MOLDMAKING TECHNOLOGY™
www.moldmakingtechnology.com

MMT INSIDER: FROM THE FIELD

Constant Velocity Cutting, Low-Cost Retrofit Help Mold Shop Startup Succeed

There comes a point in the life of every business when it has to choose between investing in an advanced technology and staying with the tried-and-true. When that choice confronted the owners of Fidelity Machine & Mould they opted for a retrofit machine tool control.

The decision brought together four entrepreneurial Canadians, two veteran moldmakers and two machine tool controls wizards. Both of their companies are recent startups but the principals already knew each other and hold one another in high regard.

Centerpiece of the Fidelity decision is a state-of-the-art MTI constant velocity controller (CVC) retrofitted to a 10-year-old Fadal vertical machining center (VMC). Almost immediately the co-owners of Fidelity—Jeff Litster and Ryan Arsenau—got the benefits they wanted in productivity, and more. In just a few hours after powering up, everything was running flawlessly. Litster and Arsenau were naturally skeptical but soon found that the CVC learning curve was half what other controllers had required in the past.

The whys and hows of this success have to do with the way a machine tool and its computer numerical control (CNC) work together. The MTI control, developed by Windsor technology entrepreneur Carlo Miceli, represents a fourth-generation in all-important look-ahead capability.

The CVC breakthrough at MTI is in cranking up the speed and accuracy of machine tools, even 20-year-old machines. That dramatically boosts the average speeds at which all their axes drives push cutters around workpieces—to between 300 and 500 inches per minute.

Gains

- Smoother movement resulting in less wear and tear, better finishes, longer cutter life and faster cycle times.
- More processing power, which allows Fidelity to program to a higher point resolution and tighter tolerance bands for gains in accuracy and surface finishes.
- A distinct cost savings over the equivalent new machine.
- An increase in efficiency due to the ability to run CAM software directly on the controller terminal.
- A quicker learning curve and a more user-friendly environment
- Actual machine times approaching 90% of the programmed time, as opposed to the previous controller which has been as low as 30%.
- Enabling Fidelity to demonstrate to customers that it is dedicated to maintaining the highest level of technology, setting itself apart from the “other” machine shops.

“With older controllers you really can’t trust the finished product,” says Litster, “which leads to slower cutting, more checking and more scrap.”

Those speeds are almost never reached and that is the dirty little secret of CNC. “Programmed feeds are reached only under near-perfect conditions and then for only a few seconds at a time,” Miceli points out. “There are a lot of reasons for this, but what is important is that the average machining speed is only 30 to 40 percent of what the programmer specifies. CVC controls typically attain average speeds of 80 to 90 percent of what is programmed, or two to three times faster.”

Advances

- Up to 8 interpolated axes.
- A minimum 50,000 blocks-per-second program execution versus 2,000 to 3,000 blocks-per-second in even the best CNC controllers.
- 80 high-accuracy smart buffers for look-ahead algorithms versus the CNC norm of a few dozen lines of code—in effect, just one buffer.
- 4 million maximum (servomotor) encoder counts a second, a measure of maximized closed-loop feedback, and far more than what is offered in even the best controllers.

GETMOREINFO

For more information visit...

Jeff Litster, Co-Owner
Fidelity Machine & Mould Solutions
5034 - 80th Avenue South East
Calgary, Alberta
T2C 2X3
(403) 724-0008
jeff@fidelitymachine.ca

Carlo Miceli, President
Miceli Technologies Inc.
600 County Road 46
Essex, Ontario
N8M 2X7
(519) 818-1963
carlo@miceli-technologies.com

Kevin Bevan, President
GBI Cincinnati, Inc.
6899 Steger Drive
Cincinnati, OH 41051
(513) 841-7391
kbevan@gbicincinnati.com
Tom Johnson, Partner
Velocitech CNC
4161 Richardson Road
Independence, KY 45237
(859) 801-3966
tom@velocitechcnc.com

MMTTOOLS

- 15-digit motion control accuracy and a minimum resolution of 0.001 micron. Very few industrial systems offer any accuracy and resolution below one micron.

The Fidelity-MTI story actually begins in Windsor, the Canadian industrial city across the Detroit River from Detroit. After years in a Windsor mold shop, Litster decided to leave for Calgary, exchanging the troubles of the automotive industry for the opportunity of Alberta's energy boom.

