

Neighborhood Watch—

ADVANCEMENTS IN CONDITION MONITORING EQUIPMENT

Matthew Jaster, Associate Editor



The XM series of machinery protection and condition monitoring modules is designed for motors, fans, pumps and blowers (courtesy of Rockwell Automation).

With all the attention given to predictive maintenance, equipment reliability, quality assurance, and machine protection, the future looks promising for the condition monitoring industry. Now more than ever, manufacturing companies are examining what steps need to be taken to ensure improvements to machine reliability by predicting system failures and minimizing downtime. Management wants to maximize profits with a minimal amount of investment in equipment.

The recent economic freefall has made account executives nervous, and they're looking for any reason to cut back programs or technologies that provide less than spectacular results. Though condition monitoring seems like a simple way to keep up with daily operational

procedures, skeptics aren't always convinced it's the right investment.

"The traditional process industries have recognized the benefits for decades, to the extent where some are now treating it as a commodity item or service, which is dangerous," says Chris James, business area director for SKF Reliability Systems. "Nontraditional applications are where most reluctance is encountered. The technology is seen as costly to buy and difficult to implement. Vibration analysis, in particular, is seen as something of a black art."

For this reason, many companies are selling and marketing condition monitoring equipment in an effort to change the perception. "Organizations are reluctant to invest due to factors like technology expertise, personnel

and understanding," says Scott Johnson, product business manager at Rockwell Automation. "Others are reluctant because they see condition monitoring as an additional equipment cost, but the return of investment is an easy calculation when the equipment helps improve reliability and quality."

Rockwell Automation, SKF and Emerson are three organizations that believe the advancements in condition monitoring will lead to future success in the industry. New training and implementation techniques, integrated monitoring systems and wireless capabilities are just a few of the key developments to keep an eye on.

"Modern digital technology is providing more powerful and physically smaller devices for data acquisition, and

computers are allowing us to process and display this data much better than in the past," James says. "This trend is bound to continue."

Handheld vibration sensors, for example, are available at SKF for use with portable data-collectors. The elimination of the flexible coiled cable normally used with these systems can help the user simply from an ergonomics perspective. Additionally, it removes the risk of the cable getting caught in guards or rotating components.

"The health and safety police like that a lot," James adds.

Handheld, wireless monitoring devices are getting faster and more productive at a time when many customers are under pressure to cover more data with less manpower.

"The low installation cost of wireless systems allows customers to partially automate some of their programs to better meet their efficiency goals," James says.

Wireless systems offer other advantages as well, including the ability to apply data collection to areas where wired systems are either difficult or impossible to install (e.g. moving vehicles).

"Wireless vibration devices have been around for years," says Todd Reeves, product manager for machinery health transmitters at Emerson. "The challenge has been the fragileness of the wireless networks of the past and the security vulnerabilities."

Emerson uses the WirelessHART standard which is based on the Highway Addressable Remote Transducer (HART) standard, a network protocol developed by the HART Communication Foundation that enables interoperability with other HART devices whether they are produced by Emerson or someone else. Adherence to the WirelessHART standard enables a robust, self organizing field network that delivers reliable data.

"The measurements our customers can make allow operators to see the effects of process changes on machine vibration," Reeves says. "Having this knowledge allows the operators to ensure process conditions do not cause damage to the rotating equipment and allows them to engage reliability and maintenance engineers sooner in the troubleshooting process."

Emerson provides a variety of wireless instruments such as pressure, temperature and level measurements, according to

Reeves. These devices can be deployed in hard-to-reach locations where safety personnel would prefer humans not have to go. They're used in applications like cooling tower gearboxes, clean-in-place pumps, press roll bearings, pond aerator motors, load-out fans and remote pumping stations.

"Wireless systems are seen to be the future of this industry," James says. "That doesn't mean that wired monitoring will disappear; we just see distributed fieldbus-type systems replacing bulky, centralized analogue vibration systems used today. Look at it as 'less-wire' instead of 'wire-less.'"

Although Rockwell Automation does not currently provide direct wireless capability, the Rockwell Automation Integrated Architecture platform allows interface with third party wireless solutions. "This is a growing area of popularity in both the condition monitoring and control systems space," Johnson says.

Instead, the Rockwell Automation role in the industry is to provide condition monitoring equipment that focuses on integration.

"The Rockwell Automation condition monitoring system is an element of an integrated approach that can address a variety of needs for discrete, process, batch, motion, drive and safety applications," Johnson says. "It can also address enterprise resource planning needs, including quality, compliance, production management and asset management."

Johnson says the integration of monitoring data into the control system is a crucial way for engineers and operators to make maintenance decisions and identify machine degradation before a failure occurs. The challenge is to make sure the products are robust enough to handle the different environment and performance needs.

