Shop Sets High Standards in Machining and Fabrication

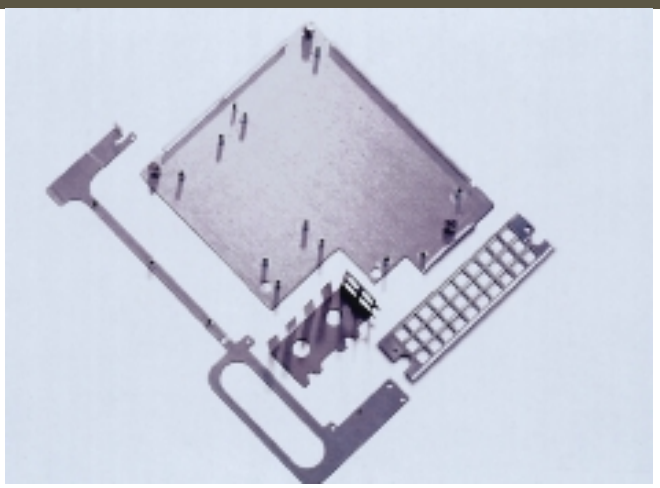
Onboard motion control is instrumental to the accuracy of a job shop's laser machining and welding operations.

According to founder Clay Dennis, Zephyr Engineering is a unique job shop. The company, founded in 1987, operates in a 65,000-sq- ft facility with 75 employees in Salem, Oregon. A fabricating department combines with a full machine shop operation at Zephyr, further enabling the company to approach that elusive but desired goal of being "all things to all people."

"We work for a diverse group of customers, from Fortune 500 giants to small manufacturers, who produce products ranging from microwave tower components to amusement park rides," says Dennis. "This spectrum of business, coupled with our typical run of 50-250 pieces and a virtually unlimited range of metal materials, creates the need for great flexibility and adaptive production scheduling at Zephyr."

The establishment of operating standards is critical to success at such a company, where CO_2 lasers, machining centers, welders, press brakes, and various pieces of finishing equipment work in concert to produce the myriad parts that Zephyr supplies to its customers. Clay Dennis cites a number of factors that contribute to these standards. "We've always taken our time to seek out the most efficient and cost-effective machinery to do the jobs at hand," Dennis says. "Since we bought our first Trumpf laser, which had a Siemens controller onboard, we were impressed by the speed and the accuracy of the movements. Those, of course, are the watchwords for any successful shop, even more so at Zephyr, where so many and so many different jobs come our way each month."

Typical parts machined and fabricated by Zephyr include these hubs for amusement park equipment.



Electronic sheet metal components produced by Zephyr Engineering include a chassis for a computer board, a heat sink, and a keypad for aircraft.

Currently, Zephyr has three CO_2 lasers, two CNC press brakes, two turning centers, three vertical machining centers, and one 5-axis DMG machining center. All

The Sinumerik 840D motion control system from Siemens.

MACHINE CONTROL

of the machines carry Siemens motion control systems.

"What we needed in the latest generation of control systems was a combination of several key components, driven by a plain-language PC," Dennis explains. "What we found was the 840C and the newest offering from Siemens, the 840D. We actually waited a while to buy our most recent laser, because we knew the new controller was on its way and we wanted it," he continues. The Sinumerik 840D has an open architecture, which allows the manufacturer (Siemens) to customize more to meet Zephyr's needs and provide the onboard control that Zephyr requires. A large number of functions can be supplied in one package that includes operator screen, PLC, interface software, CNC, power supply, drives, and the servo, spindle, and linear motors.

The fact that Siemens makes every one of these components isn't lost on Zephyr, according to Dennis. He noted that another control system and machine supplier would tend to "triage" his problems and then shunt him off to one division or another to get help. "Whereas I now get all the assistance I need directly from my machine suppliers and Siemens, who work together for me," he explained.

To illustrate how well the control system works, Dennis mentions a job in which Zephyr's customer orders more than 600 different sizes and styles of flanges for microwave tower construction. "On older control systems, an operator would need to access a library off-line, DNC the program to the machine, rename the program, do a line-by-line edit of the program, and start running every time a new flange was needed," he explained. "By contrast, with the Siemens parametric editing program, a similar part is called up onscreen in real time, the changes are made, and the program is up and running right away. From the time the operator gets the job and the flame-cut blanks, we're less than 48 hours from shipment, almost every time."

