

# REAL-TIME MONITORING SOLUTIONS

Vibration Specialty Corporation's Protect Wireless system provides an instant condition monitoring platform.

By Jeff McGuckin



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**SINCE THE INCEPTION OF THE** Industrial Revolution, machinery reliability has become increasingly important. In more recent times, it has become obvious that every aspect (from design and purchase through the operation, continuous evaluation, and maintenance) must be scrutinized for means to keep machinery performing effectively and efficiently. Each time a machine or system goes down, revenue and profits take a hit. One of the most important means of maximizing a machine's performance and operating time is to increase its reliability. Over time, condition monitoring and predictive maintenance technologies have proven to

do just that. New innovations have been developed to harness these technologies and to remotely evaluate and analyze machinery and system performance at an affordable price.

## **IMPROVE YOUR MACHINERY RELIABILITY**

From the beginning, vibration analysis has been the tool of choice for identifying and analyzing machinery problems. Today, vibration analysis has gone through numerous advancements to become an exacting, reliable and cost effective means for achieving machinery reliability. The next phase of maintenance is to enhance machinery reliability by marrying the



**Fig. 1: Protect Wireless Online Condition Monitoring and Evaluation System.**

Wireless online monitoring and evaluation system, it has become reality.

VSC's extensive condition monitoring and hardware/software development experience has enabled them to create Protect Wireless. Protect Wireless is a game changing, online monitoring and analysis system for every piece of rotating machinery, especially wind turbines. It merges predictive maintenance and condition and energy monitoring, with every other process-related vital sign, to provide a complete picture of machinery conditions at any instance.

Condition monitoring and predictive maintenance provide critical information that turns the tide on machinery reliability. In fact, the Federal Energy Management Program states that predictive maintenance programs offer a return-on- investment (ROI) of 10:1, while reducing maintenance repair costs by 25-30 percent, eliminating breakdowns by 70-75 percent, reducing downtime by 35-45 percent, and increasing production by 20-25 percent . All of this occurs because machinery faults are able to be seen well before they can cause a failure. As a result, you have the luxury of time on your side to resolve the impending problems and plan maintenance actions at the most convenient time. These remarkable predictive maintenance performances can improve even further with increased data resolution/accuracy, enhanced signal processing techniques, and more on-line data collection and evaluation.

standard process parameters (such as temperature and pressure) with the advanced dynamic predictive factors such as high resolution vibration spectra. This complex combination offers invaluable analytics for a detailed picture of the health of each machine. Merging these enhanced diagnostic abilities to the Internet's 24/7 accessibility and the latest products are making the industrial world a much smaller place. Suddenly no matter where you are located, you will have instant access to experts from around the globe to aid you in resolving your machinery problems at a moment's notice. This vision is not only possible but, with Vibration Specialty Corporation's Protect

### **TECHNOLOGY — THE WORLD AT OUR FINGERTIPS**

Our world is experiencing new technological advances each day. We have become an instant gratification society by receiving current information on our friends, breaking news, sports scores, and even live video right on our smartphones. These continual updates keep us totally apprised of our constantly changing world, making us far more informed of conditions around the globe.

Protect Wireless was designed with this same concept in mind. This communication model that

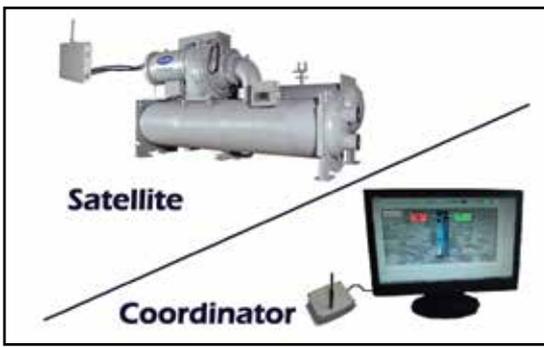


Fig. 2: The Protect Wireless Satellite is located near the machinery it monitors. It wirelessly transmits the data to a Coordinator which connects to a computer for storage, user interaction, and internet access.

keeps us up to date with world events also transforms how we monitor and analyze equipment. Protect Wireless was created so experts are no longer needed on site to evaluate machinery. The goal has been to eliminate the cost and time consuming requirements of experts that take days to come on location with their advanced equipment. This new model brings the data and email/text alarm alerts to any computer or smartphone via the Internet. Just like everything else in today's society, personnel can be notified of any deteriorating conditions in machinery as it happens.

Protect Wireless takes data collected on a machine and wirelessly transmits it anywhere around the globe, virtually in real time. The system consists of one coordinator and one or more satellites that are located near the equipment/machinery and are directly wired to the sensors. Beyond that, the system is wireless. The system can take in virtually any type of sensor and even incorporate existing SCADA/PLC wired data into the process. Each Protect Wireless Satellite comes with numerous options to fit varying needs and budgets.

One of the different options that Protect Wireless offers is the ability to select between one to eight simultaneous or synchronous data collection channels. The fewer collection channels you have, the lower the cost and the fewer multi-channel analytics that can be performed. However, even with a one-channel system, you can conduct advanced real-time FFT analysis that can paint a clear picture of the machine condition.

The data collection section is attached to one or more multiplexers, each offering 32 input channels. These can be joined together to offer more than 100 total input channels per satellite. The multiplexers have several different advanced options as well. It will suffice to say the standard multiplexer can provide ample information to accurately evaluate equipment cost-effectively from anywhere.

After the hardware gathers data from the sensors, it is initially processed and analyzed by each satellite. Subsequently, it is wirelessly broadcast at a 2.4 GHz 802.15.4 industrial standard frequency to the Protect Wireless Coordinator. The coordinator then translates and communicates the information to a local computer.