This is where he met Arseneau, who moved around the same time from Montreal. With two others from Windsor, Corey Homick and Joseph Brunelle, they opened Fidelity in the summer of 2007. In their first year they brought in more than 60 customers, shipped over a thousand orders, and grew to eight employees.

Business in booming Calgary is an expensive endeavor. Efficiency takes a much higher priority over similar operations in other, lower-cost cities. Tight deadlines, high lease rates, lack of material availability and difficulty finding skilled employees are just some of the hurdles every business owner encounters on a daily basis in a boom town.

"Calgary leases at about $18 per square foot per year versus $3 or $4 in Windsor," Litster reports. "Skilled machinists demand wages 40% higher than in Windsor and are scarce at any price." These factors left the owners of Fidelity to a simple conclusion. They had to improve efficiency utilizing the space and resources they had as well as keeping within a relatively tight budget.

And in turn, that left productivity as the only financially feasible way to boost output, fill orders in hand and seize new business opportunities all around them.

Challenge and Opportunity

Fidelity Machine & Mould had plenty of business almost from Day One. "We are the major source for injection molds in the city plus about 50% of our work is general and CNC machining," Litster says.

Fidelity started with two OKK vertical machining centers, a 1990-model MCV820 and a smaller PCV55 from 1996. "We needed maximum efficiency from them, primarily to keep up with cable-over-molding demand," he says. "Mechanically, these machines were capable of moving at 300 to 400 inches per minute, but the CNC controllers are incapable of pushing the machines accurately at anywhere near these speeds."

Litster continues, "Cable-over-molding is intricate and challenging work that's always done on tight deadlines. We found we could not afford to stop production on either OKK for a controller retrofit due to tight deadlines and backlog of work. This helped us decide on a different machine and we chose the Fadal retrofitted by MTI.

"The shortcomings of the original controllers are their inability to process data fast enough to push the machines to their physical limits," he explains. "Also, the controllers were unable to read in large amounts of data at high speeds, which led to data starvation. The machines literally did not know where to go."

Those difficulties led directly to the decision to buy a third VMC, a 1997 Fadal VMC15, retrofitted with the CVC by MTI. "Carlo [Miceli] said this was where the CVC would really shine and it did," he adds. "MTI gives us unlimited processing and communicating capabilities. We can put any size program we want in there and don't have to worry about taxing the machine or not feeding it with data fast enough."

Solution

As often happens in business, sound creative decisions spring from insufficient cash. Retrofitting a well cared for, used mid-sized VMC costs about $120,000. That's about one-sixth of the $750,000 installed price of an equivalent new machine "and that was *way* beyond our budget," Litster notes. "We got a lower-cost machine that will perform better than high-end new machine tools."

Fidelity chose the MTI retrofit over ordinary so-called high-speed CNCs due to MTI's "competitive price, the value we saw in constant-velocity cutting, and the options and features. Their service was a major factor that helped tip the scales," he adds. "So was their integrity."

Despite the hundreds-of-inches-a-minute speeds offered by CVC machining with look-ahead capabilities, high accuracy is more important at Fidelity. "Removing material fast is not our main goal," Litster explains. "Most of our jobs are small. The injection-mold core and cavity for an over-mold are about the size of a paperback novel." This work is the mainstay of Fidelity's business, three or four jobs a week.

These small blocks—often 6x8x3 inches—"actually present more of a problem than most machining," he continues, "because there is so little working area inside the core and cavity. Small cutters and tight radii often present more of a challenge and more difficult geometry, and smaller cutters are far less forgiving." Fidelity uses ball-nosed cutters as small as 0.015-inch in diameter.

A larger mold with more open areas would be much simpler to program. "This is machining with almost no clearance for the cutter," Litster points out, "so extremely precise control of all cutter movement is essential."

(In over-molding, segments of seismic cable and soldered connectors are fed into the mold tooling and a tough plastic shield is applied against moisture, dirt, shock, strain and stress.)

Fidelity also makes tooling for several other types of molds and surface finishes are always critical. Any imperfection in the molding surface will be picked up in the finished product—and rejected by customers. "In finish machining we need the smoothest possible motion," he explains, "even though they are taking small amounts of stock with each pass and shallow cuts.

"We usually feed much faster when finishing than when roughing," Litster adds. "There are still CVC benefits when roughing but for us those are not as large as in the finishing. Only about 10 percent of our cutting time is in roughing."

