

Four-axis CNC Machine Boosts Gun Stock Production 200% to 300%

Ironwood Designs, a manufacturer of wooden gun stocks, has increased production 200 to 300 percent after replacing a manual pantograph with a four-axis Techno CNC router. Previously, the company used the pantograph to carve out inlets and other areas in the gun stocks. It was a back-breaking process that was both slow and inaccurate. The four-axis CNC machine can carve the cutouts in about one-fifth the time it took to do them by hand. And since the machine can automatically reposition a part and cut all sides in one operation, it can run unattended. This lets one employee to do the work of two. In addition to being faster, the CNC is much more accurate than hand carving, giving Ironwood Designs a reputation for quality work. "The Techno machine has boosted the volume of our business by letting us take on jobs we didn't have time for, or couldn't do accurately enough in the past," says Matt Shuster, President of Ironwood Designs.

Ironwood Designs, located in San Jose, California, designs and manufactures replacement gun stocks. The company's products, made of high-quality hardwoods, are purchased by individual gun owners, gun dealers, and firearms manufacturers to replace the inexpensive plastic or softwood stocks of many imported military guns such as the FN-FAL and the AK-47. Ironwood Designs sells a four-piece wooden set that includes the butt stock, pistol grip, and an upper and lower hand guard. As one of the few companies making replacement gun stocks for these weapons, Ironwood

Designs has a thriving business. The company's previous production process had a bottleneck, however, that needed to be eliminated so they could grow.



One step of the process in creating a wooden gun stock.

Keeping up with Business

In the first step of making a gun stock, a Zuckerman copy lathe is used to automatically carve a wood block into the desired 3D profile. A Zuckerman machine is the gold standard in the industry for profiling; it is the same machine that shapes the necks of Fender guitars.

This part of the production process, which was handled by an Ironwood Designs employee, needed no improvement. The next step was the problem. After parts are cut on the Zuckerman machine, they need further cutting to carve out the inlets where the stock fits into the rifle and areas where parts such as the swivel and the butt plate are later attached to the stock. After running the parts through the copy lathe, which was located in the company's shop, Shuster took them to his home workshop where he used a manual pantograph to make these additional cuts. The pantograph had

four spindles so four parts were cut at once.

One problem with this approach was the sheer physical labor involved. Shuster did this work himself. It took an average of 15 minutes to complete the carving process for four butt stocks. If Shuster's hand slipped, four parts were damaged at once. He estimates that he had a loss of between 10 and 15 percent due to carving error.

A desire for a faster, more accurate carving process led Shuster to look at other options besides the pantograph. He had researched the technology and knew that a CNC machine could be programmed to automatically cut the shapes he was then cutting by hand. One option was to purchase a heavy and expensive CNC machining center primarily designed for metalworking and adapt it for working with wood. He had heard of other woodworking companies doing this, but the \$125,000 to \$250,000 price tag of these machines was prohibitive.

At a woodworker's trade show, Shuster found a better alternative, a four-axis CNC router machine from Techno Inc., New Hyde Park, New York, designed for production routing and drilling on a wide variety of materials including wood, plastic, MDF, solid surfacing materials, and nonferrous metals. This machine's complete system was affordable; it has two 5 HP Colombo spindles with dual rotary stations for high production, and can cut two identical parts at the same time. Shuster also appreciated its robustness, which included steel stress-relieved bases with hardened steel linear ways, ball screws, and

servomotors as standard features for precision performance, speed capacity, and machine longevity. He purchased a Techno four-axis machine with a five by six feet table big enough to handle even the longest butt stocks.

Four-axis Benefits

The four-axis capability of the Techno machine is what makes it the solution Shuster was hoping for. If he had purchased a traditional, three-axis CNC router, it would have been necessary to continually reposition parts on the machine because cuts are needed on all sides. Although this still would have been faster than cutting parts by hand, the machine would have required constant attention. A four-axis machine, on the other hand, has dual spindles, one that holds the part and one that holds the cutter. The cutting program directs the x, y, and z motions of the cutter, as with a traditional CNC machine. But it also directs the positioning of the part. After one side has been cut, the part can be rotated, for instance, to allow access to the other side. "With a four-axis machine, repositioning happens automatically so the cutting goes faster and it's completely unattended," Shuster says. Using the four-axis machine, it now takes Ironwood Designs only three minutes to cut four butt stocks, compared to 15 minutes needed with the pantograph.

Shuster estimates that the overall productivity of his business has increased by 60 to 80 percent since he acquired the CNC machine. It is located in the shop with the Zuckerman copy lathe, and one employee runs both machines. Shuster handles light finishing work. "We now produce 100 pieces in four hours. Previously that took us two days," he says.

The quality of the cuts is much better with the Techno CNC machine.

"There is less tearing of the wood because spindle is spinning at 18,000 rpm," says Shuster. "And if a cut is off by 0.010 inch, I can modify the NC program and easily fix it." In the past, the tightest tolerance he could achieve was 0.01 inch to 0.02 inch. The Techno CNC machine holds between 0.003 inch and 0.004 inch. "That is phenomenal for wood," says Shuster. "Now we produce factory quality pieces. You can't distinguish our stocks from the original military production except that we use a higher grade of wood."

The combination of higher quality and faster production has led to an increase in business for the company. After finishing a large, two-and-a-half year contract for one gun manufacturer, Shuster has now programmed the CNC machine for a new product, a replacement stock for the Belgian FN-FAL rifle. Designed in the 1950s, this rifle has been out of production for years. But surplus versions are being imported, and new ones are being manufactured in the US from old military specifications. Ironwood Designs is now offering replacement parts for this rifle to manufacturers, who will resell them as accessories, as well as to smaller gunsmiths who build FN-FALs for customers, and to individual owners of the rifle who wish to retrofit it with a nicer wooden stock.

In addition to this new product, for which Shuster anticipates a big demand, he plans to use the Techno CNC machine to take on projects he has long wanted to do but couldn't in the past because of time or accuracy limitations. For example, he plans to offer replacement stocks for common guns such as hunting rifles that are far more easier to install than those that are currently available. Most replacement stocks come semifinished. The sides



A shot of the shop where gun stocks are held.

are carved but they have not been sanded so tool marks are visible. The gun owner has to fit the rifle to the stock, a process that can take hours of filing. For those who aren't experienced woodworkers, there's the danger of damaging the stock. Shuster plans to cut these stocks on the CNC machine for a level of accuracy that has been previously unavailable. "My kits will be innovative because they give you drop-in fit," he says.

The acquisition of a four-axis CNC router improved productivity and accuracy at Ironwood Designs. The result is an increase in business. "We no longer advertise and yet our volume keeps increasing," says Shuster. "With a four-axis Techno CNC machine, we're now able to produce replacement stocks for anyone who wants one."