

Peggy Einhaus checks a small part, one of four inspection setups seen fixtured in this view. The part being measured is mounted to a standard Demmeler U-form spacer block positioned at the corner of the table.  
Source: Bluco

# Process Drives Inspection Innovation

A broad offering of contract fabrication services results in steady growth, and with it, pressure to increase the productivity of measurement and inspection operations.

BY PETER SCHULZ

Precise Laser Waterjet & Stamping (PLW&S, North Aurora, IL) specializes in fabricating precision parts in short to medium runs, typically around 1,000 pieces, and prototyping.

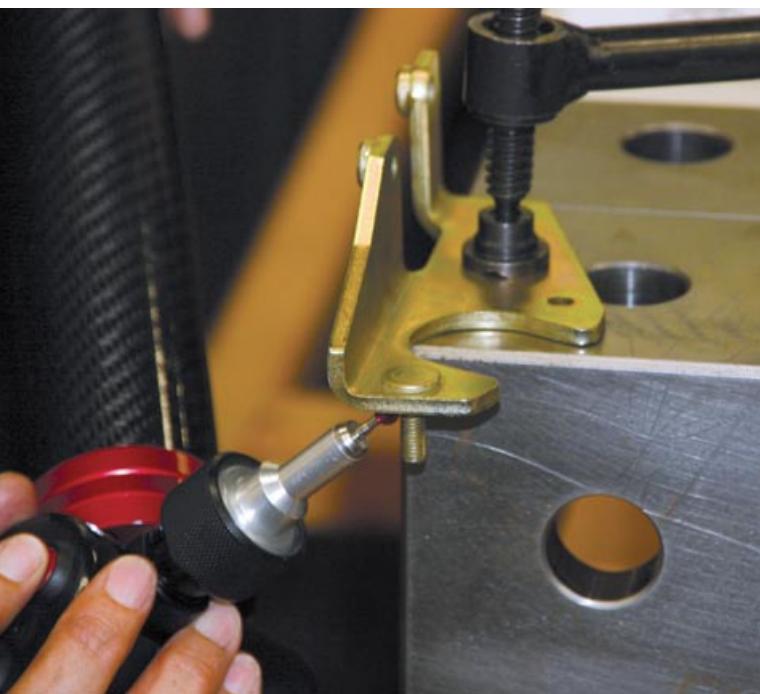
The ISO 9001: 2000-certified company is equipped to handle most materials including all types of ferrous and non-ferrous metals, stone, plastic, wood and even glass, in thickness ranging from

foils to 12 inches and more, while holding specified tolerances.

By the late 1980s, PLW&S began to experience a downturn as traditional customers moved their stamping—or even their entire business—offshore. The company responded through diversification and a strategy to expand by adding capabilities, initially those complementary to stamping. Today, PLW&S also offers EDM machining, CNC milling and welding.

## TECH TIPS

- ▶ PLW&S needed a highly efficient capability to inspect the minimum—often one part—at a time.
- ▶ With little programming, an articulated arm CMM accomplished inspection of most types of parts the company makes.
- ▶ PLW&S wanted to build a workstation that would enhance the operator's ability to do precision, manual work.



Articulated arm ergonomics offers enhanced productivity. The operator is using the arm-end as a mouse to position the cursor directly on the display screen to select datums for measurement. Triggering the probe generates the click. Used as a mouse, the arm-end can control many functions of the arm's metrology program. Source: *Bluco*

Inspection of critical features on the same small part using the touch probe on the end of the articulated CMM arm is shown. When the correct point is reached, the operator presses a trigger to register the measurement. Source: *Bluco*

#### FOUR WAYS BETTER

The plan to offer services complementary to stamping offers four business benefits: First, a larger pool of potential customers. Second, the potential to capture more types of work from individual customers requiring multiple processes. Third, “ups and downs” in sales tend to be smoothed out over time—when one customer or process is slow, another may pick up. Fourth, PLW&S is positioned to control all aspects of a project to ensure maximum value to the customer. Depending on the part, maybe one, or many, of PLW&S’s processes may be involved in processing.

