



*Milo Engineering quality inspector, Linda Couvrey, checks a miniature part on the company's Helmel Phoenix CMM. The CMM offers a 12" x 12" x 10" work envelope. Milo vp Ray Hofer says the machine was easy to learn and has performed flawlessly since he purchased it in August 2009. The automated system outputs full documentation for all inspections. it is used to check 15 to 60 critical dimensions.*

## Probing for Quality

*A Southern California Job Shop Finds that Investing in  
Quality Pays Dividends in Keeping Customers.*

*Story and photos by  
C. H. Bush, editor*

**T**orrance, CA's Milo Engineering, Inc. specializes in producing small-to-microminiature parts made of such tough-to-machine materials as nickel 200 and Kovar. However, according to Ray Hofer, vp-general manager and son of the 33-year-old company's founder, Austrian-born and trained Hermann Hofer, the parts may be small, but the quality demands are huge.

"Our parts run in sizes from under an inch down to under .100" diameter," Hofer says. "We do thousands of tiny little metric and inch threads down to 0-80. Plus, my dad still does a lot of little Levin work manually. Much of our work goes into aircraft gyros that have to spin at 18,000 rpm and remain perfectly stable. Because of the critical nature of the parts we make, some of our customers require 100% inspection and a paper trail all the way back to the original material purchase. That places a heavy quality-control responsibility on our people and our equipment."

Hofer says Northrop Grumman, his main customer over the years, has steadily tightened its quality demands.

"Right now we're making parts for Northrop that are .0005" true position on the holes," he says. "And the new parts we're doing for them under our new three-year contract also demand really tight true position. "To get and keep that

**Ray Hofer, right, and NC machinist, Juan Alvarez, discuss surface finish requirements for a part. Machine in the background is a Mori Seiki SL-15.**

new contract, we had to invest a lot into new production and quality-control equipment.”

## Investing in Quality

Hofer’s first brush with a demand for super high quality parts came seven years earlier, also from Northrop.

“In order to keep doing three parts we had always done, Northrop threw in a really tough part,” he says. “Basically, they said, ‘If you want to keep doing these three parts, you have to do this fourth part, too.’ Problem was, the fourth part looked simple, and I underbid it. It turned out not to be simple at all. If I tried to get out of the contract, I would have lost my best customer, so I had to find a way to produce that part, inspect it and make a profit at the same time.”

Hofer did it by retrofitting his Haas VF0 with a Renishaw touch probe and buying a ScienScope vision system.

“This time around, the quality demands are even tougher,” he says, “Northrop’s gotten very critical. They’ve always been tough, but lately they’re stressing high quality control, 100% inspection, good paper work, traceability, stuff like that. And, this time the production quantities are higher, so unless I wanted to lose money, I needed more equipment and a faster inspection system.”

Hofer turned once again to Haas for an answer.

“We bought two vertical machining centers,” he says. “We bought a VF2YT Extended Travel with through-the-spindle coolant and a 40-tool side-mount carousel. We also got a new VF1. Both machines are equipped with Renishaw touch probing systems. The touch probes would allow us to produce the precision we needed, but we still had to perform 100% inspection on all the small parts, which meant we needed something a lot faster than our vision system.”

To satisfy demands of the new contract, Milo also became ISO 9000 and AS 9100 Certified.

“We shopped around for a CMM that would do the trick for us without breaking the bank,” he says. “We eventually



settled on a Helmel Phoenix automated CMM with a 12 x 10 work envelope. We didn’t need anything bigger for our small parts. The Helmel is just right. It’s American made, very high precision, easy to learn and it’s fast.”

## Probing-CMM Inspection System

Hofer has worked out a system for producing and inspecting his tight-tolerance parts that virtually eliminates any part loss. His mills are equipped with two probes, one mobile and one stationary.

“We start with a precision ground block of material,” he says. “We grind the blanks ourselves. We load them into Chick vises in the machines, but the blanks have to be in a good starting position when we machine the parts. The holes on the finished parts have to be within .0005” true position, so it’s very important that the operator loads the part correctly. If he doesn’t, the part is scrap. So, as a safety measure, we probe each blank on top and the sides to get that perfect starting position.”

Once the blank is in place, Hofer uses the stationary probes to check his tools for breakage and wear.

“We use thirty-five different tools to make some of our parts,” he says. “If just one tool breaks, all the tools that come after it are going to break, too. So we have certain tools that go over to the stationary probe and touch off to be sure they’re okay. If a tool is worn more than .005” or even a couple of thousandths, the probing software either stops the machine to change the tool or it can index over to a sister tool on the carousel to continue on. Probing has saved us more time and money than I can imagine.”

Hofer probes still again after machining is completed on a part,

“There are a couple of critical bores in the .060” range that have to be within .0002”, he says. “So, we use the smallest Renishaw probe, about .020” ruby, to go in and check the holes for size and position. That way, if the tools have worn a



**Renishaw touch probe at work on a Haas vmc.**



**CNC operator Norman Villegas sets up a Haas VF2-YT equipped with a Renishaw touch probe system. Part to be produced is a Kovar gyro for the Global Hawk program.**

little, we remachine those bores.”

Even after all that, on some parts probing is done once again after the parts return from grinding and heat treating.

“The key for us is to do everything we can to be sure a part is right, before it comes off the machine and before it goes to final inspection on the CMM,” Hofer says. “By using probing on our Haas machines, we’re able to produce precision we couldn’t have done before. Programming for probing is more intense than normal programming, of course, but the Renishaw and the Haas software is fairly easy to learn. We do all our own programming now.”

### ***Moving to the Helmel CMM***

Finally, after parts are completed, they’re moved to the Helmel Phoenix for final 100% inspection.

“We’re checking the parts one at a time,” Hofer says, “but depending on the part, the CMM checks anywhere from 15 to 60 critical dimensions. Northrop wants a full inspection report, which the Helmel gives us with ease. The parts are so critical that Northrop often checks them again once they receive them.”

Hofer bought the CMM from Helmel Engineering Products in Orange, CA.

“The CMM is actually made in New York,” he says, “the last CMM made in America, which is one reason I bought it. Their support has been great. Ingo Helmel, their local representative, wrote some of the programs to get us started, and showed me how to use it. Whenever I need help, he’s there on the phone or he comes over here. I guess the main reason I bought the Phoenix is because it’s extremely affordable, and yet has incredible precision and repeatability. Our inspector loves it, too, which helps a lot.”

### ***What’s Next?***

Milo Engineering currently occupies a 5,000 sq ft facility and keeps 9 employees, including Hofer, busy. His customer base includes Northrop, L-3 EDD, Litton, GM, Boeing and others in the aerospace industry.

“My dad started out in Austria as an apprentice machinist,” Hofer says. “He taught me the importance of doing things right, and especially the importance of producing high-quality parts. As far as I’m concerned, producing quality small parts is our business. I guess the bottom line for me is that investing in quality has kept us in business all these years.” ■