At the computer, the information is displayed through the software's simple image-based user interface that provides machine and sensor hotspots. For instant problem recognition, the colors change based on the severity of the detected faults. Clicking on a colored hotspot launches a new level, revealing additional analysis details for quickly evaluating the situation. In a simple picture, the software's mid-level screen distinctly reveals the specific part of the equipment and sensors that are in alarm. One mouse click on the alarming icon allows immediate access to information with trends, statistics, and historic and real-time raw data from each sensor.

### HIGH RESOLUTION — CRITICAL DETAILS

Protect Wireless is ideal for wind turbines for many reasons. First, the high resolution data is similar to high definition television which allows the viewer to crisply see the individual grass blades on a football field or the blemish on an actress's face. VSC's high resolution data works exactly the same way. Specific fault frequency peaks can be identified earlier than in the past, resulting in quicker solutions and less damage. Secondly, the wireless communications are simpler to install, so you can quickly get set up permanently or even for temporary testing. Further, simultaneous multi-channel data collection (up to eight channels) along with the instant Internet connectivity provide an expert remote diagnostic capability and keeps you informed of any alerts.

Protect Wireless has an exceptional high definition accuracy with 24-bit resolution. This is critically important as it detects wind turbine faults early. Normal monitoring systems have 16-bit or lower resolution, which causes the noise floor to be raised. This instrument noise blocks the machinery signals. Wind turbines, like other slow rotating machines, typically have lower vibration levels. Low-amplitude data can be buried in the instrument noise, making it difficult to identify bearings faults which are inherently lower signals.

Dropping the noise level enables the system to offer logarithmic scaling which amplifies the low-amplitude signals, so that even the lowest incipient bearing or other critical fault can be seen. This factor is extremely important considering that current practices often have difficulty identifying bad bearings. By the time the identification takes place, it is simply a matter of time before the

bearing totally deteriorates. With early detection, there may be actions possible to avoid a complete failure and extend the bearing life appreciably.

### WIRELESS COMMUNICATION — SIGNIFICANT ADVANTAGES

Wireless communication has a huge advantage over wired systems for wind turbines. Only minor wiring is necessary from the satellite to the machine sensors. Once the satellite and sensors are installed in the wind turbine, the signal goes wirelessly from there to a centrally located coordinator. This provides for ease of installation and gets 24/7 machinery monitoring online quickly. Once online, each wind turbine turns into an intelligent machine that relates when there is a problem.

Data from the Protect Wireless system is accessible instantly through the Internet and received at the other end, almost in real time. This means that you can view and analyze current data regardless of the turbine's location in the world. All processing, trending, correlating, etc. can be performed to give the user immediate knowledge of the equipment and component conditions. This is invaluable when immediate assessments are required to make economical decisions regarding maintenance.

One unique benefit of Protect Wireless is that it allows offsite and onsite personnel to quickly

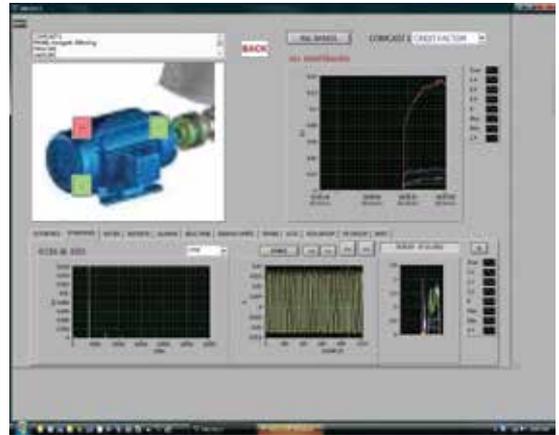


Fig. 3: Simple user interface for Protect Wireless. The red hotspot indicates an alarming sensor along with statistics and real-time and historical data at your fingertips for expert analysis.

connect with experts from around the globe to remotely review, analyze and consult on the data via computer or smartphone. In the past, analysts and engineers needed to be onsite to diagnose machine problems. Protect Wireless has changed this. This system, with advanced hardware, offers detailed phase analysis across couplings and shafts for additional analytics to promote predictive



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**Fig. 4: Protect Wireless brings vital information right to your smartphone with text message alarm alerts and total remote system control, no matter where you are.**

diagnostics. In addition, the system's distinctive ability to gather eight simultaneous channels of data is invaluable to engineers analyzing the data, because all of the data is collected at exactly the same instant. Engineers can relate each sensor's amplitude, frequency and movements to all others involved for a comprehensive picture of how each part is moving in relation to other parts as well as the entire system. This operational deflection shape

(ODS) similarity provides a third dimension to your online monitoring, enabling you to determine the total and relative movement of the structures and machines in your system.

All of this information empowers the analysts to identify explicit machinery faults, and recommend specific inspections, tests and repairs to help resolve the issue. No matter where you are, the information is always at your fingertips. Faults are found early and decisions can be made quickly to resolve issues well before they have time to deteriorate and compromise your operation.

### DATA — A WEALTH OF KNOWLEDGE

The ultimate value of this smart system goes well beyond finding specific machinery problems and energy losses, but lies in the data generated. This data holds a wealth of information which, when mined for analytical significance and correlations, can predict future operational, process, environmental and maintenance issues. Different data combinations may produce advanced diagnostic insights that were not considered possible before. This information could reveal an unlimited world of new solutions. This intelligent world will also feed off itself — blending old with new data and new sensors — to yield a profound understanding of our most perplexing problems. ✨

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