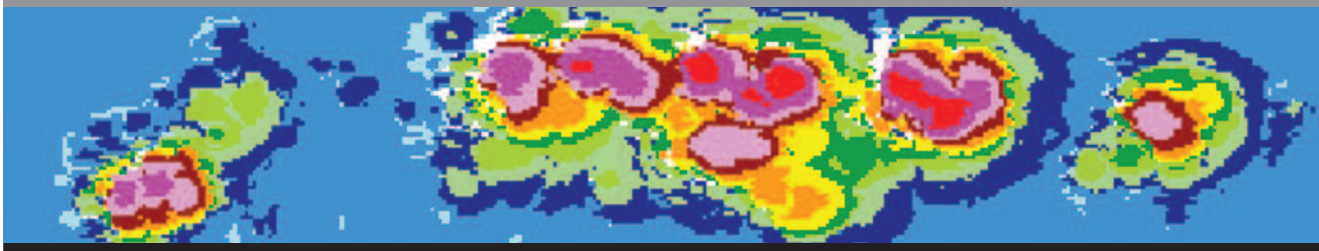
sonomatic®

innovative inspection technologies



Time of Flight Fast Screening

The Time-of-Flight-Diffraction (TOFD) technique, originally developed for crack detection in the nuclear industry, has long been considered the most effective technique for the location and sizing of flaws in ferritic welds. TOFD can also be used as an effective screening tool to identify and size local wall loss on vessels and pipes. TOFD screening removes the effect of paint or coating on the steel thickness results and allows rapid coverage over large areas.

Historically, the interpretation of TOFD screening data was time consuming. Sonomatic has developed a software package that allows rapid and accurate analysis of large TOFD screening data sets, opening the way for the technique to be used routinely for rapid asset inspection.

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Sonomatic has offices in strategic global locations so we can respond quickly to customers' requirements wherever they may be situated. Our high quality products are matched only by our customer service. In addition to our field services, we offer training and consultancy at our sites in the UK or at clients' premises anywhere in the world. Sonomatic is committed to improving asset performance through applied and innovative technology; to delivering these benefits to our customers in the products and services that we provide; and to working with our customers, as value-added partners, to realise the maximum benefits of inspection technology.

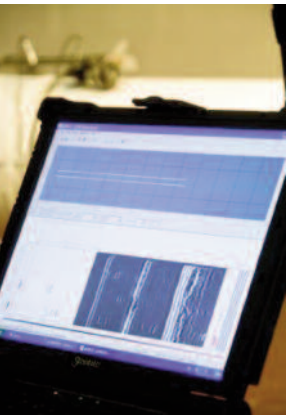
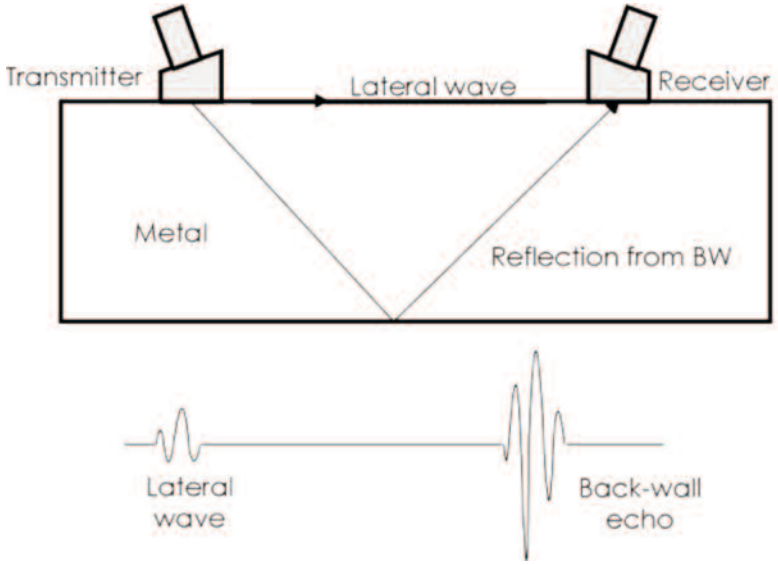


Figure 1: TOFD screening

Time of Flight Diffraction Method

Time-of-Flight-Diffraction (TOFD) utilises two ultrasonic transducers (Figure 1 and Figure 2); one acts as an emitter of ultrasound, and the other as a receiver. The transducers are moved together in contiguous parallel lines across the region of interest while continuously collecting data. When degradation is present, the time of arrival for the reflected signal is different to that for an unaffected region. An image is built up using the ultrasonic wave forms to show the cross section of the region being scanned (Figure 3). Using Sonomatic's bespoke software it is then possible to find the wall thickness at each point in the TOFD scan and to produce corrosion maps from the data.

