



# Predictive maintenance solutions

Danny Ellis, CEO and co-founder of SkySpecs, dropped in to PES to give us the latest on the different maintenance strategies and why he thinks his company has the best proposition.

**PES:** Welcome back to PES Wind magazine. It's great to talk with you again. For the benefit of our new readers would you like to begin by explaining a little about the background of SkySpecs and the importance of the wind industry to you?

**Danny Ellis:** SkySpecs is focused on wind turbine blade diagnostics and maintenance, providing robotic technology that completely automates the visual inspection, analysis, and prescription maintenance of blades with drones. Our inspections take 15 minutes or less per wind turbine, and we inspect all four sides of all three blades in a single flight without any manipulation of the wind turbine.

We do not require any prior information about the wind turbine because the drone is programmed to identify and learn about the turbine when it takes off. This streamlined approach allows us to conduct around 25 turbine inspections, with a single drone, in one day.

SkySpecs recently introduced Horizon – an analytics, reporting, and management software platform for the wind energy industry. Horizon allows customers to review, prioritize and optimize their repair campaigns based on predictive maintenance recommendations.

Our differentiator is that we measure and

track damage over time, providing insight to our customers about how soon they should expect damage to become severe, or how long they can wait to make repairs.

SkySpecs is based in Ann Arbor, Michigan, but currently operates both onshore and offshore in the U.S., Canada, Europe, and Australia.

**PES:** Currently are you experiencing more growth in the market?

**DE:** The wind energy market is continuing to grow at a steady pace, but more importantly for SkySpecs, there is a substantial increase in customers looking for predictive maintenance solutions. Historically, this industry relies on a reactive maintenance strategy where they run turbines until failure. Now, many of our customers realize the advantages of spending time, money, and resources on



proactive strategies. Using this method, inspections and repairs are scheduled based on data analytics combined with all available turbine data. When a turbine is performing well and shows no signs of fatigue or failure, inspections can be conducted less frequently. Other turbines that show signs of under-performance or have visible damage may be inspected more often. As defects are tracked and compared across a fleet, predictive maintenance can optimize when repairs are conducted and which repairs should take priority.

**PES: We mentioned your new monitoring software – Horizon – earlier. Please tell us more, how will it be used, what are the benefits to the end user?**

**DE:** Horizon is our new data analytics and repair workflow software that we have released to our beta customers and plan to roll out to more customers by the end of the year. The goal of the software is to streamline blade inspection, analysis and repair.

We developed Horizon to complement our automated inspections. The combination of precise, repeatable data and software that makes sense of that large body of data, equates to a comprehensive solution. Data collection is only as good as the decisions that can be made from it, and that's why we spent the last year-and-a-half working toward this goal.

Our current customers are very enthusiastic about Horizon, and we continue to work closely with them to bring it to market on a global scale.

**PES: How do you see future wind turbine monitoring developing or has it gone as far as it can?**

**DE:** All infrastructure inspection will continue to improve with better data collection methods, better predictive analytics and more experience gained over time. The wind industry is still relatively young compared to other major industries and turbine technology is constantly changing. This will require continued research and development into more efficient maintenance methods.

**PES: With more and more companies providing UAV services how are you finding this and what do you think makes SkySpecs stand out from the competition?**

**DE:** SkySpecs stands out by providing the only completely automated UAV inspection solution that can inspect all three blades in a single flight without manipulating the wind turbine. There are other companies that manually fly drones or have started to implement partial autonomy on a single blade, but all these solutions take longer and are less repeatable. Often, these solutions also require the customer to look through all of the data themselves, which

monitoring and fixing turbines based on data analytics.

Because we've been working with leaders in the industry, we've had the privilege of collaborating and solving problems beyond just collecting data. It became clear we needed to provide a lean, flexible solution to turn data into decisions. Our customers' feedback and input shaped our offerings, and we continue to work closely with them to ensure we are providing a tool that helps them work faster and more efficiently when it comes to blade operations and maintenance.