"Our customers need these capabilities for an increasing number of new applications where condition monitoring has not been traditionally applied," Johnson says. "This means developing products that meet new challenges like expanded temperature ratings, new certifications and higher speed acquisition."

Rockwell Automation's equipment is commonly used in power generation, as well as oil and gas applications. Food and beverage, pulp and paper and waste/



SKF's online monitoring systems cover several key maintenance strategies (courtesy of SKF).

wastewater industries have also adopted the company's condition monitoring system.

"A ski resort even used the technology to monitor the health of an expensive gearbox that powers their state-of-the-art gondola, helping to reduce downtime for skiers and avoid purchasing costly replacement equipment," Johnson says.

SKF's condition monitoring also takes an integrated approach that covers several processes including deciding what equipment to measure, taking the actual measurements, analyzing the data, conducting corrective actions and bringing feedback and analysis back into the maintenance strategy.

"The word 'integrated' is overused in many industries," James says. "There are several different meanings to the word in regards to SKF's approach."

At a business, technology and instrumentation level, SKF can offer discrete products and services to the market. Many companies consider the type of data acquisition and process technology used for condition monitoring a "high technology."

"But is it any more 'high-tech' than the communications technology in your pocket?" James asks. "The components used to process voice and video in a mobile phone are no different than those used for vibration data processing except for one thing—volume."

While the design and manufacturing costs for mobile phones are spread across millions of units worldwide, the condition monitoring market is smaller. Therefore the cost for the same chipset is higher.

"The universal challenge of getting the right-priced product at the right time to our customer still applies," James says.

SKF's systems are used in the process industries like oil and gas, hydrocarbon

continued



Emerson offers custom monitoring products to meet the needs of each client (courtesy of Emerson).

processing, metalworking, mining and pulp/paper.

“We are seeing non-traditional applications emerging—monitoring wind turbines for example,” James says. “In the future there will be more condition monitoring occurring in the transportation sector such as railways and marine.”

While a total system approach is helpful to organizations that have the necessary financial capabilities, smaller companies need a more direct approach.

Reeves says that even though machines are similar from one plant to another and there are industry-best practices, each scenario is different.

“Emerson has always focused on producing vibration monitoring products and software that users can configure to meet their monitoring needs,” Reeves says. “Users can also call on Emerson’s service professionals to provide custom configurations.”

James at SKF adds, “The ‘devil is in the detail’ and that’s where its importance lies. The ‘custom’ part is attending to all the small things that need to go along with the mainstream product to make it successful—mounting studs, cables, adaptors, junction boxes, etc.”

“Condition monitoring systems have changed from stand-alone, dedicated channel systems to systems which are flexible for multiple applications, distributed and multiplexed,” Johnson says. “In the future, we will see this trend continue as well as even more information and networking capabilities from condition monitoring equipment to

control systems.”

As the technology improves, many believe it’s vital that the training and implementation programs follow suit.

“Too often we’ve seen a first-timer buy the cheapest data-collector and software they can find, usually to address some upper management directive—and then plan to go it alone,” James says. “SKF knows from experience that training and support is a must-have for a customer to get an effective system in place.”

“There is always reluctance in the market to try new things, but there are also people who are eager to be on the cutting edge of new technology adoption,” Reeves says. “Emerson is always working on improvements, and we will be listening to our customers and working on the changes they request in subsequent product versions.”

In addition to wireless developments, integrated system approaches and training/implementation programs, what does the future hold for condition monitoring equipment?

Assetivity Pty. Ltd., an Australian consulting firm that specializes in physical asset management, recently reviewed the marketplace to identify some of the growing trends in the industry.

These trends include the development of smart sensors, the growing rate of built-in vibration sensors in motors, pumps and turbines, sophisticated software developments in condition monitoring and the integration of common standards for interfacing condition monitoring software with CMMs and process control software.

Assetivity sees traditional condition monitoring services reducing in the future due to several factors. These include the increase in “expert” software that will allow less skilled personnel to conduct condition assessments, the reduction of condition monitoring costs and an increase in the amount of equipment being monitored that will lead to new developments in monitoring technology.

While the industry was once scattered with vendors, the consulting firm sees a new trend appearing today where companies either develop their own condition monitoring equipment or acquire an existing player in the market. Experience may very well be the key to success.

SKF’s approach is to offer customers root cause failure analysis and engineering consultancy with its condition monitoring equipment.

“Redesigning the correct bearing arrangement on a fan with repeated bearing failures, for example,” James says. “SKF has been doing that for almost 100 years, so there’s a lot of expertise in the company that can benefit our customers. (Ed’s Note: Please see our feature on smart bearings on page 15 for additional information).”

Naysayers will continue to argue that paying the right skilled workers to oversee maintenance and operation procedures is still the most financially appealing route to take. Assetivity consultants note that predictive maintenance techniques that include the human senses (look, listen, feel, smell, etc.) or statistical process control techniques are considered cheaper alternatives by many industry professionals.

