

Seeing through blades

Blade quality scrutinized through our ultrasonic scan program.

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Our global headquarters moved into new and modern facilities.

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NewsLetter

MARCH 2009

The LM 53.2 P is the first blade to be designed with our customized LM airfoils. The airfoils enabled us to design a blade at maximum length and optimum energy output. The blade is produced at our factory in Ponferrada, Spain.



First blade with customized airfoils

After more than a year of research and hard work, in late 2008, the first LM 53.2 P blade came out from our factory in Ponferrada, Spain. The LM 53.2 P is not only the second largest blade in our portfolio – it is also the first LM blade to be designed with the fully optimized LM airfoils.

LM Glasfiber's long experience with blade design and manufacturing, excellent engine-

ering competencies and advanced design tools were crucial in order to achieve an optimal design for the LM 53.2 P blade. A global team located in Denmark, the Netherlands, India and Spain handled development, design and production, applying our extensive internal know-how in all areas, including advanced wind tunnel testing. The result is a blade that encapsulates and leverages our knowledge base and strengths while being aligned with the LM Production System,

which secures a smooth start-up of an efficient production.

The specially developed airfoils, optimized for high performance, for the LM 53.2 P were thoroughly tested in LM Glasfiber's wind tunnel facilities, using state-of-the-art measurement techniques and equipment.

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Thornton Bank in Belgium

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NewsLetter

18 LM 61.5 P2 blades are in place and contributing to the production of power in the initial phase of Belgium's first offshore wind farm, Thornton Bank, located approximately 30 km from Zeebrugge. In a water depth of some 25 meters, six REpower 5M turbines with LM 61.5 P2 blades were successfully installed during the summer last year, and the first phase of the wind farm was completed in September 2008.

Once the third and final phase of the project is completed, the Thornton Bank wind farm will have a total installed capacity of 300 MW. The annual power production is expected to be at about 1,000 GWh, corresponding to the annual electricity consumption of 600,000 people. This will result in a reduction of CO₂ emissions equivalent to 450,000 tons/year.

Alpha Ventus in Germany

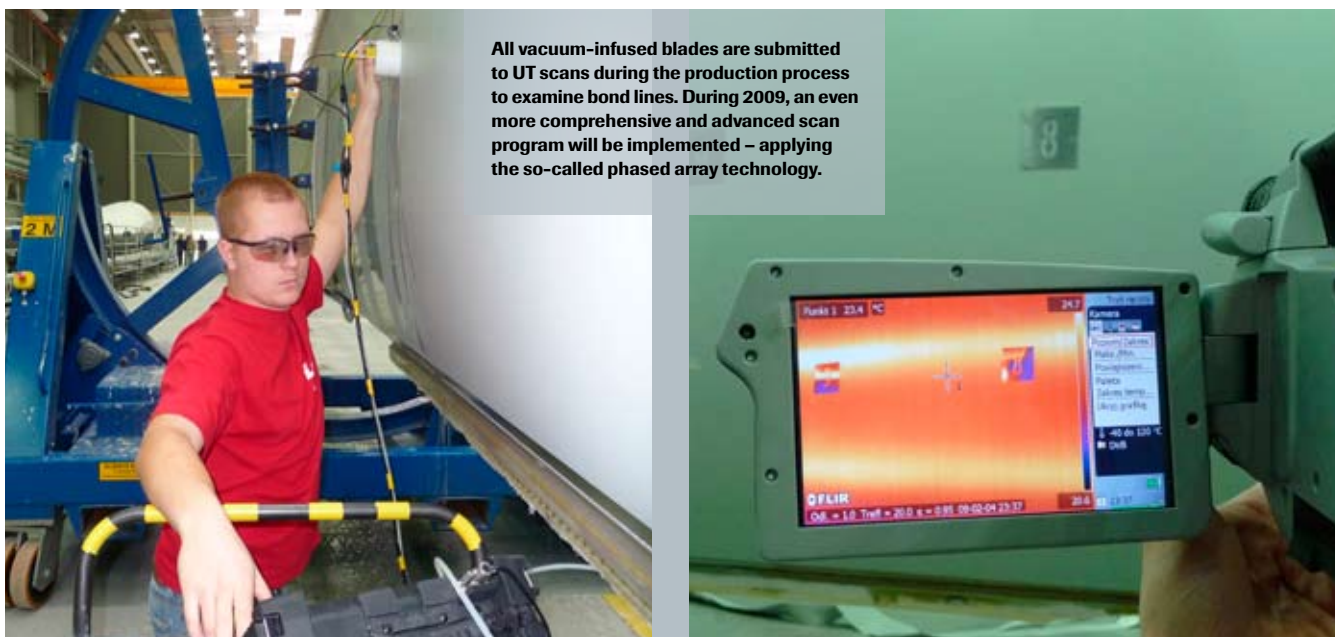
Installation of the turbines for the first German offshore wind farm is scheduled to start this summer. The 12 wind turbines will be erected on an overall area of four square kilometers, 45 kilometers north of Borkum Island. The first six turbines are REpower's 5M equipped with LM 61.5 P2 blades.