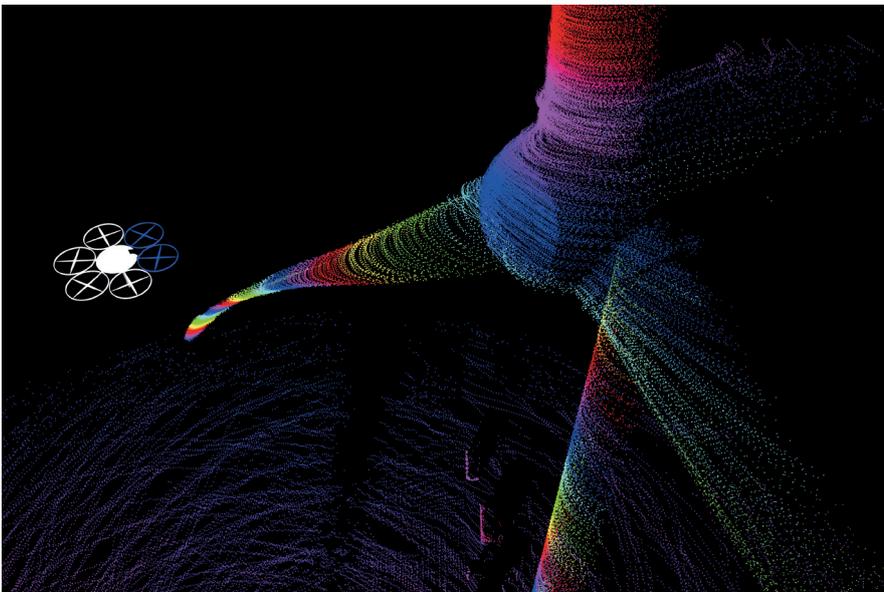
**PES: We would like to know about your philosophy on wind turbine maintenance service and how that impacts on your inspection solutions?**

**DE:** There are three main philosophies on any type of maintenance: reactive, proactive, and predictive.

A reactive strategy allows the wind turbine to run until failure or near-failure before an inspection or repair is scheduled. If everything runs smoothly and nothing fails, this approach works well! Based on our nearly 6,000 wind turbine inspections, however, this isn't typical. In fact, our data often locates damage that was previously unknown to our customers – many times the damage falls into the critical category.

A proactive strategy is time-based, usually including annual or bi-annual inspections and standard repairs with the goal of keeping the wind turbine operational without any catastrophic failures. This method results in fewer failures, but may also be more expensive since time, money, and resources are being put into turbines that may be perfectly operational.

A predictive strategy is data-based and is usually the best of both reactive and



can quickly become an impossible task because of the amount of data collected.

The bottom line is that SkySpecs offers a complete solution, from the data collection, to the analysis and repair recommendations, all with an autonomous system that performs the same inspection on each turbine, year after year.

**PES: Where do you operate and where are your key markets and are there are any areas, geographically speaking, that you would like to break in to?**

**DE:** SkySpecs is actively operating throughout the U.S., Canada, Europe, and Australia with plans to expand to South America by the end of 2018. We have received requests for inspections in many countries, and our business development team actively explores and provides recommendations for every inquiry.

**PES: What is the single biggest challenge facing the market today?**

**DE:** The single biggest challenge facing the market today is long-term forecasting. We constantly see customers planning on a 3 - 6-month cycle, 12 months if we are lucky and are planning all repairs and maintenance based on a 12 month budget. This doesn't allow for optimization of wind energy generation for the next 10 – 20 years.

**PES: Your tagline is, 'Renewables powered by Robotics'. What is your collective mission when it comes to furthering the renewable energy industry using automation?**

**DE:** Renewable energy will always compete to be the most affordable and available type of energy with other forms of energy generation. SkySpecs firmly believes that wind energy can be the most competitive if

the operations and maintenance processes are optimized. Wind turbines are going to continue to degrade from environmental factors and manufacturing challenges, but robotics will be able to provide an affordable method of predicting these failures before they happen. Automated data collection and analysis will help wind farm owners make better maintenance decisions, allowing wind farms to be as efficient as possible.

**PES: AI and Machine learning are buzzwords that are frequently tossed around today. Do you use either, and to what extent do they allow SkySpecs to provide a better or more sophisticated solution to your customers and prospects?**

**DE:** Artificial Intelligence (AI) is simply a computer making a decision, or series of decisions, without human oversight. Many people associate AI with a computer having eyes and ears and acting like a human, but more often AI is less obvious. SkySpecs' wind turbine blade inspection has many layers of AI incorporated into the final product. When collecting inspection images, SkySpecs' drone doesn't require any information ahead of time.

On take-off, it identifies the wind turbine and automatically calculates the most optimal flight path to collect every required image in the shortest amount of flight time. When analyzing the inspection data, a different set of algorithms work to identify damages and defects. Each of these areas is a form of AI. Machine Learning (ML) is simply a form of AI that is often associated with the computer 'learning' from a set of data, similar to how a human learns from being taught in school, but the computer learns at a much faster pace. SkySpecs does implement ML principles to continually improve the data analysis and repair planning optimization.

**PES: Looking the rest of 2018 and beyond, what trends and/or changes are you anticipating in the market and why?**

**DE:** We are expecting to see more data analytics entering every aspect of the wind energy market, followed by more specialized repair crews and data-based repair schedules. This will open up opportunities for companies that can offer best-in-class, niche repair solutions where major OEMs or ISPs have historically been hired as a complete maintenance solution. Owners are looking to better understand their data and we are starting to see industry leaders come up with standards and best practices. We look forward to serving as a resource for these decisions and actively participating in the future of blade O&M.

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