MRO is about more than keeping equipment lists and ordering parts. A global maker of bio-based food ingredients and biochemicals shows how a central maintenance and reliability strategy supported by complex MRO software can optimize operations to world-class levels.

An acronym meaning "maintenance, repair and overhaul" might lead you to think that MRO is about repairing or replacing broken equipment in the discrete manufacturing and assembly industries. But the "O" in MRO really is about operations—keeping equipment performance at peak levels, extending machine mean times between failure, and cutting costs in the maintenance-and-reliability value chain. Building a best-in-class maintenance organization that helps optimize operations is no small task.

According to Kevin Shoemaker, reaching such a goal requires a kind of organizational maturation—a level of maturation that is beyond what he calls the "Superman" phase of development, which is more than the ability to see through the metal of your equipment and take corrective action early. As senior vice president of global operations for Corbion, a worldwide maker of bio-based food ingredients and biochemicals headquartered in Amsterdam, he should know. Shoemaker and his team are seeing significant operational gains from the use of complex MRO software and a centralized maintenance and reliability strategy, directed from an operations center in Blair, Neb.

Shoemaker and his team found that gaining best-in-class status requires the transparency and discipline that comes with using MRO software. The structure and metrics provided by the software built on the maintenance and reliability gains the company had already made, improving individual plant performance and boosting Corbion's production around the world.

Industry experts usually divide MRO software into three categories: component, heavy and complex (see sidebar, p. 37). This subset of enterprise asset management (EAM) software links traditional maintenance and support functions with project management and logistics. Shoemaker believes in this class of software because it is helping his team to break through a performance barrier that had kept Corbion's maintenance costs from falling below 2 percent of the replacement value of plant assets.

"Our goal is to drive our maintenance costs down to 1.4 percent," says Shoemaker. This is the threshold for best-in-class status in the chemical industry, according to the benchmarking gurus at Dallas-based Solomon Associates.

Corbion hit the 2 percent barrier after improving this metric from a starting point of more than 4 percent. The company owes its initial success to a three-point initiative involving predictive maintenance, planning and scheduling, and precision maintenance. "We had invested heavily in predictive maintenance technologies like vibration analysis, infrared thermography, ultrasonic testing, non-invasive motor testing, and oil analysis," notes Shoemaker.

His team also maximized utilization of the company's assets by planning and scheduling maintenance with the computerized maintenance management system (CMMS) in its enterprise resource planning (ERP) system. Then, when technicians did maintenance, the emphasis was on performing it with precision. When they align shafts, for example, they take the effort to make sure that they are in perfect alignment and not just "good enough."

Despite the initial success of this initiative, the improvements eventually plateaued, prompting Shoemaker to ask the

head of maintenance and reliability what it would take to reach the 1.4 percent goal.

"After he thought it through with his people around the globe, he came back and said that we need to be connected," recalls Shoemaker. The CMMS managing all of the work orders was not connected with the predictive maintenance system, nor with all of the databases containing records for completed work. For example, it was not connected to every database holding data for shaft alignments.

Breaking the barrier

To rectify the situation, Shoemaker invested in AssetWise APM MRO software from Bentley Systems. Bentley's software is primarily used by architecture, engineering, construction (AEC) and operations companies to design, build and operate large constructed assets such as roadways, railways, industrial and power plants, and utility networks.

Shoemaker also sought help from reliability consultants at Management Resources Group, a consulting firm that automation vendor Emerson Process Solutions acquired last spring. The consultants helped Corbion to integrate its various maintenance databases and link the management functions with advanced analytics at its plants in Thailand, the Netherlands, the U.S., Spain and Brazil.

Now that all of the data is part of the same system and accessible, the software can calculate and report key performance indicators (KPIs) for individual pieces of equipment, and for entire processes. "We can develop a reliability strategy that uses failure mode and effects analysis (FMEA) and reliability-centered maintenance (RCM) to evaluate the equipment, perform criticality ranking, analyze failure modes, and develop maintenance plans for equipment," says Shoemaker. "We want to be more on the proactive side of the maintenance curve than on the reactive side."