According to Christopher Goblet, president of PLW&S, “Compared to working with multiple shops, our everything-under-one-roof workflow enables us to provide customers with an obvious logistical advantage. Not so obvious is the quality control advantage this provides. Since we know what it took to add value at each operation, we also know what’s critical to look for as a part moves up stream.”

Each new job requires its own unique workflow—some parts may require only laser- or water jet-cutout,

others may add bending; sometimes, secondary operations will accumulate to include welding or machining together with drilling/tapping or other processes. As a result, the junctures at which QC must occur are multiple and varied, and the opportunity to accumulate error grows.

“We always take great care in our measurement and inspection procedures, whether using traditional tools such as calipers, verniers, height gages and micrometers, at each operation, or whether we check parts on our manual coordinate measuring machine (CMM),” says Clyde Braviere, production manager, PLW&S. “In any case, at one point on certain large, complex parts, we were getting rejections. So we took samples outside to a large CMM and confirmed that while each individual measurement was within tolerance, error was still accumulating and wandering outside acceptable limits. Something had to be done.”

At the same time, PLW&S was looking for a way to improve inspection throughput. Besides the need to inspect for internal production, PLW&S also performs contract inspection. Braviere says, “All in all, there was potential

for a massive inspection log jam. We needed to improve both measurement precision and productivity.”

Automated measurement, as with a CNC/CMM, was not practical at the low per-part volumes the shop puts out. At the same time PLW&S found that the programming and setup required by its manual CMM made it effective only for its largest runs of multiple, identical parts.

What PLW&S needed was a highly efficient capability to inspect the minimum—often one part—at a time. If it could do that, then efficient inspection of larger numbers would follow. So that is just the capability PLW&S set out to create. And, in finding the solution, two seemingly unrelated technologies were combined.

#### MANUAL ARTICULATED ARM CMM

Goblet explains he has attended many trade shows with the intent of finding some variant of CMM technology that would fit the bill. “We saw a lot of interesting concepts and finally bumped into the manually operated articulated arm CMM manufacturers.”

Articulated arm CMMs use an anchored, jointed arm with an attached

probe tip at the moveable end. The length of each arm section is combined with the encoder angle at each joint to compute the probe's position.

Goblet continues, "It was immediately apparent from the way they operated that with very little programming, an articulated arm CMM could accomplish inspection of most types of parts we make. Articulated arm CMMs depend on the intelligence of a human operator to pick the right points. It's possible to just fixture a part and begin measuring. Then, if a higher priority part needs immediate inspection, the operator can break-off the original session, fixture and completely inspect the high priority part, and then go back to finish the first part."

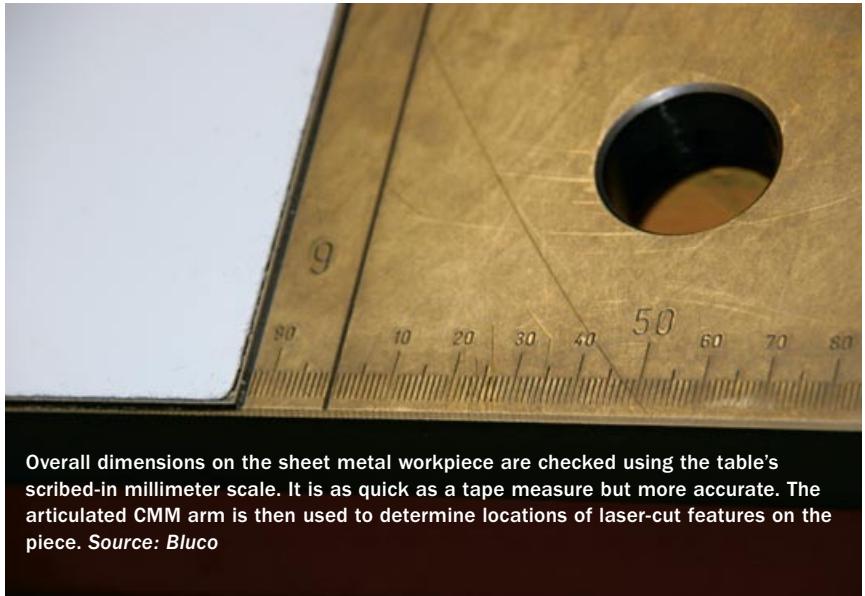
Goblet adds, "Another interesting aspect of manual articulated arm CMMs is that the exact placement in fixtures is not critical since it is the operator who uses his knowledge to locate points to measure, and not a CNC program which requires a precise, pre-determined starting point toward which it will drive the probe—hopefully without crashing."

