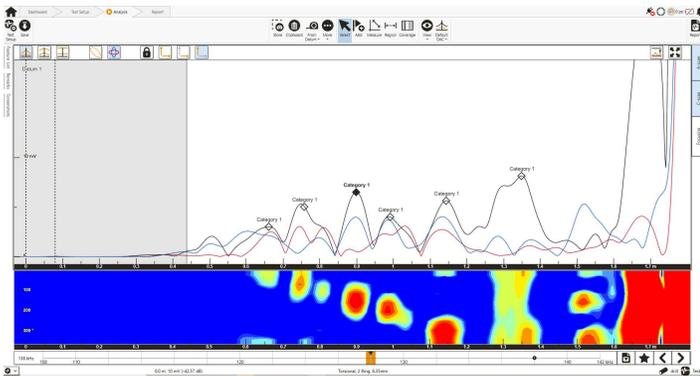


Figure 5: A-scan and colour map of the data showing the defects in the pipe. The coloured spots correspond with the defects. The rotation of these spots matches identically with the defects' rotation on the pipe.

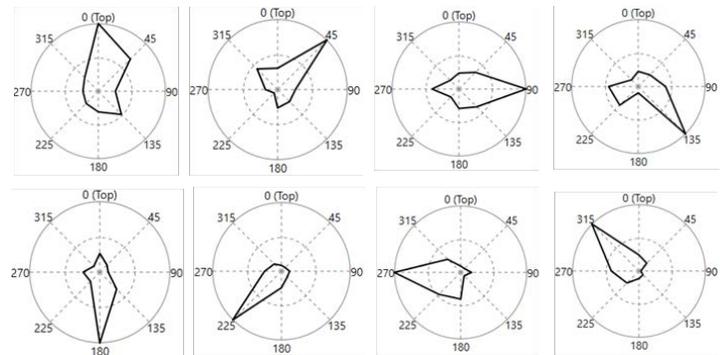


Figure 6: Focusing shows the defects' rotation with distance from 0° to 315°

The Benefits

Although this pipe was designed as a calibration test pipe for drill riser inspection, the principle and sensitivity are transferable to other pipe sizes and materials as a potential solution for consideration to other important inspection challenges within the energy, chemical, food, and even pharmaceutical industries.

For example, particularly interesting would be to inspect stainless steel pipe where corrosion from chloride attack or microbiological induced corrosion can lead to very localized corrosion. The MRUT methodology can detect this when inspecting the pipe section by section.

In addition, a targeted inspection of U-bolt clamps by MRUT is another highlighted area of interest by the industry. Small diameter pipe clamps are difficult to inspect. Using MRUT would negate the need to interfere by lifting or using radiography.

Finally, an inspection of air to soil interfaces where the first few inches of inspection are important for detecting corrosion is another example of utilizing the attributes of this technique.

Therefore, targeted inspection on any small diameter pipe 40 to 200 millimeters (1.5 to 8 inches) would be interesting for this technique.

For further discussion and information, please contact us.