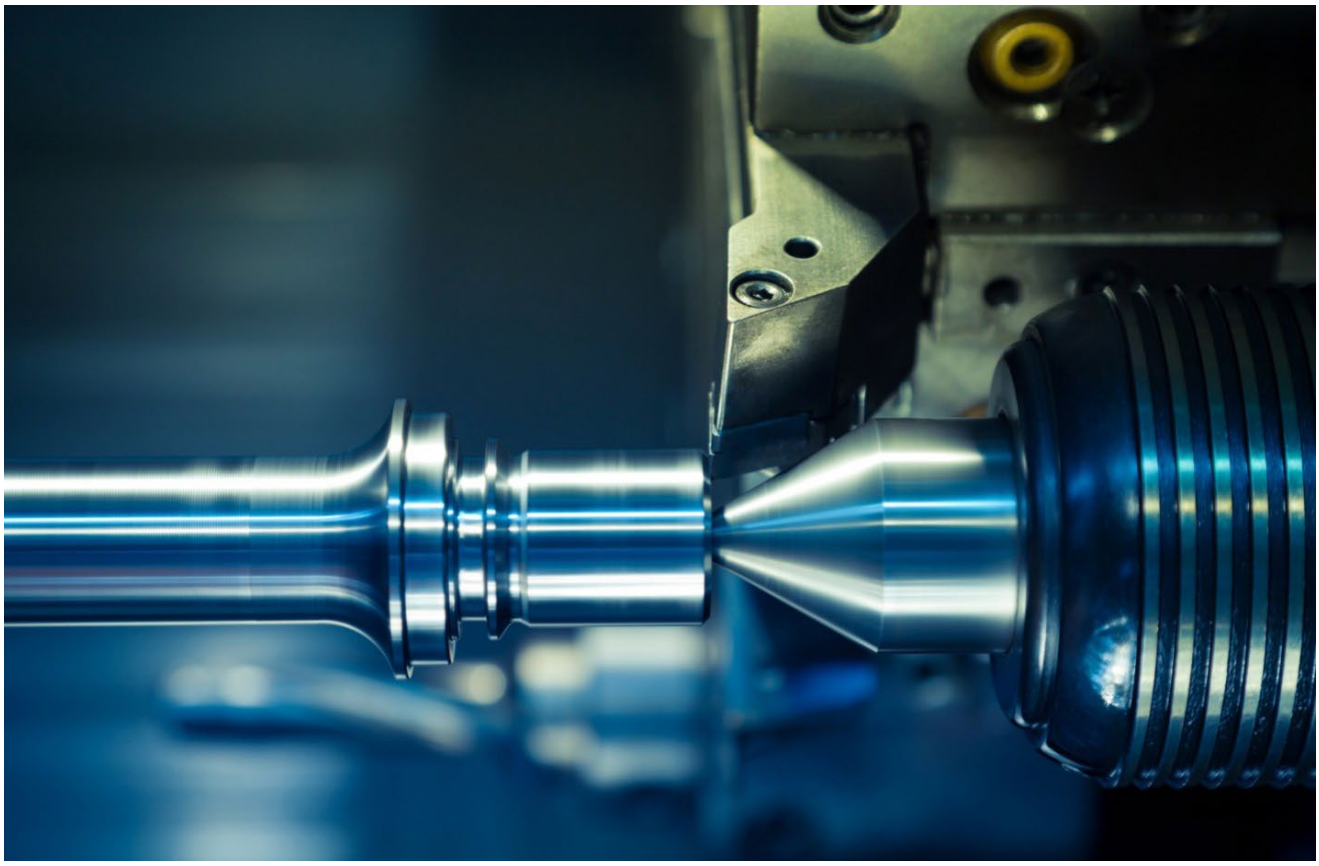
Six Steps to Implement **Condition Monitoring for Industrial Equipment**



Maintenance, repair and operations (MRO) management is no easy task — as any professional who maintains an industrial operation can confirm. What is interesting is that many of these experts list the same five challenges when maintaining their systems:

1. Equipment conditions are impossible to predict.
2. Quality control is hard to automate consistently.
3. Downtimes due to unplanned failures are a constant fear.
4. Production costs are on the rise.
5. Safety risks persist because of all of the above.

Any of these issues can lead to a loss of product, which then impacts the bottom line, sales, cashflow and more.