As a result of their findings PLW&S decided to purchase and install a manual articulated arm CMM. They chose a Romer model. With six encoder joints, it provides an accuracy of approximately  $\pm 0.0012$  inch over its 8-foot sphere of reach.

But one problem remained. Braviere explains, "We wanted to be smart about mounting, fixturing and accessorizing the articulated arm, but there weren't any standard ways to install the device. Some people recommended mounting to a Portage grid plate. We also considered using a product consisting of hardboard sheathed in stainless steel. We also looked at some acorn-type cast-iron welding platens. But since we were going to be using a manually operated CMM arm, we wanted to build a workstation that would enhance the operator's ability to do precision, manual work. Nothing we were looking at seemed to accomplish that. Then we came across the Demmeler modular fixturing systems from Bluco Corp. (Aurora, IL)."

#### DEMMELENER'S CONCEPT

PLW&S's Demmeler system consists of a worktable that serves as a platform



Overall dimensions on the sheet metal workpiece are checked using the table's scribed-in millimeter scale. It is as quick as a tape measure but more accurate. The articulated CMM arm is then used to determine locations of laser-cut features on the piece. Source: Bluco

on which to mount a variety of angles, blocks and fixturing accessories. The tables are made of 25-millimeter-thick high tensile-strength steel, ribbed to ensure stability.

Tables 28-millimeter diameter mounting holes on a 100-millimeter grid across the face and four sides of the table with an accuracy of  $\pm 0.025$  millimeter hole-to-hole, and  $\pm 0.05$  millimeter overall. Fixture elements match the holes and grid pattern on the table. Structural pieces have 28-millimeter slots to position fixtures between holes. Positioning and clamping bolts attach fixtures and workpiece positioners.

Clamping bolts insert through the fixturing elements and the worktable. An O-ring in the body of the bolt helps prevent rotation during tightening. Turning the knurled bolt head extends a series of five locking balls into a chamfered recess at the bottom of the mounting holes to center the bolt shank and clamp the components together. With each element positioned, a hex wrench tightens the bolts.

The Demmeler table's mounting system makes it easy to secure the Romer arm. The station includes a CMM-dedicated PC plus overhead-mounted flat panel display to complete an ergonomic installation.

The stability, hardness (nitrided to Rockwell 55C) and flatness (0.1 millimeter) of the Demmeler table allow the articulated arm to be used in conjunction with other gages, such as a height

gage, for example. In addition, the table has a scribed millimeter scale.

According to Goblet, "Two other aspects of the Demmeler table are that it speeds things up since the clamping system let us quickly grab hold of a part and begin checking. Also, fixturing setups are easy to duplicate. We just take a picture. For more complex setups, we include the fixturing solution with electronic files that also include a scanning path for the articulated arm."

Usually, PLW&S has multiple parts fixtured in the inspection station, sometimes as many as four or five at the same time.

It did not take long for PLW&S to develop the utility of the dimensional measurement and inspection station. Now, virtually every job in the shop runs through it, on any given day inspecting and documenting as many as 40 to 50 parts.

With the system, PLW&S has met the pressure to increase the productivity of measurement and inspection operations. **Q**

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*For more information on the companies mentioned in this article, visit their Web sites: Bluco Corp., [www.bluco.com](http://www.bluco.com) PLW&S, [www.precisestamping.com](http://www.precisestamping.com) Romer, [www.romer.com](http://www.romer.com)*