In addition to making components for microwave towers, Zephyr Engineering makes components for aerospace and aircraft navigation equipment, including Global Positioning System (GPS) transceiver parts. The company also makes chassis parts for motor coaches, parts for various athletic equipment sub-assemblies and toys, and parts for amusement park rides, go-cart structures, and mountain bikes. Substrates of virtually all metals are cut and formed on the company's equipment.

With partners Brett Dennis and John Martin, Clay Dennis runs Zephyr's fabricating and machine shop operations. They are supported by a full staff of machinists, laser operators, press brake operators, welders and robotic welder operators, and programmers, as well as customer service and applications personnel. In the fabricating department, the most recent Model L3030 Trumpf laser incorporates Sinumerik 840D controls for positioning, laser auto-focus, and sheet detection. It also incorporates an auto-loader, which removes and replaces each workpiece on the cutting table, resulting in nearly non-stop production.

One of Zephyr's customers in the amusement-ride industry needed a new belt drive cog. The cog that it had been using was made from aluminum and had an unacceptable wear rate due to the dusty conditions in which it was used. The customer wanted a steel belt cog that would hold up better, but had three requirements that would need to be met for any replacement to be considered. The cog must be an exact replacement with respect to diameter width and shaft diameter, it must run the exact same belts as the earlier aluminum models to minimize spare part inventories, and it must be light in weight.

The control becomes, in essence, an onboard PC with its hard drive, giving the operator a faster look into off-normal conditions and a plain language format for inputting commands.

The customer found that no off-the-shelf product could meet these needs.

Zephyr took on the challenge to design and manufacture a belt cog that would meet these requirements, and be economical to produce. A solution was found in using both machined and fabricated parts. Instead of the usual cast disk, machined to size, Zephyr constructed this cog with an outer rim sawed from drawn-over-mandrel tubing, a small turned core, and laser-cut spokes in between the core and the rim. The accuracy of Zephyr's latest lasers with the Siemens control allowed the use of fabricated parts in an area where they were not traditionally considered accurate enough. The new parts improved durability, reduced lead-time, and held the line on cost for Zephyr's customer.

Another customer, a supplier to the motor coach industry, had a fabricated and welded component that was the main structure for a rack and pinion mechanism. The problem was maintaining alignment and accuracy without a machining operation. The product had been designed using standard punched and sheared components. With the objective of redesigning the components to utilize a tab-and-slot type of construction, Zephyr drew upon the ability of its lasers to cut slots equal to or less than the thickness of the material being cut. This strategy allowed better fit-up accuracy and required less welding, which minimized heat distortion. It also permitted faster production of

the part and reduced reject parts from 10% to less than 0.1%. Clay Dennis calls the case "a prime example of how parts can be improved by designing them with the latest technology in mind."

Dennis says of the control system used by Zephyr: "It's a data-based programming system, plus the maintenance is simplified with bar graphs and additional input points for diagnostic set-up. The control becomes, in essence, an onboard PC with its hard drive, giving the operator a faster look into off-normal conditions and a plain language format for inputting commands."

Serviceability is another reason why Zephyr Engineering has set its standards around the Siemens control system, according to Dennis. Because the plug-and-play modularity of the components is "far out in front of the competition," retrofits that not long ago took eight hours can now be completed in 20 minutes. "The electronics, data screens, human-machine interfacing, long use life, and reliable service we've seen as Siemens standards, remain the best in the industry, at least as far as Zephyr is concerned," says Dennis.

"All our Siemens-equipped machines have an overriding logic interconnection, which makes that often-avoided subject of crashes one that I'll discuss freely," observed Dennis, who related a recent event to demonstrate.

"We had a tool stick in the spindle because the tapers were actually too identical," says Dennis. "The operator thought the tool was out but the machine knew it wasn't. Older machines, where the program was in parallel, didn't interact with the control all the time, and this situation would have sent parts flying through the door. In this case, the machine knew what the operator didn't, or couldn't, know. The next lathe we're purchasing will most likely be a two-spindle, two-turret design, but it will most definitely have a Siemens motion control system."

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