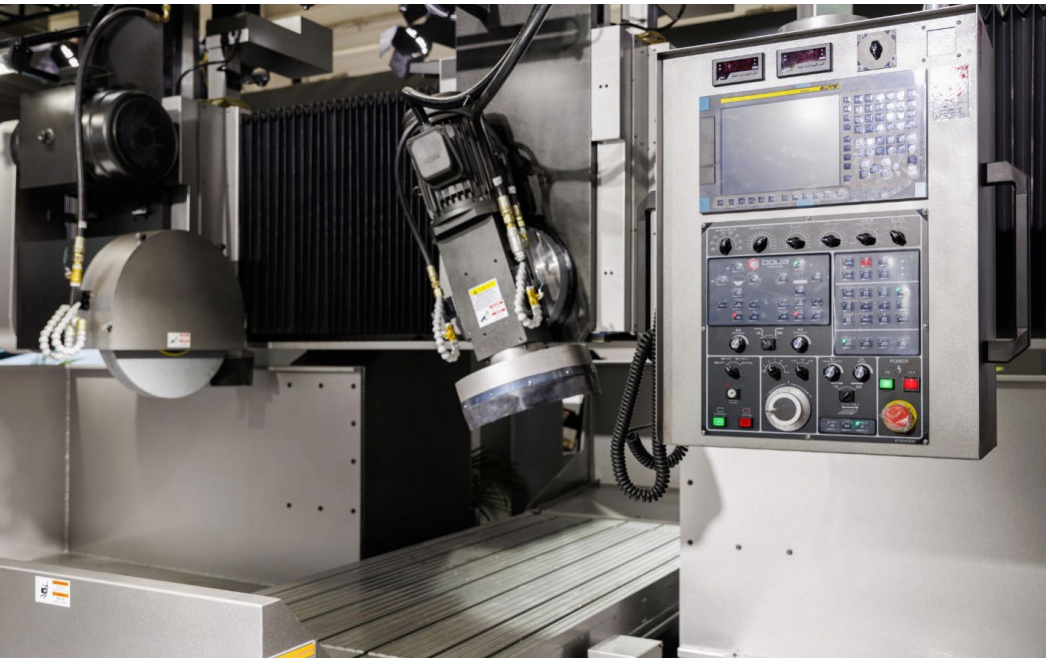
"Traditional MRO runs on schedules, or [total] run hours," says Erik Dellinger, director of Industrial Transformation at Strategic Maintenance Solutions. "But between that time equipment can often fail. This unplanned down time is expensive. If you could plan them, you could save on employee overtime, expedited shipping, spare parts and safety issues. By being able to better prepare, technicians have parts on hand and are good to go."

Previously, MRO experts had a hard time preparing and scheduling downtime due to a lack of insight into the health of industrial processes and equipment. The solution is to peek into these 'black box' systems via predictive maintenance and condition monitoring. This document digs into the six steps to get that workflow in place.

STEP 1:

ATTACH NEW SENSORS OR MAKE BETTER USE OF THE ONES YOU HAVE.

The first step to better understand the health of an industrial system is to collect — or make better use of — existing data. MRO experts can capture this data through PLC's, SCADA or the sensors embedded within existing equipment. But if those data sources are unavailable, then experts must install new sensors on critical equipment.



These sensors can collect various values including temperature, pressure, current or vibration. The goal (as subsequent steps will detail) is to bring that data into applications that provide analytics and insights based on those readings. As these sensors continue to collect data, any reading beyond a certain threshold will trigger a response from the condition monitoring system. This informs MRO experts that there may be an issue with a piece of equipment.

"Those thresholds will determine if it vibrates too much, or the temperature is too high, so we should look into what's the issue," says Dellinger. "In some advanced analysis, we can actually tell you the issue before you look at the equipment."

STEP 2:

INSTALL DATA GATEWAYS TO COLLECT AND SECURE SENSOR DATA.

Based on the number of sensors deployed, MRO experts can determine the number of data gateways needed to get the condition monitoring system running. With enough sensors, experts can create a full vibration monitoring system — which can predict the location of a problem. However, if an MRO expert only needs to look at trends, fewer sensors and gateways are necessary.

The job of the gateways is to perform some computations on location (often referred to as 'at the edge') and then send information to a cloud-based and/or on-premises data storage system. The system can add this data to dashboards or further analyze it to learn more. Some gateways connect to sensors and data storage systems wirelessly (via Wi-Fi or Bluetooth) or with a wired connection.

"Typically, [for security reasons this process is] read only data, so you can't interfere with the equipment that is running," says Dellinger. "It's typically a one-way communication solution."

STEP 3:

MAKE USE OF THE CLOUD'S DATA PROCESSING, ACCESS AND STORAGE ABILITIES.

