Maintaining the Auto-Industry's Automated Edge

Joy LePree, Contributing Editor

High-tech automated equipment supports today's automakers, but requires its own high-tech support from skilled maintenance teams to do the job.

An automobile manufacturing plant is a technological site to behold. Orange sparks light up the factory as robotic welders swiftly perform their duty and smoothly send product down the line. Brightly colored door panels ease their way through the plant by means of a twisting and turning conveyor. Overhead, empty skeletons of vehicles float by as cranes effortlessly transport them to and fro.

High-tech automated equipment, which automakers notoriously embrace, makes this dazzling spectacle possible. But the high levels of efficiency automation brings to auto manufacturing brings new dimensions to the maintenance process as well. Experts say maintaining the mechanical, hydraulic and pneumatic components of robotic equipment is similar to that of non-automated equipment, but diagnosing these problems can be tricky. So many take advantage of advanced troubleshooting procedures, as well as high-tech predictive methods to simplify the job.

"Our most common maintenance problem stems from the fact that we have a highly automated plant," says Robert Burke, general manager of manufacturing engineering for Mitsubishi Motor Manufacturing of America, Normal, IL. "We have lots of automation cells and an automation cell involving conveyors, multiple robotics, and transfer equipment will go down for no apparent reason, bringing the entire production line to a halt," he says. "Even when it's something as simple as metal shavings landing on top of and obstructing a magnetic proximity switch, it takes forever to get the cell going again because it's difficult to find the problem. Usually, the diagnosis consumes 90% of the downtime and fixing it requires only 10%."

To help combat this, Burke says his company employs PLC logic, which has allowed them to plug in a laptop computer to pinpoint the place in the program where the problem has occurred.

However, even using PLC logic can pose a challenge, says Gordon Van Dusen, a team manager in Ford's Dearborn Engine and Fuel Tank Plant in Dearborn, MI. "While a lot of the packages we get include logic to make troubleshooting and diagnostics easier, sometimes they have a completely different set of logic than we are used to using, which requires additional technical training," he says. For example, Van Dusen says Ford brought in a new engine that is English driven so they had to send people to England to learn the differences in electrical and mechanical prints. "Understanding what their prints are saying has made it easier for us to do the troubleshooting," explains Van Dusen.

Automated equipment also makes the task of identifying problems before they occur more difficult. "In the past, when automation was all mechanical it was easier for tradespeople to find something wrong when they were doing a visual check," explains Dorothy Hennessy, director of the Quality Network Program, a joint program between the United Auto Workers and General Motors Corp., in Warren, MI.

"But now much of the equipment includes circuit boards and chips. Tradesmen can't just look at a chip and know if it will fail.
"As a result, we have to use high-tech equipment to identify problems in automation. You no longer have the ability to see that something is wearing because that's not what runs it. But if you use a thermography gun, you can see if a chip is much hotter than the others and that will help you see that you're going to have a problem there," says Hennessy.
At GM, she says, these types of specialized tasks are crucial elements in the quality program for maintenance. The company has employed a program of planned maintenance tasks for equipment that is deemed critical, which includes performing scheduled checks and using high-tech equipment like infrared, thermography and ultrasound for predictive maintenance activities.
"We use scheduled maintenance to identify anything that may become an emergency and then follow up with scheduled work to repair it before it becomes an unplanned breakdown," Hennessy says.
These types of activities are routinely performed on automated equipment throughout the company. This means high-tech planned maintenance is used on everything from a piece of equipment like an assist tool for installing glass on a vehicle, machining equipment in an engine plant, or equipment that moves the stamped piece from press to press in a stamping plant.
"This is critical because if any of these machines go down, then you have downtime and our goal is to reduce downtime for all lines, whether it's assembly or powertrain," says Hennessy.
Keeping a database of equipment specifications is essential to these types of predictive and preventive maintenance tasks, says Burke. "When you're taking vibration analysis, looking at infrared, or getting thermal readings on pieces of automation, you have to have a database set up that shows what these readings should be," he says. "That way, over time you can compare current readings to historical readings and see if it indicates that you need to replace the equipment."

Advanced training required

As equipment and troubleshooting techniques become more advanced, maintenance workers are faced with the challenges of learning how to pinpoint problems and fix them, which demands intensive training. "Automated equipment is more sophisticated, so the diagnostics are more sophisticated," says Patricia Watters, vice-president of consulting with Harbour and Associates, Inc., a Troy, MI-based firm that publishes an annual report on manufacturing productivity. "This means that the education and training of skilled tradesmen needs to be more sophisticated, too. Training should be included as part of the investment of the equipment and tools."
Hennessy agrees: "We train our people proactively like we do our maintenance proactively," she says. "In each of our locations, our goal is to have 80 hours of training per year in areas specific to high-tech maintenance tools."
She says as GM brings apprentices into their plants, they go through a program that includes training in planned maintenance, specifically high-tech predictive maintenance, prior to becoming full-fledged skilled tradesmen. "Because they are learning all these planned maintenance skills, they walk in the door ready to

