NOT just another tool in the toolbox

Condition monitoring technologies should help you change your processes

BY ALAN FRIEDMAN

A good tool should change the way you work. In fact, you could define whether a tool is good or not by the extent to which it changes the way you work. But what happens when you adopt a new tool or technology but don't fundamentally change the way you do things? What if you tied your new pickup truck to a team of horses and let them pull it around? It wouldn't make much sense and no one would be faulted for wondering why you spent so much money on a pickup truck if you were just going to use it like a carriage!

This is exactly the problem many companies face when adopting condition monitoring technologies like vibration analysis, IR thermography, ultrasound, oil analysis, and motor testing. These technologies are intended to give you an early warning of impending machine failure so you can make better repair decisions. Improved information about the health of your assets will help you plan your repairs, saving money on labor and spare parts. If you can schedule the repair weeks in advance, you can make better use of your labor force and avoid unnecessary overtime. You can be sure you have the parts in stock or order them to arrive "just-in-time," reducing storage costs. You can have the job well planned

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and the parts staged to maximize "wrench time" and reduce the overall cost of the repair. Lastly, better scheduling of repairs helps you reduce unplanned downtime and increase production.

If you are able to detect machine faults months in advance and watch their progress, you can avoid catastrophic failures and their consequences, including secondary damage to other assets and injuries to personnel. This will help you avoid non-compliance events like dumping pollutants into rivers or spewing toxins into the air. Plus, it will help you keep production on track and meet your commitments to deliver quality products to your clients on time. Your insurers will be happy that you use best practices to maintain your assets and will reward you with better rates.

If, however, you use the technologies listed earlier but do not change how you make repair decisions, you are probably not getting the benefits. If you detect a problem using vibration analysis and repair the machine the next day, you are probably not getting any benefits associated with better repair planning. If you still repair or replace machines or major components on a time basis rather than based on condition, you are not getting the advertised benefits of condition-based maintenance. Similarly, if you monitor equipment that will be run to failure regardless of its measured condition, you are also wasting time and resources. In other words, if the technology does not change the way you make decisions, it is not benefitting you.

Similarly, if you do not quantify the benefits you get from both a technical and financial perspective, it is doubtful you are getting real benefits. Even if you get real benefits, it will not be clear to others if you don't document them. People below you need to understand what you are doing from a technical point of view, and people above you need to understand what you are doing from a financial perspective. As a general guideline, you should be able to show a 20- or 30-to-1 return on investment on a condition monitoring program. If you don't measure this and report it, do not be surprised if the person who pays your salary decides the plant will be more profitable by laying you off.

In order to get this type of return on investment, you need to utilize these technologies as part of a broader strategy to change the culture of the organization. In other words, it is not so much about adding another tool to the toolbox as it is about changing decision making processes and procedures. It's more about running a program than it is about employing a tool. This misunderstanding is the reason why 70 percent of programs fail to deliver the expected return on investment.

10 components of a successful condition monitoring program

A successful program consists of the following 10 components: Right goals, right people, right leadership, right tools, right understanding, right data collection, right analysis, right reporting, right follow-up and review, and right processes and procedures. The 10 components are interrelated and linked together and, therefore, they need to be balanced in order for the program to succeed. I will provide a brief summary of the 10 components here; a more detailed explanation and guidelines for running a successful program can be found in my book: *Audit it. Improve it! Getting the Most from Your Vibration Monitoring Program* available on Amazon.com.

You have to be clear about the goals of the program. I would recommend writing them down. If you cannot write them down, or think it takes too much effort, you do not know the goals of your program! Goals should be specific, measurable, achievable, realistic, and time bound. I noted previously some common goals above related to savings associated with better scheduling of labor and better management of spare parts inventory, etc. If these are your goals, you need to measure whether or not you are meeting them. This comes under the component of right follow-up and review. Here, you will need a formal process of measuring key performance indicators (KPIs) to determine if your goals are being met, and to calculate your return on investment. If you don't measure how your program is doing, you have no way of knowing if you are getting real benefits, and neither does the person who pays your salary!

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Some condition monitoring technologies, such as vibration analysis and thermography, require a great deal of technical expertise, training, and time to master. These are not skills you acquire in spare moments when you're not busy with other responsibilities, or in the last two years before retirement. You need the right people with the right skills and level of education to be successful using these tools. In my experience with vibration, I believe you need someone who loves the technology, as it can take years to master and there is no limit to what can be learned.

Because the tools are being used as a means to change how decisions are made, what we are really talking about is changing the culture. People do not like change, so strong leadership is required to overcome adversity and keep the programs on track. The leader needs to help break reactive habits as the plant moves into the condition-based and eventually proactive modes of operation.

The tools need to be appropriate to the people who will use them, in terms of their level of commitment, education, etc. You might purchase top-of-the-line monitoring equipment but you might not have anyone on staff capable of understanding how it works. Sometimes, lower tech options work better if they are more suited to the people who use them. Also, keep in mind your commitment to providing training and to dealing with employee turnover. If you truly understand your goals and what you hope to achieve, you will probably find numerous strategies to get you there. Choose the tools based on your people, or choose people who have the skills to use the tools you want to use.

Understanding how to read data can help you set alarms to detect if data indicates a defect

Right understanding is about understanding what you are trying to measure or monitor from a technical point of view, and making sure you have the right tools to do the job. In machinery condition monitoring, this involves understanding the failure modes of the equipment, how quickly the failures progress, and what indicators the equipment gives that it is entering into a failure mode. This component is too involved to cover here, but as a quick example, a journal bearing in a large turbine can fail catastrophically in a matter of seconds, so it would not make sense to take vibration readings on it on a monthly basis. Rather, it will need to be monitored continuously with a protection system. Equipment criticality ranking, RCM, FMEA, and FMECA, all fall under the umbrella of right understanding.

Right data collection is a more detailed version of right understanding. It has to do with making sure you are using the correct sensors mounted in the correct locations and taking the right data to detect fault indicators. For example, not taking an oil sample from a sump, or taking a photograph at night with the flash turned off. With vibration analysis, in particular, it is often not clear to the user that data being collected is invalid. When you take a photo in the dark without a flash, you know it is a bad photo; with vibration analysis, this is not so. Therefore, it is advisable to have your program audited to make sure you are getting good data.

If you understand how data you collect relates to the failure modes of the equipment, you will not have a problem understanding how to set alarms or detect if your data indicates a defect. Right analysis is therefore linked to right data collection, and it refers to your ability to process reams of data in an efficient way and turn that data into actionable information or right reports. Going back to your goals, it needs to be clear who the recipients of the reports are and what they are meant to do with them. If the planners don't use the reports to plan better, and the schedulers don't use them to schedule better, your goals are not being met. Reports need to be delivered to the right people at the right time and in the right format for them to understand what actions to take. Right follow-up and review is required to see if the actions they took were the correct actions. And it is a key component of "continuous improvement," which is the

broader goal of most programs. It includes root cause failure analysis and a commitment to remove the root causes of your problems rather than simply fixing them.

Lastly, all of the components mentioned thus far need to be understood in the context of improving processes and procedures. How you choose what goals to work on, what technologies to use, what people to hire, how to train them, how to measure the results of your efforts, etc., should all be done within the context of processes and procedures. The bottom line: processes and procedures should be followed and, at the same time, should be continuously refined and improved. How will a new tool change and improve your processes and procedures to help you better meet your goals? If a tool does not lead you to improve your processes and procedures, the tool is not useful, or you are using it incorrectly.

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