The Alpha Ventus project is partly financed by the German Ministry for the Environment and will generate essential experience in building and operating offshore wind farms. The research and development results and experience from this project will be integrated into the design, construction and operation of future offshore power plants. Thus, the Alpha Ventus is a ground-breaking project for the German offshore wind market. Currently, more than 20 German offshore wind projects are in the pipeline up to 2015.



The first six turbines installed completed the first phase of the Belgian Thornton Bank project in September 2008. Picture: Jan Oelker

UT scans to ensure blade quality



All vacuum-infused blades are submitted to UT scans during the production process to examine bond lines. During 2009, an even more comprehensive and advanced scan program will be implemented – applying the so-called phased array technology.

Securing the quality of our blades is an integral part of our production processes. All blades go through so-called firewalls, where the blades are inspected for various quality issues. One of the methods applied is Ultrasonic Testing (UT) scans to examine bond lines, which a strong team of people in our factories worldwide carries out every day.

Making sure our blades live up to strict quality standards is key for LM Glasfiber and our customers. Our comprehensive ultrasonic scan program is one of the ways in which we control the blade quality. And it is a key focus for our quality program that we continuously improve the inspection methods applied and the equipment used.

“We comply with the guidelines of the American Society for Nondestructive Testing (ASNT). This means that we follow the highest internationally recognized standards for training and for the methods and processes applied when scanning our blades, as well as for our subsequent handling of documentation,” says Jørgen D. Vestergaard, Team

Leader Blade Measurement, who started the global training program to certify key people in all factories.

The highest standard

After 1½ year of comprehensive training, a dedicated team of Non Destructive Testing (NDT) inspectors worldwide has now been educated to perform advanced UT scans on all our vacuum-infused blades. “To apply the ASNT guidelines to our specific business and product, we have developed our own UT scan standard that ensures our customers that the NDT inspectors are thoroughly trained, that quality data from the scans is valid and that the methods and techniques we use are continuously followed up on and improved. All NDT inspectors working with this are re-certified every three years,” Jørgen Vestergaard says.

Continuous improvements

The next step is implementing multi-transducer technology, which will allow us to scan much larger areas of the blade – the so-called UT Phased Array scan, which is used in e.g. the aeronautic sector.

“LM Glasfiber will be one of the first in the wind industry to apply this technique for quality control of rotor blades, using reliable, portable and user-friendly equipment,” says Laura Rodriguez Gil, Global Process Engineer, who is in charge of implementing the phased array technology.

“Implementing the phased array technology means that our NDT inspectors will receive comprehensive training in order to acquire expertise in using this specific technique. We have already started the training in some of our factories,” Laura Rodriguez Gil says, and she continues: “We will be able to offer our customers a higher level of quality assurance because we are able to scan the blades even more thoroughly, and the blade inspection time will be reduced due to the improved equipment, which ensures a more efficient scan process. The phased array scan is expected to be fully implemented by the end of 2009 where all plants will have certified NDT inspectors to carry out phased array quality inspections,” she concludes.

LM 53.2 P – next generation blade design

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NewsLetter

More than 30 years of experience in blade design and manufacturing combined with in-house specialist competencies and advanced design tools provide the foundation for the first blade with specially designed and tested LM airfoils – the LM 53.2 P.

The LM 53.2 P is the longest blade LM Glasfiber has produced outside of Denmark where we produce the LM 61.5 P2. It is manufactured in our factory in Ponferrada, Spain. However, perhaps the most interesting fact about the LM 53.2 P is that it features our customized LM airfoils.

With a global team based in Denmark, the Netherlands, India and Spain in charge of the development, design and production, a broad range of LM Glasfiber's in-house specialist skills were put into play.

