INCORPORATING ADVANCED NDE TOOLS IN BELL HOLE INSPECTIONS

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As the resolution and probability of detection in In-Line Inspection (ILI) tools improve, particularly for crack detection, the ability to accurately characterize and document degradation during follow-up direct examinations has increased in significance. No longer is the detection of threats using solely traditional methods such as conventional Ultrasonic Testing (UT) and Magnetic Particle Testing (MT) sufficient when compared to the benefits of incorporating more advanced non-destructive evaluation (NDE) tools.

Combining Structural Integrity's advanced arsenal of NDE tools with certified SI specialists who have extensive expertise in evaluating pipeline integrity ensures a more thorough integrity assessment. An example of some of these advanced tools include:

- Specialized Time of Flight Diffraction (TOFD) for crack sizing,
- C-Scan imaging using a Phased Array UT Wheel Probe, and
- Fully Automated / Encoded UT.

STRESS CORROSION CRACKING - CRACK SIZING

As the prevalence of ILI crack detection tools increase, the likelihood and frequency of detecting critical crack-like flaws grows accordingly. While MT provides a robust and inexpensive method of detection, it is unable to determine the through-wall depth of the cracks. Stress Corrosion Cracking (SCC) occurs in piping due to the combination of material susceptibility, environment and stress.

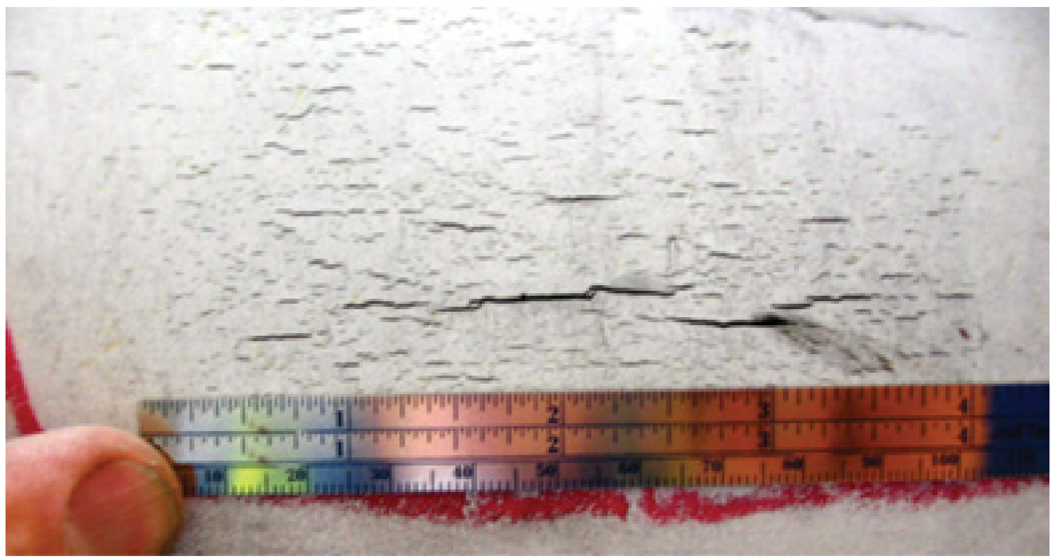


Figure 1: Illustration of Typical SCC

SCC in the pipe body typically forms as colonies containing a number of cracks. A high length-to-depth ratio is typical, often in the range of 20-50:1. Crack depth sizing can be a challenge due to a low through-wall dimension (TWD), as well as the close proximity with adjacent cracks within the colony.

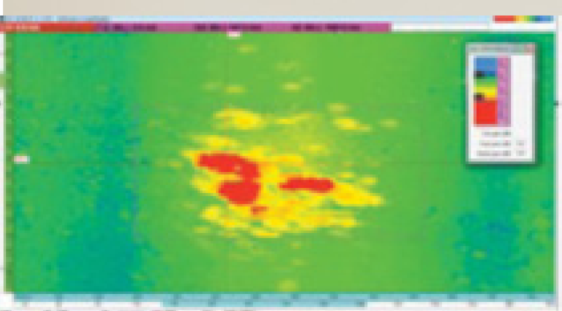
Structural Integrity uses several different sizing techniques, depending on size, orientation or other conditions. We developed a specialized variation of the Time-of-Flight-Diffraction (TOFD) technique for providing consistently accurate and repeatable sizing of SCC flaws. Our micro-TOFD system uses high frequency, small diameter transducers with very low probe center spacing. Our system is designed to locate the diffracted energy from the crack tip. Micro-TOFD has been shown to be effective on thin wall materials and relatively small cracks. This system requires two probes, one on either side of the crack. Linear phased array techniques can also be effective in measuring crack depth and are beneficial for situations where access to the crack is limited to a single side. The phased array approach uses a transducer array and timing delays (phasing) to direct and focus the beams to the desired location. This technique can use longitudinal waves or shear waves and the transducer array is housed in a single probe, permitting sizing when only one side of the flaw is accessible. The technique may be pulse-echo, thru-transmission, or pitch-catch as applicable.