Figure 2: TOFD principle



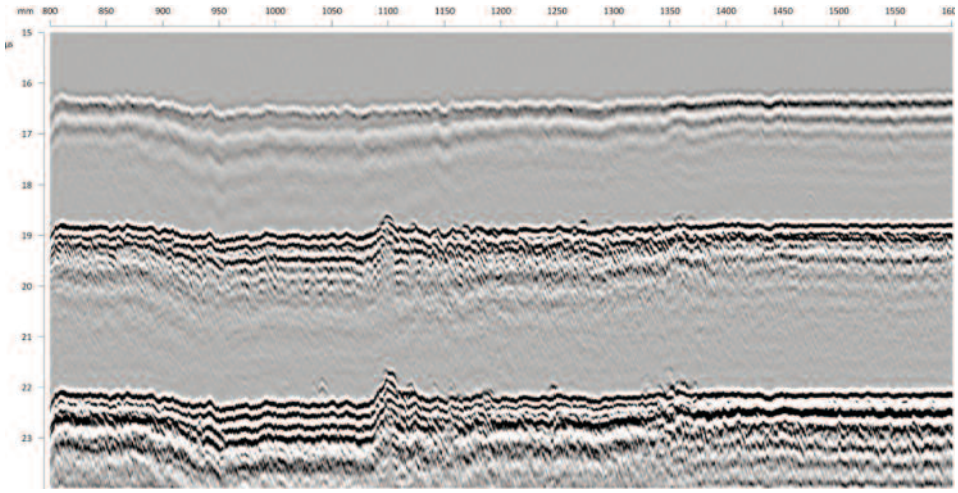


Figure 3: TOFD scan showing corrosion

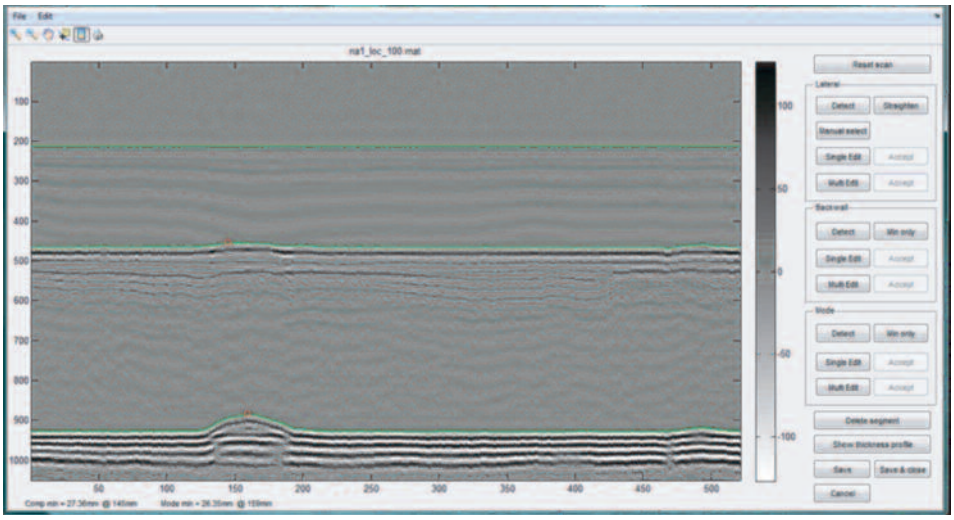
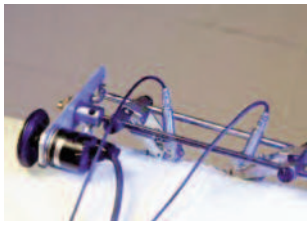


Figure 4: TOFD scan after processing in Sonomatic's bespoke software



Data Analysis

Sonomatic's TOFD analysis software allows the thickness of each point in a TOFD scan to be calculated and stored. The software straightens the data, to allow meaningful visual interpretation, and identifies the time of arrival of each ultrasonic reflection to allow the thickness calculation to be performed. Figure 4 shows an example scan that has been straightened and each signal identified using the bespoke software.

The thicknesses are stored for each TOFD scan as profiles which can be combined to produce corrosion maps giving a visual representation of the variation of thickness across the inspected region (Figure 5). The corrosion map allows quick and clear visualisation of the wall thicknesses and highlights any trend in the measurements. By examining the corrosion map it is easier to identify thinner regions that are more likely due to manufacturing processes than real wall loss e.g. thinner regions at knuckles. Regions where data has been lost due to access restrictions (e.g. nozzles) are also easier to visualise. The software has many additional built in functions to further analyse the TOFD data to ensure the best results are achieved for the data, for example thickness distributions are easy to produce for selected regions or for the whole of the vessel to allow statistical analysis of the thicknesses (Figure 6).