Combining experience and advanced tools

"We apply a holistic design approach when designing new blades," says Jesper Madsen,

Engineer in the Research department. "This means that we take several parameters into consideration, from blade structure and materials to the overall design and efficiency of the turbine. With our advanced calculation software, we are able to process several airfoil pre-designs to ensure the optimum design for the blade. And we continue to optimize our catalogue of airfoils to offer our customers the best possible designs. The



The LM airfoils will remain an important component in the next generation of LM blade designs.

JESPER MADSEN

LM 53.2 P is a really good example of where we have used our accumulated knowledge and thoroughly tested designs," Jesper says.

He continues: "The LM airfoils will remain an important component in the next generation of LM blade designs with cutting edge aerodynamic features contributing to increased annual energy production. For the LM 53.2 P, the airfoils have enabled us to design a blade at a maximum length while still sticking within the specified loads. Without the new airfoils it would have been necessary to make a shorter blade and thus the energy production would have been lower. Having a wide selection of thoroughly tested and verified airfoils in our product catalogue allows us to efficiently customize the blades according to the needs and requirements of our customers. Thus, they will have better, tailor-made blades faster."

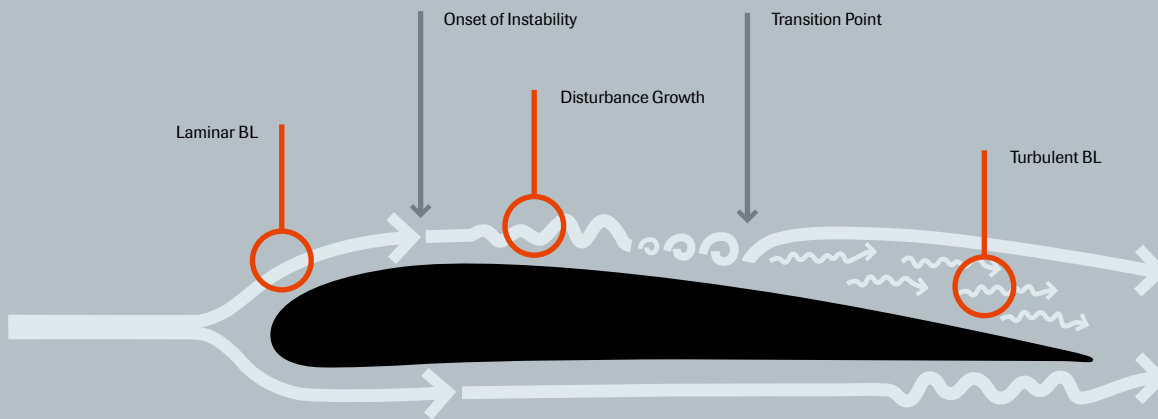
Comprehensive static and dynamic testing of the LM 53.2 P prototype is currently going on in Denmark. Series production is expected to start at the end of 2009.

The LM 53.2 P encapsulates the vast experience, advanced technology and know-how of LM Glasfiber. The blade is manufactured at our factory in Ponferrada, Spain.



The transition point is key

FACT WHAT IS TRANSITION?



The fluid boundary layer that forms between the fast-moving outer flowing mass, and the fluid resting at the surface of the airfoil is initially laminar, i.e. the layers slide smoothly on top of each other without mixing. At a certain point, the flow becomes unstable and small waves form and grow until they eventually break up at the point of transition. From that point on, the boundary layer is turbulent, i.e. the fluid moves in an eddying motion, which increases the frictional loss of the airfoil.

Developing, testing and quality controlling our blades requires highly advanced technology. In LM Glasfiber's Research department, a new infrared camera has enabled us to work on additional ways of improving aerodynamics on our new blade designs. The state-of-the-art camera is used to study turbulence in the boundary layer of the airfoils, providing precise data for optimizing blade performance.