Though a condition monitoring system can work without the use of the cloud, modern trends, benefits, technologies, AI and data analytics tools make this step increasingly dominant. On-premises systems require more work from IT professionals, whereas cloud-based systems offload much of that work to the cloud provider.

The data storage and computational abilities of the cloud are also more flexible than on-premises systems. If MRO experts need more CPUs, GPUs or storage, they can gain access to them with a few clicks on the cloud; this process can even be automated. For on-premises systems, expanding their capabilities requires much greater capital and operational expenses.

The cloud offers other benefits because it is accessible to any device with an internet connection. This makes it easier to connect gateways to the system and enables MRO experts to access the condition monitoring system from anywhere.

Gateways will perform much of the initial computational analysis at the edge; however, the cloud's massive computational resources can also dig deeper into the numbers via data analysis, AI and machine learning algorithms.

STEP 4:

CONTINUOUSLY MONITOR THE DATA TO DETECT UNEXPECTED MEASUREMENTS.

When a condition monitoring system initially comes online, there is little data available to know what readings are normal and what is unexpected. A good place to start, however, is to contact equipment suppliers and reference maintenance documents. Once a reading surpasses a threshold from one of these sources, the condition monitoring system notifies MRO experts.

"Sometimes, these [initial thresholds] are unrealistic and need to be adjusted," cautions Dellinger. "Maintenance people on the floor working with the equipment can guide us where the thresholds need to be. They know a pressure is 'totally fine' even when an OEM says not to go that high. [Setting thresholds] is multifaceted guesswork."

STEP 5:

SETUP AUTOMATED ALERTS TO PROVIDE REAL-TIME NOTIFICATIONS.

Once the condition monitoring system notices that a reading is beyond a threshold this should trigger a response. This response can be as subtle as sending an SMS text message, something as obvious as starting an alarm, or something more automated — like creating a work order within enterprise asset management (EAM) software.

"EAM is where maintenance techs spend time reviewing job plans and work orders," says Dellinger. The condition monitoring system "can automatically create the work order or give a notification to the planner to suggest making a work order."

According to Potential-Failure (P-F) curves, vibrational analysis can predict equipment failure one to nine months in advance. This is plenty of time to properly schedule maintenance for a more opportune time. To make the most use of this time, MRO experts should investigate whenever the monitoring system registers unexpected readings — even if it suggests it will be months before anything fails.

STEP 6:

USE ANALYTICS AND AI TO EXTRACT INFORMATION AND IMPROVE THE PROCESS.

Once the condition monitoring system is running, it will be collecting a lot of data. It would be a waste to let that data sit idle. For instance, Dellinger notes that AI threshold adjustment tools exist. The system would have to capture a significant amount of data before these tools are helpful, but after that they will take much of the manual guess work out of Step 4.

"We adjust thresholds because they tend to start low, but we don't want to have alert fatigue," says Dellinger. "AI solutions allow us to automatically set or reset thresholds."

"From there," he adds, "we analyze the data and eventually apply machine learning." These algorithms may determine that the number of times sensors take a sample can reduce as fluctuations are minimal or rare. This could reduce the amount of money spent on data storage.

AI insights can also interface with a dashboard system that outlines the overall health of a facility — or even a series of facilities around the world. MRO experts can then drill into a map of the system to find more real-time details about each operation.

The analysis may reveal other trends that can help prevent, or even find the root cause of, annoying maintenance issues that continually pop up. Either way, the data collected from the condition monitoring system should be put to use to continuously improve that system and the equipment it monitors.

HOW 6IX FOR MTO CAN HELP

Fortunately for MRO experts, Strategic Maintenance Solutions has already produced turn-key solutions for industrial condition monitoring. One example is 6IX for MTO (Machine Tool Operations). 6IX is a smart industrial transformation system that utilizes sensors, gateways, connectivity, analysis, alerts and the cloud to monitor equipment.

"6IX reduces unplanned downtime and increases the reliability of industrial assets and equipment," says Dellinger. "It provides enhanced visibility through data-driven analytics and insights. It reduces maintenance costs and improves operational profitability, safety and product quality."

As for the MTO version of the solution, Dellinger says it was "built for CNC, grinding, milling and drilling machines in a factory ... We take vibration sensors, and place them on different motors that comprise the tool. The solution will then monitor these and take readings during equipment operations. If something is anomalous, we will automatically notify maintenance planners or technicians. It's important to monitor these machine tools as the time down is very expensive."

To learn more about 6IX for MTO, read www.sms-inc.net/6ix-for-mto