Robot Saves on Labor Costs, Improves Quality

Faced with overseas competition and a regional labor shortage, Porcelain Metals Corporation turned to a supplier of robotic paint systems for assistance…

Matthew J. Little, Editor
mlittle@pfonline.com

In June 2002, Louisville, KY-based Porcelain Metals Corporation—a provider of porcelain enameling services since 1927—found itself facing a problem that is all too familiar for many others in the industry.

"We were getting killed on labor," says Randy Smitley, finishing unit manager at PMC. On the one hand, PMC was trying to defend against overseas competition where everything is done cheaper thanks to the lack of laws designed to protect workers and the environment. On the other, Louisville was facing a labor shortage in the late 90s and the first couple years of the new century.

At the time, PMC—which also provides powder coating and metal fabrication services—used a wet porcelain enamel spray process that consisted of a combination automatic electrostatic guns and hand spray. This provided PMC's customers with an acceptable cosmetic appearance on many of the parts that were run through the system. But as a labor-intensive process, it also posed big problems for the company.

"Spraying had become the least desirable job at PMC," says Smitley. "At one point, we actually ended up in a position where we were forced to use untrained labor on several of the spray jobs. What followed was a period of time where we had burn-off on one part and sags and runs on the next."

That's when PMC, which does a lot of work in the oven and grill industries, began looking at some alternatives to hand spraying. According to Quality Director Frank Zebich, robotics was a natural choice. "We knew that several of the major appliance manufacturers had invested in robotics, so we called around to see what was offered," he says. "We knew going in that the biggest objectives would be to reduce labor, improve quality, save materials and improve consistency in the process." Zebich and Smitley also knew that dependability, ease of programming and maintenance would be factors.

In its search for a supplier, the PMC team encountered Artomation, a Cleveland, OH-based manufacturer of robotic paint systems. Though Artomation had no experience with the materials used by PMC, its engineers agreed to work with PMC to see if Artomation's expertise in the application of liquid paint could be adapted to porcelain enameling.

Back to Basics

The differences between paint and porcelain enameling are vast, so Artomation—with PMC's guidance—took a back-to-basics approach to its development of a system for porcelain enameling.

Artomation began its education by devel-

Oven cavities, like the one demonstrated here by Quality Director Frank Zebich, are representative of the type of porcelain enameling work done at Porcelain Metals Corporation

oping some basic machine movement programs akin to the type that would be used to coat a piece of flatware. After a period of trial and error, the company began experimenting with more complex part types, eventually making its way towards the complicated oven cans that constitute a significant portion of PMC's business. Along the way, it noted the complexities of porcelain enameling. All of the timing and defaults built into the spraying programs had to be modified to allow for the heavier material build required by porcelain. Another issue was the regulation of film build, which was accomplished by changing gun speeds. And while spraying stationary parts was a relatively simple matter, converting the system to be able to handle the complex oven cavities as they moved along a line was an entirely different matter. Still, patience and resolve persevered and the two companies eventually overcame all obstacles.

When John McBride, the owner of Porcelain Metals, saw the results of the joint experiment, he decided to have one of the robotic systems installed at PMC. Because humidity control is an important aspect of the porcelain enameling process, PMC decided to retrofit its existing enclosed wet booth in order to house the robotic system. The roof was raised by five feet to accommodate the gantry, and one of the booth's walls was removed so that the robot could be introduced to the area. In addition, a control room was installed to house the computers that control the spray guns and the robot's motion system.

After construction of the robotic system was complete, it was shipped pre-assembled from Cleveland. The unit was delivered and set-up by personnel from both Artomation and PMC. After set-up was complete, an Artomation engineer was sent to Louisville to lead training sessions on the new system.

Programming Ease

"One of the reasons we went with this

unit was the ease of programming," says Smitley. Short turnaround times are a reality for PMC, so it could not afford to spend hours and hours programming the robots for new parts.

When a new project comes into PMC, its technicians start by taking a digital photo of the part. The image is then transferred to a software program that renders it as a three-dimensional image. The technician then draws spray paths and inserts trigger points using the computer's mouse. After suggesting some additional parameters—gun speed, gun angles, width, length and depth of the part—the part is ready for a test-run.

The introduction of robotics to PMC's facility has saved the company 40-60% on wet enamel usage.

The test run is a very basic process. First, the gun goes through its motions without a part in front of it. When the technician is satisfied with the movement, a part is centered in the work frame without spraying, and the speed and spray paths are tweaked. At this point, the gun is hooked up to the pressure tank and a few additional parameters—fan size, fluid pressure and atomization—are adjusted in the software program. Finally, the robot is told the direction of the line movement and where it should begin spraying the part.

Smitley says that normal set-up for a new part usually takes about one hour from the time his team first sees the part. Once a set-up is made and saved into the program,

Randy Smitley, finishing unit manager, makes an adjustment to the robotic system's spray path from the line's control room.

Teaching Robots to "Think" Like Painters

Artomation has been awarded a U.S. patent for developing a system that allows machines to automatically paint complex parts.

While the geometry and mathematical computations that underlie the invention are complex, the idea is simple: teach a machine to paint the way an experienced person does.

The Artomation software creates an "optimum path" for spraying paint and other coatings that lessens overspray, resulting in reductions in time, money and materials. "Overspray is not just a nuisance, it's a large cost in unnecessary paint, maintenance, emissions and clean-up," says John McDonough, president of Artomation.

In 1994, Artomation spearheaded National Science Foundation supported research that generated significant breakthroughs in software-controlled robotics and led to the unique, patented, PC control technology that is supplied to customers today.

changing from one part to another (when using the same enamel) takes approximately 30 seconds. When the technicians have to change the enamel—which requires cleaning of the enamel hose and gun, and changing the pressure tank—the changeover time increases to about 10 minutes.

"The beauty of the system is that it allows us to make adjustments on the fly," says Smitley. "Spray paths or any of the other parameters can be changed while the robot is running production. As a matter of fact, you can install a completely different set-up, save it, and—when you want to try it—send it to the robot and not miss a beat. If the change doesn't do what we wanted, we can simply recall the previous program." The system also gives Smitley and his team the ability to program on an off-site computer and then transfer the program to the robot's computer.

Although the robot gives PMC the ability to spray parts complete, the company still keeps a manual sprayer on the line for touch-up. "By using this method, we enjoy the advantages of the robot while maintaining line speed," says Smitley. "We've saved at least two hand sprayers on every job we run." Smitley estimates that the addition of the robotic system has allowed PMC to save 40-60% on wet enamel usage while increasing its throughput and yields to between 93 and 97%. "But the biggest gain has been in the consistency of our process," he says. "Reducing labor costs and material savings are certainly enough to gain our interest, but the quality improvements we have experienced make this kind of change a must for our survival." PF

LEARN MORE
www.pfonline.com

■ **Rise of the Machines**
With the advent of smaller and more versatile tools, robotic technology is establishing itself as a viable, affordable option for small- and mid-size job shops…

Find the link to this article online at *www.pfonline.com/articles/060502.html.*

PF Direct

For more information on robotic paint systems, contact Artomation at 440-234-1988 or enter PF Direct *code* ***111NX*** *at www.pfonline.com.*