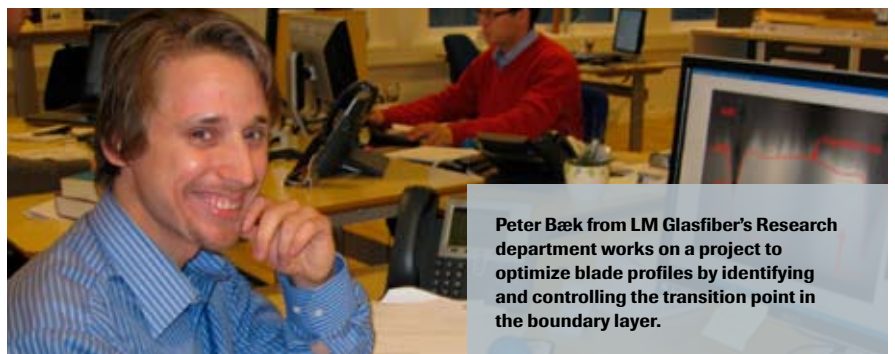
Our Research department works constantly on optimizing our blade designs. Measuring the transition point is a new way of doing that. "We haven't been able to measure this before, but with our new infrared camera, we can identify the transition point, i.e. exactly where the turbulence is generated in the boundary layer. That is an important parameter for designing the airfoils that will make a high-performance blade," says Peter Bæk, Aerodynamicist. The new camera takes 30 pictures every second – corresponding to shooting video – and it features technology used by the American Forces to shoot down fast moving people or vehicles. Our purpose is harmless, however.

Peter Bæk explains: "Identifying the transition point is crucial when developing high-performing blades. If it is possible to control the point of transition on the airfoils, the frictional drag of the airfoil can be reduced significantly and ultimately increase the power production of the wind turbines".

Customized airfoils

"Our airfoils are customized to fit the conditions our various blade types are exposed to. We use advanced computer calculations and experimental verification in our wind tunnel

for that purpose. To design a high-performing blade, the transition point must be optimized to give the airfoil low drag, gentle stall characteristics and low susceptibility to roughness, such as dirt and bugs that accumulate on the blades over time. The new equipment allows us to fine-tune the mathematical models we use even more to fit reality better. Generally, the new infrared camera will increase the quality of our wind tunnel measurements, providing our customers with the best possible blade design," Peter concludes.



Peter Bæk from LM Glasfiber's Research department works on a project to optimize blade profiles by identifying and controlling the transition point in the boundary layer.

Streamline operations

As of January 1, a VP, COO (Chief Operating Officer) was added to LM Glasfiber's Group Management in order to ensure that we continue our extensive work to align our manufacturing practices globally and focus on product quality, efficiency and safety.

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Bringing with him 25 years of international experience in executive operational roles, Iain Gow is our new VP, COO. Iain Gow joins LM Glasfiber from a position as VP Operations, Medical Nutrition at DANONE.

The new operational set-up with Iain Gow in charge is the next step in the business transformation of our company which has been our main focus for the past two years. The creation of this new function secures our focus on continuous improvement and operational alignment.

Iain Gow says: "Our business across the world will be able to supply our customers with high quality blades more efficiently, while making sure that our factories have the necessary focus and support to become world class. This includes ensuring a safe working environment for our people to develop in. I am really excited about this new role at LM Glasfiber. I have been in global operations roles in different companies over the last few years, and what I enjoy most is being in an entrepreneurial business where I can work, together with a committed team, to make a difference. I am confident that I will continue to learn and grow while using my experience to deliver business benefit to LM Glasfiber and our customers," he concludes. Iain Gow will be based at our Global Business Office in Amsterdam in the Netherlands.



SPECIAL CRANE FOR MORE EFFICIENT BLADE HANDLING

Lifting even the largest blades



The yellow gantry crane in Little Rock is able to handle even our largest blades. The picture shows the first LM 43.8 produced in Little Rock being moved to the storage area.

LM Glasfiber's focus on streamlining our operations and processes concerns all areas of our business, from safety and production in our factories to how we handle storage and logistics before handing over the blades to our customers. An example of this is the mobile straddle carrier crane that secures safe and efficient handling of even our largest blades.

The so-called rubber tired gantry crane has added several new dimensions to the way in which we handle blades when transporting them to and from storage areas or loading them onto the various vehicles that will take them to their final destination on our customers' turbines. Our factory in Little Rock is the first to use the new crane type, which is also fit to meet the future challenges of increasingly larger blades. The crane has a carrying capacity of more than 36 tons, allowing it to handle our largest blade types.

Flexible and cost-effective

"With this type of crane, the suspended blade has the center of gravity almost in the center between the four rubber tired wheels, resulting in an evenly distributed wheel load, which enables it to move across concrete or

cobblestone paving. This means that we can avoid establishing expensive specially reinforced areas for maneuvering," says Troels Thomsen, Business Developer, who has helped bring the gantry crane to Little Rock.

