CASE STUDY

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Reduce Rework and Increase Throughput With 3D Laser Projection

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For Manitowoc Cranes, Seeing ROI is Believing

Everything, it seems, has a vulnerability. For werewolves, it's silver bullets. For Superman, it's Kryptonite. For manufacturing, it's rework. Rework means loss of throughput, which means loss of profit, which can mean death by a thousand rewelds. But, just as silver bullets can be dodged, and Kryptonite can be avoided, much rework can be prevented by adopting appropriate technology.

In 1902, Elias Gunnell, Charles West, and Lynford Geer launched the Manitowoc Dry Dock Co. to construct and repair wooden ships. Starting in 1925, West, then the company's CEO, began building cranes on a subcontract basis for the Moore Speedcrane Co., a move that marked the beginning of a legacy of world-class crane manufacturing. Today, Manitowoc Cranes, conveniently located in Manitowoc, Wisconsin, manufactures lifting solutions including crawler, boom, telescoping, and tower cranes. A culture of ingenuity is important for Manitowoc to better compete in a global market and to "Build Something Real" for its customers, investors, employees, and partners. In this case, Manitowoc's ingenuity takes the form of applying the leading technology to reduce manufacturing rework and increase throughput.

The Tracer^{M} features accurate, variable and long-range projection to cover an area of up to 50 x 50 feet, and has a 3D projection range of 6 to 50 feet.

Tradition vs. Technology

Manufacturing lifting solutions involves miles of welds; that's a lot of opportunity for error and rework. When all aspects of rework, such as rework labor cost, lost production, and paperwork costs are added up, it can easily take a 30-percent bite out of productivity. For Manitowoc, like all efficiency-conscious manufacturers, that's an expense that's unaffordable.

"The last frame we put together included about 8,000 inches of welding altogether," says Samuel Dick, Manufacturing Engineer II at Manitowoc Cranes. "We previously used just blueprints, tape measures, chalk, and some physical templates to set all of the parts on each frame. All of that was done by hand and we would lay out each frame the same way."

There were downsides to the traditional way of laying out each frame using manual measuring methods—for example, rework and all those associated costs. Parts located on the wrong side of a chalk line or parts welded on backwards because the holes were offset in the plate were typical errors requiring rework. Training new employees and cross-training veteran ones proved to be an ongoing challenge as well. There was also no effective way to catch if something was laid out or welded improperly without performing 100 percent inspection.

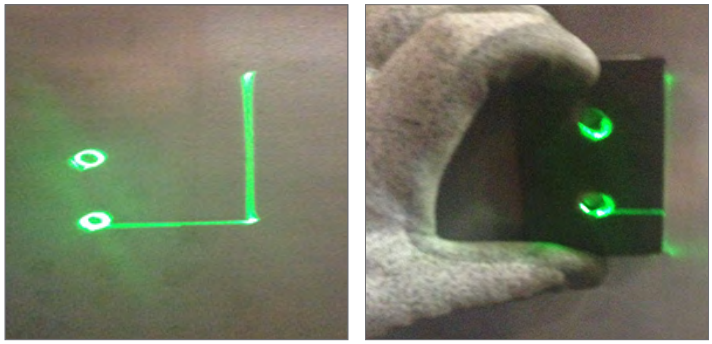
> ***"Time studies showed ROI for three projectors in less than a year. Another investment in FARO laser projection technology paid for itself in ninety days."***
>
> *– Samuel Dick, Manufacturing Engineer II*
> *Manitowac Cranes*

FARO

Putting the Brakes on Rework

Manitowoc's manufacturing engineers started the process of investigating rework solutions and then management made the decision to invest the capital necessary to upgrade to the FARO® Tracer^{M} Laser Projector.

"I've seen both sides of the reworking issue," confides Dick. "I've supervised the area where we use the lasers and have also been involved in the rework process. When you have to send someone over to cut a part off because it was welded onto the wrong side of a [measurement] line, the team has to gather up their equipment, leave the building they're currently working in, rework it, and then come back and get back to what they were doing. Rework just kills any forward momentum. The Tracer^{M} eliminates employees putting on incorrect or obsolete parts. Since we integrated the Tracer^{M} solution, we have not had to rework any incorrect laser-set parts in more than 18 months." Naturally, the Manitowoc team had to overcome a certain amount of resistance to change within the ranks.