But looking at the big picture—condition monitoring provides a variety of plant engineering needs at a faster, more economic rate. James argues that the use of knowledge-based “expert” software packages or embedding “smart” algorithms into the hardware will make it easier for customers to use the tools effectively. So the man vs. machine argument continues.

Regardless of your point of view, condition monitoring products aren’t worthwhile if they’re not used as a fully integrated part of your preventive maintenance needs.

“Predicting a failure is only one part of the total business process, albeit a tricky one,” James says. “Making sure the failure does not occur again is a key

part of achieving improved reliability. It is pointless making predictions if nobody will take action.”

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Condition Monitoring—Product Spotlight

Big brother is everywhere these days. He's got cameras on the streets, spies on the Internet and tracking systems on cell phones. Satellite pictures can zoom into your backyards and iTunes can tell you what kind of music you should purchase. While conspiracy theorists struggle to live in such an environment, the machines on your manufacturing floors have been dealing with this sort of scrutiny for years. These machines are poked, prodded and spied on 24/7 in the hopes of preventing machine failures and maximizing equipment life.

Unlike their human counterparts, a little surveillance and personal invasion is not exactly a bad thing. Manufacturing equipment that has to answer to vibration measurement, infrared thermography, oil analysis, ultrasonics and motor current analysis are frequently implemented for predictive maintenance measures. Here's a quick look at some of the condition monitoring products on the market that can improve machine reliability, minimize downtime and predict system failures:

SKF's

Aptitude Asset Management System

Aptitude is a cross-communication software platform enabling collaboration between maintenance, operations and reliability teams that combines a variety of hardware and software components.

"It's the glue that holds SKF's integrated condition monitoring processes together," says Chris James, business area director for SKF Reliability Systems. "The platform can start with a maintenance strategy, move through to support a wide range of hardware for data-collection, implement decision support knowledge-base for diagnostics and then complete the cycle with interfaces to maintenance management systems (e.g. work orders)."

The *Aptitude* software platform provides tools for every part of the plant asset management process under a single umbrella. For more information on *Aptitude*, visit www.skf.com/skf/campaign/aptitude/.

Parker's

Fluid Condition Monitoring Products

Parker offers a line of on-site fluid condition monitoring products that can prevent catastrophic failures in critical systems while providing continuous monitoring for water contamination. This includes certification of water cleanliness levels, immediate results with laboratory accuracy, new oil cleanliness testing and identification of a fluid's saturation point and/or water content. Products include the Icount Particle Detector, a laser-based, permanently mounted device for fluid management and contamination control and the IQ200 Particle Detector that provides continuous online monitoring of the contamination levels of hydraulic and lubrication fluids. For more information on Parker's line of fluid monitoring products, visit www.parker.com.

Emerson's

CSI 9420 Wireless Vibration Transmitter

The CSI 9420 enables the cost-effective, frequent monitoring of rotating plant and/or mill machinery. The transmitter provides both overall velocity and *PeakVue*, Emerson's roller bearing and gearbox anomaly detection technology. One accelerometer with an embedded temperature sensor may be connected to the CSI 9420 allowing the overall velocity, *PeakVue* and temperature to be measured from a single device.

"When a plant is trying to produce a product, no one wants to have to shut down the process because of an unexpected machine problem," says Todd Reeves, product manager at Emerson. "Seeing problems early lets the production and maintenance groups work together to ensure plant or mill uptime is maximized."

"Customers who have tried wireless vibration systems have been extremely pleased with the ability to see vibration data that was previously unmeasurable," Reeves says. For more information, visit www.emersonprocess.com.

GE's Handheld Diagnostic and Data Collection Products

The Bentley Nevada line of condition monitoring products from General Electric feature numerous portable instruments designed to measure and collect vibration for field diagnostics and for test stand use. Products include the Snapshot for Windows CE, a hand-held data-collector used by machine specialists and operations personnel that supports a variety of measurement types and signal processing options and the Snapshot *Clipboard* software package that provides plant personnel with the ability to log meter and gauge readings, make inspections and jot down notes that would normally be written on a log sheet. For more information on GE's line of condition monitoring products, visit www.ge-energy.com.

Rockwell

Automation XM Products

The XM line can operate in stand-alone or integrated applications and is used in four key areas including machinery protection, production assurance, predictive maintenance and quality assurance. It can be integrated with the Rockwell Automation Integrated Architecture, a control and information system equipped with fully integrated control, network, visualization and information technologies.

"Keeping your equipment up and running as well as producing quality products that are within tolerance is essential in today's manufacturing environment," says Scott Johnson, product business manager at Rockwell. "Operating efficiency is one of the most critical metrics for nearly every company."

For more information, visit www.rockwellautomation.com/solutions/conditionmonitoring/.

—Matthew Jaster