Introduction

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, but the principles used are applicable across the range of GFRP parts. Common defects in this material will include air voids/bubbles trapped in the epoxy (porosity), delamination's between fibre layers especially around areas with thickness changes and damage to the spar due to excess stress on the blades.

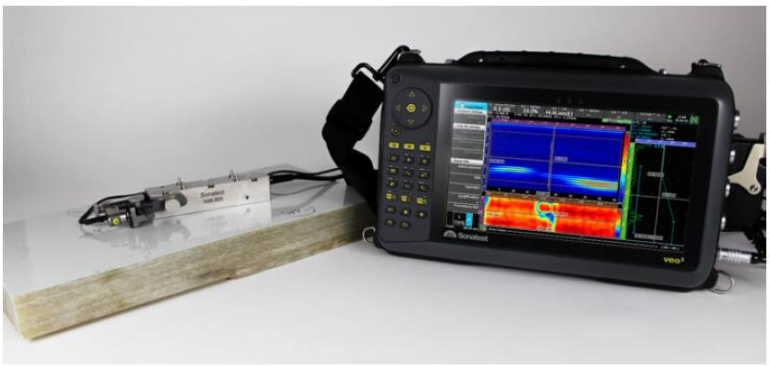

Figure 1 – VEO3 GFRP scan setup

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

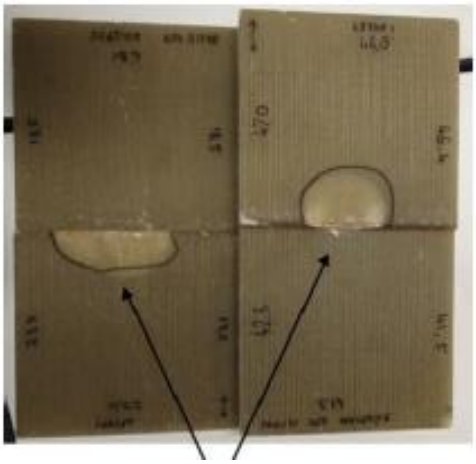

Figure 2 – shows the two samples inspected for this trial, both samples have areas of simulated defects, Left plate has simulated lamination, Right has simulated area of thickness loss

Industries

- Aerospace Aeronautical Inspection
- Aerospace Astronautical Inspection
- Chemical & Petrochemical Sector
- Oil & Gas Sector
- Nuclear Energy Sector
- Wind Power Renewables Sector
- Maritime Shipping Industries

Application

- Corrosion / Thickness measurement
- Composite Material Inspection
- Storage Vessel Inspection
- Material Bonding Inspection
- Asset Integrity

Typical Parts

- Wind turbine blades
- Ship Hulls
- GFRP pipeline
- GRFP repairs
- GFRP flange
- GFRP plate

Inspection Techniques

- Phased Array L-Scan

Features and 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

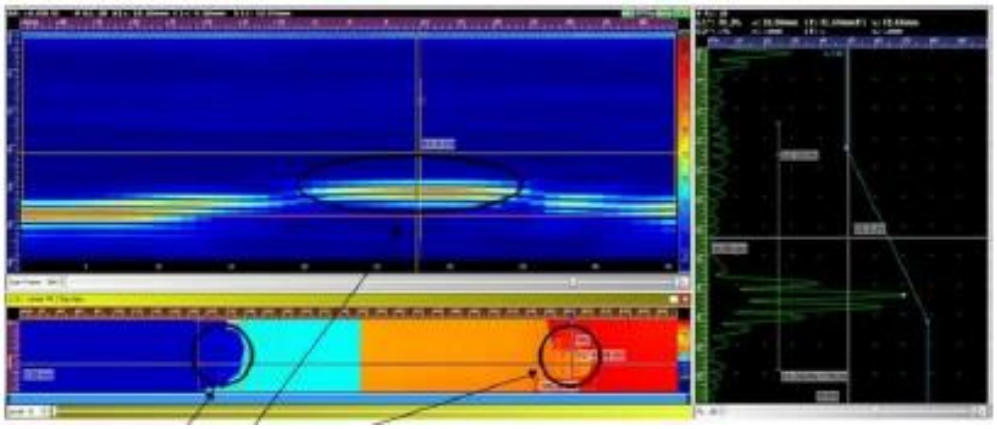

Figure 3 – shows the results of the scans, both plates were lined up end to end, both defects have been highlighted

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 achieve, 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: applications@sonatest.com

Recommended Tool Package

Category	Part #	Description
Acquisition Unit	VEO3 / RSFlite / PRISMA Phased array data acquisition units	
Probe	X6B range of low frequency probes, available in 0.5MHZ and 1.0MHz versions	
Encoder	AXYS Encoder	

Get in touch with your local Sonatest expert, available in more than 50 countries over 5 continents!

Sonatest (Head Office)
Dickens Road, Old
Wolverton Milton Keynes,
MK12 5QQ
t: +44 (0)1908 316345
e: sales@sonatest.com
Sonatest

(North America)
12775 Cogburn, San Antonio Texas,
78249
t: +1 (210) 697-0335
e: sales@sonatestinc.com