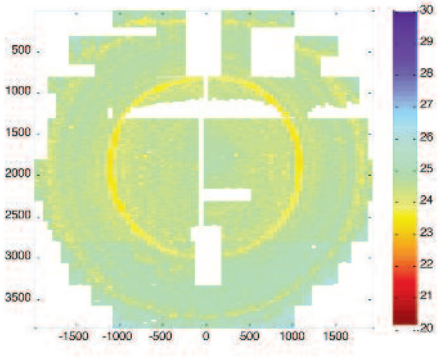


Figure 5: Corrosion map generated from TOFD data of dome end

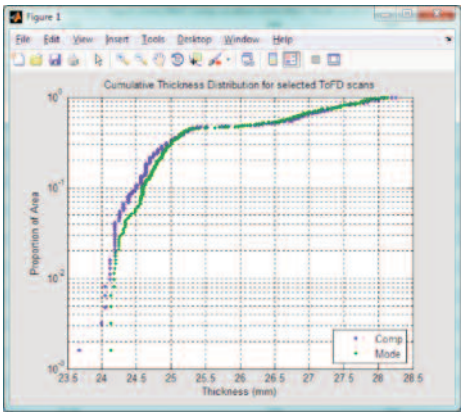
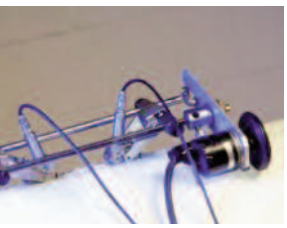
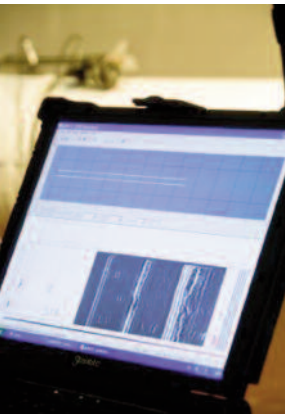


Figure 6: Cumulative thickness distribution





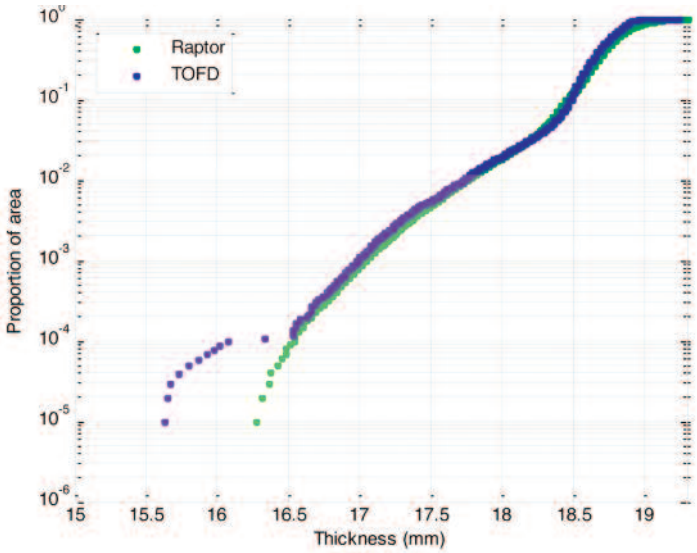


Figure 7: Cumulative thickness distributions for zero degree corrosion mapping (Raptor) and TOFD

Comparison to Corrosion Mapping

Through various evaluation projects, TOFD screening has been shown to be a highly efficient scanning technique with a high probability of detection (POD) and a low false call rate. Sonomatic's TOFD screening software compares exceptionally well to zero degree corrosion mapping. Figure 7 shows an example cumulative thickness distribution for a region inspected by TOFD (blue) and zero degree corrosion mapping (Raptor-green). With the exception of the tail, the curves are in very close agreement. The difference in the tail was due to TOFD recognising a defect that was obscured to the corrosion mapping by an inclusion; highlighting the additional capabilities of TOFD.

Benefits

- Rapid coverage of inspection area.
- High probability of detection for localised degradation.
- Low false call rate.
- Proven reproducibility and accuracy.
- Produces steel thicknesses independent of paint or coating.
- Permanent records with graphic images.
- Composite corrosion maps can be generated.
- Data allows statistical analysis.

Applications

- Pressure vessel inspection.
- Non-intrusive inspection (NII).
- Inspection for localised degradation in internally coated vessels.
- Pipework and Pipeline inspections.
- Topsides and subsea inspections.

QA and HS&E

It is Sonomatic's ongoing commitment to supply services and products, through the application of technical and engineering excellence, which complement both the customer's and our own QA and HS&E requirements.

Sonomatic's commitment to quality is maintained through continuous assessment and review of our Quality Management Systems to BS EN ISO 9001:2008. Sonomatic actively promotes the development, implementation and improvement of our QMS as a part of our ongoing drive to enhance customer satisfaction by meeting or exceeding customer requirements. In 2009 Sonomatic achieved UKAS accreditation as an Inspection Body to BS EN ISO/IEC 17020 (UKAS IB4276).