CORROSION MAPPING -
PHASED ARRAY UT PROBE

We have found that conventional UT to provide a comprehensive thickness scan of the excavated/exposed section is an efficient means for detecting areas of wall loss. However, if extensive degradation is discovered, a more detailed mapping of the corroded area can provide advantages through more accurate input into remaining strength analyses as well as more auditable records and documentation for resultant decisions. Thus, Structural Integrity has incorporated a handheld phased array wheel probe to further characterize any internal pipe wall thinning discovered. The probe is field rugged and designed for efficient hand scanning of pipeline surfaces using phased array UT and is compatible with standard UT phased array systems. The unit acquires encoded thickness data (as many as 90,000 data points per square foot) as the probe is rolled along the surface and is capable of outputting the data captured in tabular form for use in pipeline remaining strength models as well as advanced imaging/resultant scan output (see Figure 2 below for an example image of the probe and mapped C-Scan image of a corroded pipeline). This approach provides the field rugged and efficiency benefits of a conventional UT system with the encoded and detailed analysis benefits of a more automated approach.

CONCLUSIONS

Due to improvements in ILI inspection capabilities, particularly for crack detection, follow up of ILI indications using direct examinations require more advanced technologies for degradation characterization than traditional techniques. This, in combination with the benefit of employing technologies which can encode and store data for model input and record tracking over time, has resulted in the need for more advanced inspection solutions. As such, Structural Integrity has recently added several new technologies into our oil and gas inspection offerings.



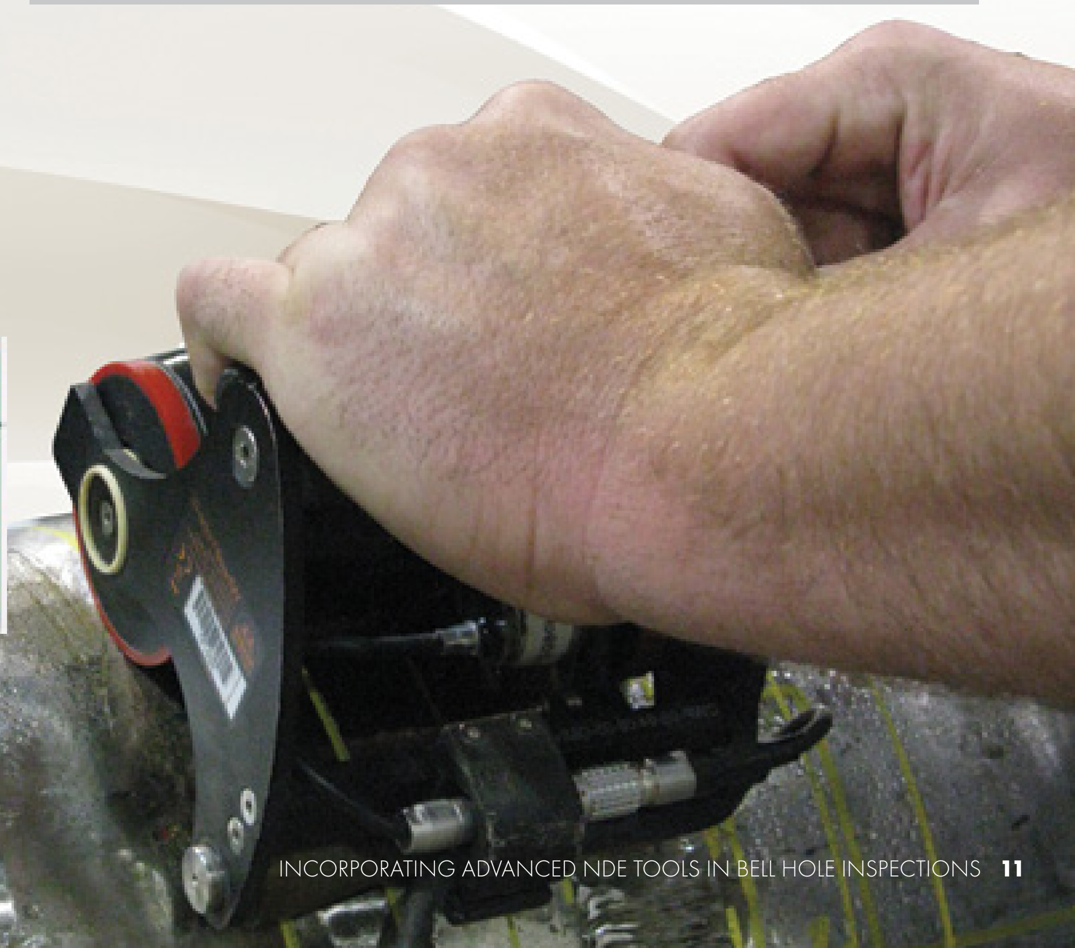


Figure 2: Illustration of the Roller Probe and Scanned Output of Corroded Area