Left: *The Tracer^{M} projects alignment marks for a bracket onto a surface.*
Right: *The bracket is placed on the surface according to the projected marks and then welded in place.*

"People just don't like change and so they make excuses why they can't do something a new way. You just have to take away their excuses," chuckles Dick. "I saw a few guys just shaking their heads while we explained how it works, but then we went down to the floor where some operators were setting parts on a frame. Once they saw the projector in action, it was really very simple to understand."

Recent recession markets forced Manitowoc to lay off a number of people, which meant more seasoned employees had to take over in this area. They were weary of the new technology, but the Tracer^{M}'s usability and usefulness quickly won the day."It didn't even take a week to sell them on it," says Dick. "We have the computer screens set up right there at the welding stalls and when you walk by and all the screens are lit up green you know they're using the laser projection system.

"Some of the guys didn't trust it at first. They would look at the line it was projecting and measure to the line just to verify it," Dick continues. "But now, with the Tracer^{M}, there are no mistakes and the need for rework goes away. When they're not going back to cut incorrectly placed parts off - and they know why - they're sold."

Kicking Throughput into High Gear

The same attributes of the projection system that reduce rework have the additional benefit of increasing throughput. Although Manitowoc employs robotic welders for long runs, there are still many pieces that must be manually attached to each frame.

"Rather than chalking off every single part that has to be welded onto a frame, we use the Tracer^{M} projector to set 70 percent of the parts," explains Dick. "A frame can have up to seventy or more 'trinket' pieces to weld on, so each individual measurement adds up to a lot of time. It takes less than 10 minutes to set the projection system up and find the targets. If we are building multiple frames, we can use the auto align option, which cuts set up time in half. We cut four hours off production time on the last big frame we built—that's half a shift."

The Tracer^{M} system includes a software suite to guide the assembly process, which enables the Manitowoc production team to customize the build program.

Using CAD files to provide a virtual templating solution eliminates the need for physical templates and hard tooling, and the risk of human error and costly scrap during assembly is significantly reduced. Manufacturers can avoid the time and expense associated with using large, heavy templates while significantly improving quality control processes. An easy-to-use operator interface minimizes both the time and the skill required for operation.

"The program is built in layers, so after the operator verifies the first measurement of a run, he or she then just sets the parts designated in the first program layer, toggles to the next layer, sets the parts for that layer, and so on," says Dick. "The software allows us to set up those layers with groupings of parts so the operator doesn't have to keep walking around the frame. The process is now the same for all rough terrain (RT) frames, so cross-training employees across the product line is much easier and faster."

Enhanced Engineering

Samuel Dick began his tenure with Manitowoc as a welder, worked his way up through supervision, and then into manufacturing engineering. At that time, engineering new equipment was synonymous with engineering new templates and jigs.

"I used to be a template guy myself," confesses Dick. "But when I got into engineering, I saw how much template work—and cost—was involved when you go to make an engineering change. Sometimes you're not able to rework the original jig, and you might see a $4,000 template turn into junk. Now, with the Tracer^{M}, if there's an engineering change, I just load the new data into the program. Days of template rework are replaced by less than an hour of time loading the new model into the program." The Tracer^{M} has greatly reduced Manitowoc's use of physical templates and is revolutionizing its engineering efforts.

"It is possible to develop an entire build program in one day," says Dick. "Once the basic program is built, changes can be made in minutes and we don't lose time or have the cost of making so many new templates or obsoleting the old templates." Revision changes can be done and programmed before the frame ever makes it into the weld stall.

One can only imagine the revision headaches avoided with all changes made in the program itself—no more multiple blueprint revisions floating around the shop floor or squirreled away in a desk.

Return on Investment

"I did some time studies last spring and saw one operator set 27 parts in about 22 minutes," boasts Dick. "Those time studies showed ROI for three projectors in less than a year. Another investment in FARO laser technology paid for itself in ninety days."

The cost savings of less time to build the product and not having to perform rework on the assembly line is obvious. The subtle takeaway is that during lean market times, the technology cuts down on production time, thus increasing net profit. In boom times, the time to ROI decreases dramatically.

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From frame build to engineering to subassembly on fixturing tables, Manitowoc's team continues to find new ways for the FARO Tracer^{M} Laser Projector to increase throughput, reduce rework, and lean out its processes—which, of course, improves its bottom line.

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