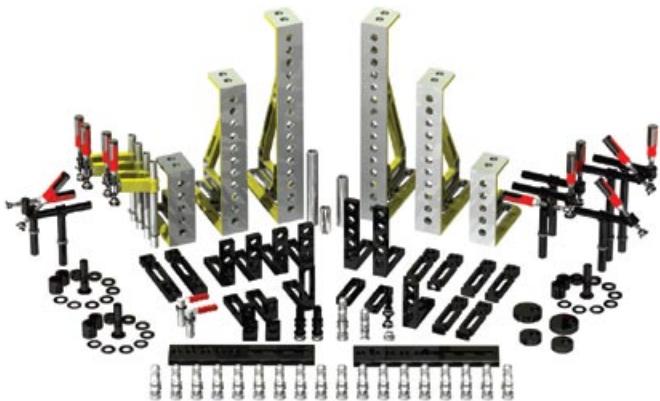
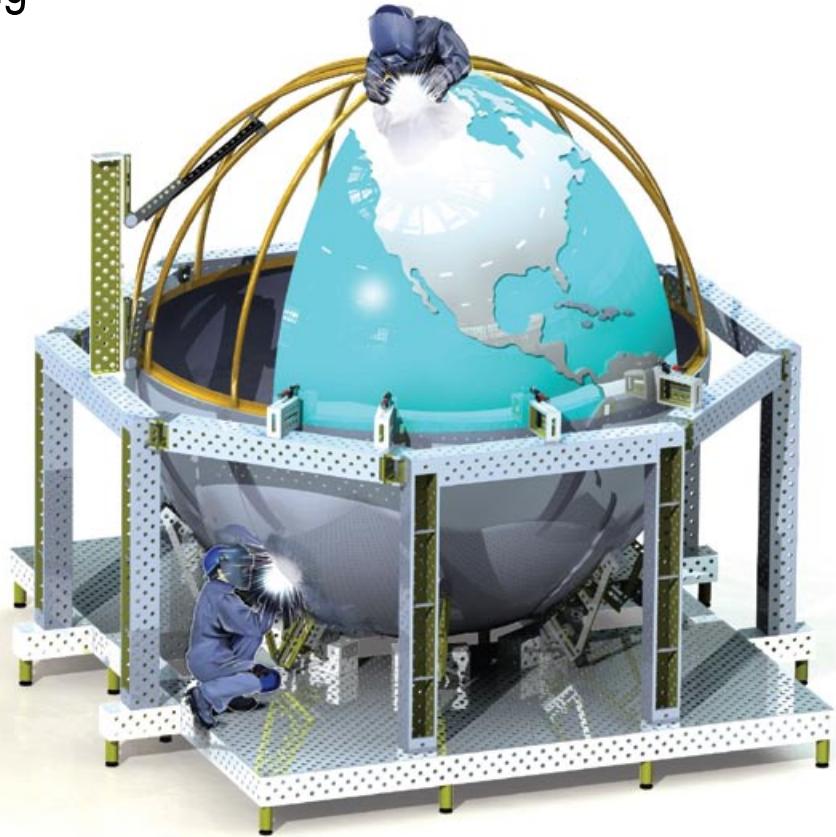
# You're On Top Of The World...

...Modular Fixturing for Welding

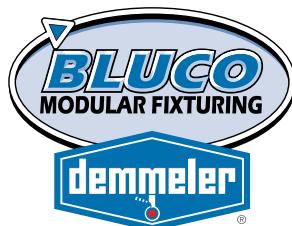
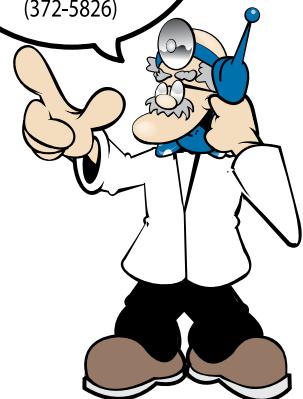
Whether your world of short run welding jobs is flat, round, square, rectangular or any other shape, you need good fixturing to get it right. Parts as small as a telephone or as large as a rail car can be fixtured with equal ease.

With modular fixturing, you can double your output and double your quality. Modular fixtures can be built when you need them. Instead of storing them, they can be taken apart and used again for other parts.

Where parts are larger than the table surface, angles can be mounted to the sides of the 3-D tables as outriggers. For even larger parts, tables can be joined together.



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