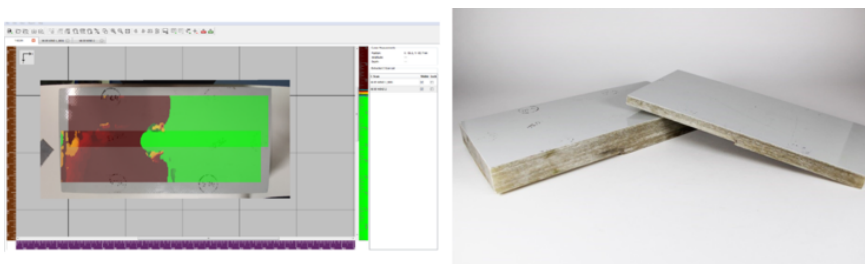


Application Note

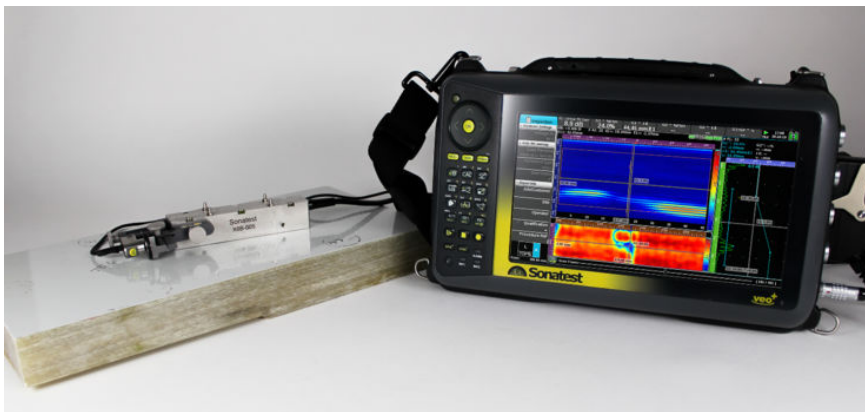
Brief Description

In this application note we will be focussing on the inspection of glass fibre reinforced plastics (GFRP), specifically those used in the manufacturing of wind turbine blades. Common defects in this material will include air voids/bubbles trapped in the epoxy (porosity), delaminations between fibre layers especially around areas with thickness changes and damage to the spar due to excess stress on the blades.



Features & Benefits

- Larger coverage hence gains in productivity
- Reduction in down time as inspection can be done while the blades are on the Turbine
- Greater penetration due to our low frequency transducer
- Lightweight and portable
- Excellent signal to noise for a clear image



Inspection Procedure

The test procedure was demonstrated on two samples as shown below, the parts being inspected are sections from a wind turbine blade, both sections have 2 different thicknesses, 18.5mm, 23.5mm, 41.5mm and 46.4mm.

Industries & Market

- Oil & Gas
- Petrochemical
- Power Generation
- Marine

Typical Parts

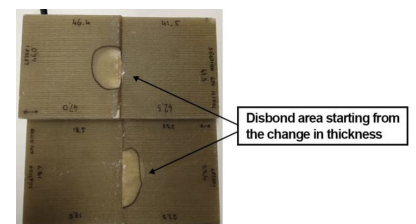
- Flange
- Billet
- Bar
- Wind Turbine Blades
- Ship Hulls

Inspection Technique

- Encoded Phased Array C-Scan
- Amplitude based Technique

Recommended Tool Package

- Veo+ or RSFlight
- UTstudio+ or UTmap
- Low frequency phased array transducer X6B 1/0.5MHz
- AXYS Encoder
- Couplant (water will work well and reduce clean up time)
- Calibration piece (for this I used 2 sections of turbine blades, each with two different thicknesses)

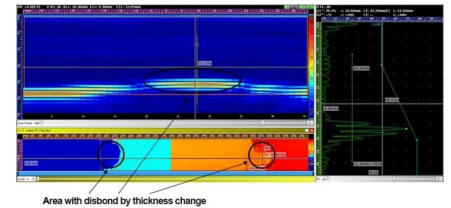


The defects start in the area where the thickness changes and continues part way into the thicker side of the samples.

Practical Outlines

Need for Phased Array Inspection

- The need for inspection of wind turbine blades begins at their manufacture and continues throughout their lifespan as each blade comes under different stresses from their environment.
- During the manufacturing process, delamination can occur, these defects are often hidden from the visual view and need to be ultrasonically inspected. Common areas for delamination are around drilled holes (for fasteners) and around edges/thickness changes.
- Another defect that can be introduced during manufacturing is porosity, this is an area or air/air bubbles that get trapped during the resin injection and curing process.
- Over the working life of a wind turbine blade inspections need to be made to help discover new defects that may be formed, these can include:
 - Separation from the spar due to high stress
 - Impact damage from birds
 - Delamination caused by too much flex of the blades while in operation during high winds



Benefits of Inspection

- Wind turbine blades are high value items, they are also hard to transport and change. Therefore, it's very important that proper inspections are made, reducing the need to change blades unnecessarily, as well as avoiding in service failures.
- Using this test method, the inspection can be performed while the blades are attached to the turbine via rope access, meaning there is no need to remove the blades and bring them to a ground location, reducing cost and overall down time.
- Not all delamination will be failures, using phased array, it makes it easy to monitor any growth in delamination size, therefore finding the right time to remove or repair the turbine blade.
- Delamination, wrinkles, porosity sizing and characterisation is improved with UTstudio+ and could even be size automatically with the unique UTmap annotation.

Conclusion

- The Sonatest low frequency phased array transducer, paired with one of our fast, capable units gives an easy to use and reliable way to guarantee thorough NDT inspection of wind turbine blades.
- Due to the versatility of our units, many other inspections related to wind turbines can be achieved, for instance the welds in the supports as well as checking for corrosion in specific areas.

For further information or support, please contact the Sonatest Applications Team:
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Get in touch with your local Sonatest expert, available in more than 50 countries over 5 continents!



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