EDITORIAL

What is the Future of Predictive Maintenance?

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Some things require immediate attention, examples being a flat tire or a heart attack. These things, like a broken machine, require an immediate response because they bring everything to an abrupt halt. Other things do not require immediate action; however if not addressed in time, they can result in severe consequences. Examples are: not changing the oil in your car or not going to the dentist. If either of these situations is not taken care of today, tomorrow, next week or even next month there is no immediate problem. It is obvious, however, that in the long term not performing these actions will result in major pain and/or expenses. In the predictive monitoring world, these expenses are related to the consequential damages that result from a failure and the even more significant consequential downtime associated with a breakdown.

It is frequently a struggle to get management to stay focused on long term issues such as predictive maintenance. All too often the problem *de jour* gets all the attention. In the past, this lack of long term commitment by upper level management was offset by personnel on the front lines taking an active interest in predictive maintenance and thereby supporting it from the ground up instead of the top down. Cuts in front line personnel are now threatening the bottom up approach.

When the overall picture is evaluated, what we have in effect is a form of economic Darwinism occurring. Global competition, massive increases in health care, deregulation and demographic shifts are the predators. It is not too difficult to figure out who the prey are. All of these factors are pushing towards reducing the work force not only in manufacturing, but now also in its support functions, i.e., predictive maintenance. In the past year, work force reductions have even hit the nuclear industry that heretofore had been immune to job cuts.

With these inevitable cuts in personnel, where are we headed in the predictable maintenance business? It is hard to predict the future precisely, however, as well known futurists have indicated, there are some things we can do to at least get an idea. For instance, you cannot predict what will happen tomorrow, but you can predict with a fair degree of certainty that, based upon past experience, the earth will keep turning, the stock market will go up and down, and there will be trouble somewhere in the world. We can therefore start to look into the future by studying the past, then looking at the forces of change and our available options in regard to responding to these forces. One well known futurist gave the following thoughts regarding agriculture and manufacturing. "If we look at past stages of development we can see that, for instance, in the case of agriculture, the system became more and more efficient. We still grow incredible quantities of corn, wheat, soybeans and cotton; we just do it with a small fraction of the personnel that it used to take. The same is true with mining and manufacturing. Tremendous amounts of coal are mined and vast quantities of goods are produced; it just takes far less people to do the work." As was pointed out by the futurist, based upon what has happened to other industries we can predict with a fair degree of certainty that the information industry (of which predictive monitoring is a part) will have to, like every other industry, accomplish more with fewer people.

In the predictive maintenance arena, part of the efficiency increase will be attained by getting smarter on how we monitor things. For instance, should all equipment in a plant be monitored on a monthly basis, as is often done? Most likely that is not necessary. Should very critical equipment be monitored more frequently? This is also probably true. We can therefore increase both effectiveness and efficiency by more closely studying which equipment to monitor and how often to do so. The greatest potential for efficiency improvements in predictive maintenance, however, lies in the synergism of combining the technologies that are either presently available or in development. Wireless sensors coupled with in-plant networks and accessed by the internet promise to automate the collection and logging of data. These data will then be available for viewing by analysts anywhere there is an internet connection. The vibration analyst could literally be sitting in an airport, at home or in a motel with a wireless internet connection looking at the condition of his critical machines and sending correspondence to operations on whether or not the equipment will make it to the next outage.

What then will predictive monitoring look like in the future? Based upon the economic forces that are present, the past history of other industries and the technology already available or shortly to come on line, it will probably look somewhat like the following:

1. There will be fewer personnel collecting data and performing analysis. The previously mentioned combined economic forces of global competition, skyrocketing health care costs, deregulation and demographic shifts are so compelling that this is nearly a certainty.

2. Data will increasingly be brought to the analyst rather than the analyst going to get the data. This will almost surely be true for periodic data collection, first stage problem detection and basic analysis. However, when a problem is complex, it will still require "boots on the ground," as the military likes to say. An editorial from a few years ago titled "The Perils of Troubleshooting in Cyberspace" goes into the details of why solving machinery problems from a computer screen can be difficult. Detection and basic analysis can be performed remotely, but specialists will still have to go on-site to solve certain classes of problems.

3. Data from similar machines will be archived so the wheel will not have to be reinvented each time a problem develops. The nuclear industry will probably be the first to use this approach. For example, if there are 37 nuclear units with the same design of Containment Spray Pumps or Residual Heat Removal Pumps, then there are obvious advantages of maintaining a common data base. Following the nuclear plants will be small process plants that have numerous sites with identical equipment scattered throughout the world.

4. The combination of wireless transducers, plant networks and the internet will become a powerful force enabling the collection and transport of data to the first line analyst and then on to specialists, if necessary. The problem to date has been what the phone people call the "dreaded last mile." This refers to the fact that you can set up the trunk and branch lines of a fiber optic network, but the difficulty lies in the need to go the last mile into the millions of homes and businesses. The last mile issue in regards to predictive maintenance (the numerous connections to the bearings on each machine) will be solved by a battery- or scavenged-powered wireless connection between the transducers on the machines and the plant network or internet connection. See the May 2002 S&V editorial.

5. The approach to predictive maintenance will vary from plant to plant. In large plants with hundreds of machines, there will probably be a hybrid solution that consists of the machines that are vital to the operation being wirelessly monitored on perhaps a daily basis and the non-vital equipment being manually monitored maybe every six months. This would reduce the amount of manual monitoring to a small percentage of what is being done today and at the same time provide better coverage for the vital equipment. As costs come down, the number of machines that can be monitored wirelessly will increase in these large facilities. Intermediate-size plants that cannot justify onsite personnel will

need to choose between contracting out a manual service and going to a contracted wireless service. Small plants, like those that supply liquid oxygen, perform specialty chemical processes or have pumping operations that are geographically scattered throughout the country would best be served by entirely going to remote monitoring in order to reduce the travel time required to go from site to site for manual monitoring. Since these types of plants use nearly identical equipment at dozens of facilities, they will be ideal situations for remote monitoring with all the data going to a common point so a knowledge base can be acquired and the data mined for use in fine tuning the future prediction of problems.

If businesses were more humane and considered the immediate welfare of the workers, then things would stay the same and everyone would remain employed doing what they are doing. That has not happened in agriculture or manufacturing and it will not happen in our little world of predictive maintenance. And, in the long term it is probably a good thing. What if 50% of our population were still employed in agriculture? The key to the survival of the analysts and to the companies they work for is to recognize what is coming and to be on the forefront of making it happen rather than lamenting about the past. SV

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