"Other benefits of the gantry crane concept are the crane hooks, which can be individually controlled and lowered to the height of the person helping out on the ground. The horizontal crane beams make it easier to position the crane right above the blade, and the blade can be lifted and lowered independently at the root as well as at the tip. The integrated GPS steering system ensures that the crane follows the same track exactly every time, and it can be connected to a computerized inventory system that receives information about the blade location from a bar code chip stuck onto the blade," Troels concludes.

FACTS RUBBER TIERED GANTRY CRANE

Carrying capacity: 36,287 kg
Wheel base: 9.14 m
Tread width: 12.80 m
Height to crane hook: 10.01 m

First blades out from Poland

Recently, LM Glasfiber reached an important milestone in the Northern European region of operation. We delivered the first set of blades from our newest factory in Goleniów, Poland.

The factory, which is our third in Northern Europe, is built to be able to supply blades up to more than 60 meters in length to key markets in Northern, Central and Eastern Europe, and to the offshore market. The first blades to come out from Goleniów were LM 43.8 P for Nordex.

“LM Glasfiber has been very well received here in Goleniów,” says Krzysztof Krzyzanowski, HR Manager. “As of January 2009, we have 280 employees and we expect to strengthen our team with an additional 100 operators later this year. By having a reputation as a reliable employer who takes care of our people and their working conditions, we have been able to attract many qualified people, which is promising for our positive development here in Poland.”



Our newest factory in Goleniow, Poland, recently delivered the first set of blades after starting production in late 2008.

Moving to our new global headquarters

December 2008 marked the beginning of a new era in LM Glasfiber's history, when we moved our global headquarters from our historical headquarters in Lunderskov to new and modern facilities in nearby Kolding.

LM Glasfiber's new headquarters are located centrally in Kolding, Denmark, with easy access to motorway and airport.

The new corporate address is:

LM Glasfiber A/S
Jupitervej 6
DK-6000 Kolding
Denmark

Phone numbers and e-mail addresses remain unchanged.





I believe that our short-term challenges are what will, in the end, secure wind energy its rightful place in the future.

ROLAND SUNDÉN

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ShortNews

Introducing a VP, Quality

At the end of January, we welcomed **Randall Hoeflein** as our new VP, Quality. The creation of this new role reporting directly to the CEO secures our strategic focus on quality and continuous improvement throughout the organization.

Randall comes from a position as VP, Continuous Improvement with Rockwell Automation based in the USA where he was in charge of continuous improvement initiatives and processes across 11 business units worldwide. He will be based at our Global Business Office in Amsterdam.

EWEC 2009

This year's major wind industry event takes place in Marseille, France, from March 16 to 19. LM Glasfiber CEO Roland Sundén has received the honorable task of chairing the conference and will open this on March 16.

The technical content of the conference includes a presentation by one of LM Glasfiber's aerodynamics experts, Peter Bæk. The session takes place on Wednesday from 9 to 10:30.

New market dynamics

By Roland Sundén, CEO

Change is the only constant in the wind industry – after years of exponential growth, the current credit crunch is creating new short-term market dynamics. I believe the result will be a healthy emphasis on innovation, continuous improvement and proven performance. I believe that our short-term challenges are what will, in the end, secure wind energy its rightful place in the future. The inherent demand for business and technological excellence that characterizes a new market situation will kick-start the final phase of transformation of our industry towards full maturity.

When I entered the wind industry almost three years ago, the maturing process had already begun. The development from niche industry to mainstream player in the energy business had started a drive towards a much higher degree of professionalism. When I look back now, it is clear that we have made quantum leaps but also that we have great opportunities ahead.

Optimizing our supply chain, continuously improving our production processes, and securing innovation to improve our end solutions is demanding, yet necessary to secure the competitiveness of wind energy.

This is something we are very conscious of at LM Glasfiber where our main focus, especially over the past year and a half, has been to streamline and optimize our operations. Building the foundation that will enable us to seamlessly scale our business to meet our


customers' demands is our focal point – and our goal is to emerge strengthened from the current slowdown in growth rates.

The changed market dynamics for wind energy will only be temporary.

The medium to long-term perspectives for the wind industry remain bright. Wind energy represents a key solution to some of the main concerns of the international community: fighting climate changes while meeting the growing need for electricity without dependence on energy supply from high-risk nations.

So we can be proud to be part of an industry with an ambitious mission – and this represents a meaningful and rewarding motivation for taking on our short-term challenges.

Kind regards



Roland Sundén



LM Glasfiber supports the Wind Power Works campaign. See more on www.windpowerworks.net