perform these tasks, which is important because no one is born knowing how to use infrared to diagnose a problem," says Hennessy.
Mitsubishi also makes training a priority. In addition to training all their skilled tradespeople at the OEM shops, the company sends them through the Mitsubishi Learning Institute, which provides an on-site, classroom-learning scenario that employs these maintenance tactics. All skilled tradesmen must also take a high-level PLC course. "We continually have five people involved in training," says Burke.
Not only are Mitsubishi's tradesmen schooled in maintenance tactics, they learn how to schedule activities. "You need to train skilled workers to go by the manufacturers' guidelines for maintenance tasks, but over time they also need to learn how to adjust the PM schedule based on their own experience with the equipment. Often they learn that they can either increase or decrease the frequency of some activities," says Burke.
Developing skills in this area is critical to running an efficient maintenance operation, says Watters. "The overall balance of fully training and using skilled tradesmen so they know what type of maintenance really needs to be done is one of the areas automotive manufacturers need to work on," she says.
"The OEMs of equipment send a laundry list of maintenance tasks, all of which can't be realistically done," says Watters. "So the maintenance crews must learn which ones are the key tasks and have the discipline to do them."

Flexibility, a key payoff

While automation requires a very specialized set of skills, the benefits of automation are significant. Among the chief benefits is flexibility - a key aspect of automaking and auto development.
"When we launch a new model, it is pretty easy to modify the carriers or hooks to accept the added configuration through the existing critical path conveyor systems," says Mitsubishi's Burke. "And then we concentrate on programming changes to the robotics and flexible automation, which is all tied in to identifying to the automation what type of vehicle is there for it to work on." After this point, the body shop and sub-assembly areas usually require the addition of a different cell, which means new floor space is usually added.
Industry experts also say automated equipment can retard the manufacturing process when it goes off line or is not properly designed for flexibility. "I can run different styles on my equipment," says Ford's Van Dusen, "but if one piece goes down, I'm down across the board." Unfortunately, cost and associated inventory levels usually make it prohibitive to have back-up equipment for automated lines, he says.
Furthermore, says Watters, if automated equipment "is not designed with the concept of quick change over from model to model or model year to model year, it can be a roadblock."
She offers an example of how to properly use automated equipment. Many of the weld tools in the body shop's of Japanese automobile manufacturers, she says, have three sides: two are for two- and four-door models, while the third side is for the addition of the next model year tool set. "Workers can come in during planned downtime and attach the new tooling to the third side and simply rotate it in like the two-door or four-door tooling. This allows it be tested without taking production

down." The benefit of this approach becomes evident, she says, when compared with changeovers that require tradesmen to come in over a weekend to take the equipment down, install new tools, test the new tooling, uninstall it and then replace the old ones.

So while automation has helped automakers achieve rapid retoolings, increased production and world-class production values, it clearly depends on the maintenance department's skill and knowledge.

"Automation is a good thing if automotive manufacturers are doing their planned maintenance and have the ability to preserve uptime," says Watters. "If they don't have that discipline, automation will have costs that fall well beyond the initial investment."

Sidebar

By Rick Carter, Editor-in-Chief

Demand for World-Class Maintenance Will Increase as U.S. Automakers Pursue Japanese Standards

When Ford Motor Co.'s Atlanta, GA-based Taurus assembly plant won top Harbour Report honors for North American efficiency last year, it was the first time a U.S. automaker had done so since the list was started in 1980. (See IMPO, "Newsline," July 2000 issue). According to Troy, MI-based Harbour and Associates, Inc., which compiles the respected industry report, the plant beat out the acclaimed Nissan Manufacturing Corp. plant in Smyrna, TN, where the Altima sedan is produced. Harbour, which ranks automaker productivity by the average number of labor hours it takes to build a vehicle, determined that workers at Ford's Atlanta plant averaged 17.16 hours for each Taurus and Mercury Sable it built in 1999 (the year covered in the 2000 report). Workers at Nissan's Smyrna plant averaged 17.53 hours for each Altima sedan.

While the award is a feather in Ford's cap, the report noted that the company was able to squeeze ahead of Nissan less by improved maintenance and production techniques than by controlling overtime and getting more out of its workers. According to auto-industry experts, U.S. automakers will only realize true Japanese-style efficiencies whey they implement programs that include changes in everything from car design to world-class maintenance programs and redesigned plant configurations. The 2000 Harbour Report noted that General Motors is aggressively pursuing such fundamental changes.

The award for top overall efficiency plants in 2000 went, for the seventh consecutive year, to Nissan. Its North American assembly plants in Smyrna, TN, and Aguascalientes, Mexico, averaged 18.7 hours per vehicle. Nissan was followed by fellow Japanese automakers Honda of America Manufacturing, Inc., with 20.26 hours per car, and Toyota Motor Manufacturing with 21.76. By contrast, Ford takes an overall average of 23.94 hours to produce a car or truck, General Motors Corp. takes 28.81 hours, and DaimlerChrysler, 30.16 hours.

The report concluded that if U.S. automakers implemented Japanese performance efficiencies at all of their plants, savings would be dramatic. If GM could produce vehicles as efficiently as industry-leader Nissan, for example, it could save $ 925 per vehicle, or $ 5.3 billion a year; Ford would save $ 612 per vehicle, or $ 2.8

billion a year; and DaimlerChrysler would save $ 950 per vehicle, or $ 2.9 billion annually.

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