Also a factor in the MTI decision was being gouged for a replacement circuit board for the larger of the two OKKs. “The control builder told us it was $9,000, take it or leave it,” Litster recalls. “We had no choice but to pay. Everything in the MTI control is readily available hardware. That means MTI will never leave me at the mercy of the big vendors and their high-priced proprietary hardware.”

Results

“Perhaps the most important thing about the MTI controller is that it lets us program cutter paths with tighter tolerances,” Litster says. “That gives us more control over the cutter and better finishes. On the other machines, we have to open up the tolerances and slow down them down so much to keep them from violating the surfaces.

Among the many MTI gains with CVC are, Litster points out:

- Cut times are down by as much as a third. Some one-hour programs now run in 40 minutes with better surface finish and longer cutter life.
- Gains in some cutting applications as high as 70 percent, but it is difficult to come up with a reliable average as the gains realized vary from application to application.
- The ability to install CAM software on the same CPU and interface as the controller. That not only cuts down on travel time between work centers and machines but also eliminates any reason or excuse to run a program that is less than perfect. “This increases efficiency, certainly, but it also helps the operator understand the cutting tool and program limitations better,” Litster says. “That helps us program closer to target parameters the first time.”

There also is an intangible result. “I notice a rise in our confidence that we can meet customer demands for quality and appearance of our finished parts,” Litster says. This helps explain why Fidelity prospered almost immediately.

Benefit

The same functions in the CVC that provide the capability for high-speed axis travel—50,000 block-a-second program execution, 80 look-ahead buffers, 4 million encoder counts, 15-digit motion control accuracy and 0.001 micron resolution—give Fidelity what it needs for intricate work on cable over-molds and other challenging jobs.

“We are the new guys here in town,” Litster points out, “so we get all the jobs nobody else wants to do, all the difficult ones. And we get a lot of work with very short deadlines. Every job presents us with a machining challenge in some way.”

As for retrofitting itself, putting an MTI on the Fadal gave Fidelity what Litster termed “a low-commitment way to try out the controller, increase our productivity and stay within our means,” he adds.

The next big decision confronting Fidelity is when to retrofit the larger OKK, the MCV820, a vertical ram-type machine. The main considerations are when it makes sense financially to do this and when they can afford to power down the machine for a few weeks.

“The 820 handles fifty to sixty percent of all our jobs so that retrofit may have to wait till we get a fourth VMC,” says Litster. “But we have made the decision that we will do this. The success of the CVC on the Fadal convinced us we have to.” With the MTI controller, he adds, “we have something unique to the Calgary market. We definitely plan to use its capabilities in our marketing.”

Barely a year old, Fidelity Machine & Mould is now firmly established in Calgary and the energy business. It is a classic example of a small combination mold shop and machining job shop, growing nicely as its reputation for performance spreads.

“Back home” (2,000 miles to east) they would be struggling with the woes of the Detroit Three automakers and with a strong Canadian dollar that has taken away the currency-exchange advantage Canadian manufacturers have enjoyed for years.

An indisputable part of this Calgary success comes from wringing more productivity out of 10- and 20-year-old machine tools with brand-new constant velocity cutting retrofits.

Constant Velocity CNC Controller - Miceli Technologies, Inc.

The “Revolution” line of CNC machines from GBI Cincinnati Inc. is a result of the unprecedented efficiency of the “MTI Constant Velocity Controller” from Miceli Technologies Inc. (MTI) (Essex, ON) with a minimum processing capability of 50,000 blocks per second - warp-like speed compared to other controllers on the market. The value of such speed is that it dramatically increases the average feed rate available today when it comes to machining complex geometry. When applied to moldmaking, for example, milling operations can become much more predictable resulting in higher output and thus new levels of productivity. Designed from the user’s point-of-view, the “MTI Constant Velocity Controller” is packaged in a clean, simple, durable, intuitive and easy-to-learn interface. The design ensures that the needed controls are at the operator’s finger tips, while more detailed operations can readily be carried out with a durable stainless steel keyboard. Features of the “Revolution” machine tool product line include a standard hand-held pendant, supporting up to 6 axis, easy to customize to specific end user environments, the ability to interpolate eight continuous axis with no performance sacrifices, RTCP functionality for common 4 and 5 axis kinematics, on-board email, scheduling software, viewers, data collection applications and the ability to install any commercially available CAD/CAM software inside the controller.

Miceli Technologies, Inc.
600 County Road 46
Essex N8M 2X7, Ontario, Canada
Phone (519) 818-1963 Fax (519) 723-2829