To reinforce this more proactive stance, the software also calculates higher-level KPIs that measure the effectiveness of each plant's maintenance activities for review by management. The two primary ones are maintenance cost to the replacement asset value of the plant, and the overall equipment effectiveness (OEE)—at least, that is, the factors in OEE that are under the control of the plant manager and his staff. The software also reports two other important KPIs that reflect proactivity: the ratio of proactive vs. reactive work, and the ratio of planned work vs. unplanned work.

This transparency has permitted management to reinforce the best practices that a development team had already instituted to a large degree during the earlier three-point initiative. "We scripted the way that the system is supposed to work so that the MRO system is really deploying best practices," explains Shoemaker. "In some ways, adhering to best practices takes a little freedom out of the equation, but it provides a structure for optimizing our operations."

The structure and metrics provided by the software also identified weak spots in the company's maintenance and reliability infrastructure. "We were getting great benefits from the progress that we had already made, but we needed a step change to get to world-class levels," notes Shoemaker.

With this greater transparency, Corbion was able to focus more tightly on the areas that had been in its way of reaching its 1.4 percent goal. As a result, the company has finally been able to move past the 2 percent plateau. "We're now at about 1.75 percent maintenance cost to replacement asset value," reports Shoemaker. "We're on our way again to our goal."

> WE WANT TO BE MORE ON THE PROACTIVE SIDE OF THE MAINTENANCE CURVE THAN ON THE REACTIVE SIDE.

Connections and trust are key

Corbion's experience with connections is fairly typical of top performers in maintenance and reliabil-

ity, according to Robert DiStefano, founder of Management Resources Group and now vice president and general manager of reliability consulting at Emerson Process Management. He believes that most manufacturing plants, even those in the bottom quartile, already possess the necessary elements to become top-quartile performers. The key to making the transition upward is to establish viable connections among the various elements in the maintenance-and-reliability value chain.

The transition also requires overcoming an underlying distrust that many operations people have for the data. "Unfortunately, few feel that they can trust the early warning signs coming from condition-monitoring technology," says DiStefano. "So most wait for visible signs of failure. By the time that happens, though, the failure has advanced to the point where there isn't a lot of time for planning and scheduling."

Corrective action, therefore, is largely done in a reactive mode with limited planning and scheduling, which typically has little impact on costs and "wrench time." The meager results inspire little confidence in using predictive technology to take a more proactive approach to maintenance.

Flawed foundational data only undermines confidence further. "Even in companies that have a CMMS, the data in the master equipment list is usually incomplete and inaccurate," observes DiStefano. In part, this incompleteness stems from the fact that certain silos in the company often maintain their own lists—for instrumentation and high-voltage equipment, for example—because they do not trust the task to a centralized system under somebody else's control. For this reason, it is not unusual for a dozen or more equipment lists to be floating around a large organization.

Even for assets on the master equipment list, the database often does not reflect additions and changes that occur over time as plants undertake capital projects. "In many cases, the same asset is represented in more than one place, and the data is not in agreement," reports DiStefano. Important details, moreover, are usually lacking.

Repairing these broken connections begins with developing sound foundational data and performing a criticality ranking of all equipment. The data and ranking must be very granular and take into consideration not only the needs of operations, but also safety, cost and environmental compliance. "In a reactionary maintenance environment, a low granularity of detail suffices for that level of practice," explains DiStefano. "A more proactive environment, on the other hand, requires much more granular technical information than before."

These details are important for supporting the analysis of failure modes and the development of optimal preventive-maintenance regimes for specific pieces of equipment. An example is gearboxes. "In order to do a good vibration analysis," offers DiStefano, "we need to know how many gears are in a gearbox, what their ratios are, and how many teeth they have if we are going to recognize patterns in the spectra."

The only way to rectify the situation and to establish one trustworthy central information source is to reconstitute the master equipment list with the appropriate detail. Such projects involve tracking down the equipment, digging into old files, and reconciling discrepancies. Because the effort will require tearing down silos and investing a lot of time and money, support from the executive suite is crucial, both to do the consolidation and update and then to maintain the database thereafter.

Securing this support, however, is not easy. In fact, it is impossible without first making the case in business terms, such as the value of unscheduled downtime and the value of being a proactive performer in the top quartile. "A second-quartile performer will spend 5 percent of the plant replacement value on maintenance annually," notes DiStefano. "For a billion-dollar plant, that's $50 million a year. A top quartile performer will spend 1.4 percent, and that's $35 million less."

AW