



## ***High-speed Control Slashes Machining Time for Mold Shop***

**Substantial savings in machining, finishing and spotting times has enabled the shop to shorten times quoted for contoured molds by two weeks.**

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**This 13-year-old mill, retrofitted with the Creative Evolution high-speed CNC control, handles 3D milling of mold components at Sagittarius Mold in a fraction of the time it would take either of the shop's 5-year-old vertical machining centers.**

### **Creative Technology PC-based CNC control feature**

Sagittarius Mold's latest CNC mill runs circles around the other machines in the shop. The machine's performance is all the more impressive when you consider that it is 13 years old and was caught in a plant fire. But the older, faster mill has something that the shop's newer, slower machines do not: a high-speed CNC control that boasts the industry's fastest servo rate. The high feed rates that the control makes possible have completely changed the shop's approach to 3D part machining--and programming.

Sagittarius Mold Inc., a plastic injection mold shop in Greenville, SC, burned to the ground in April, 1992, but founder and owner Norm Hervey was not ready to retire. He bought two new vertical machining centers (VMCs) and moved into a leased facility. Three years of long days and hard work later, he moved into a new 22,000-square-foot plant several miles from the site of the original shop.

The process of converting blocks of steel into molds for plastic injection molding machines involves a mix of 2D and 3D machining, the amount of each varying with the job. When the mix swung too far to the 3D machining side, it created a problem: "Feed rates of our two VMCs--10 to 30 ipm--were too slow," explained Ellis Jarrell, CNC manager for Sagittarius. "The slow feeded

rates effectively capped the volume of work we could handle."

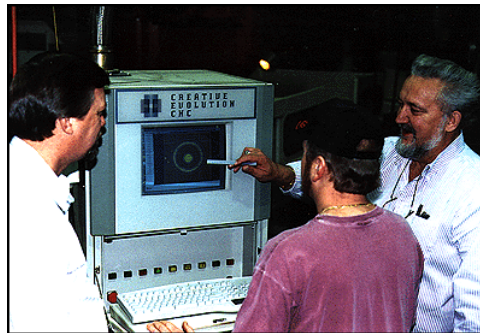
Sagittarius needed more 3D milling capacity to handle its growing business. The shop wanted the high feed rates of a brand new machine--without having to buy one. It had a 1984 electronic tracer mill, similar to its two newer VMCs, that had been damaged in the fire but kept as a potential candidate for rebuilding. Sagittarius decided to rebuild the fire-damaged machine and, where possible, to give it the performance capabilities of a brand new machine.

The shop approached the firm that made the tracer mill (and its two newer VMCs), hoping to buy a new, state-of-the-art, CNC control for the restored mill. The manufacturer offered to sell the shop a control like the one that originally came with the mill, or one like those on the shop's two newer VMCs. However, the firm would only sell its newest CNC control as part of a new - machine purchase.

Sagittarius then turned to independent manufacturers of CNC controls. While exploring the field, the shop learned about the Creative Evolution CNC control made by Creative Technology Corp., Arlington Heights, IL.

The Creative Evolution CNC is a 3-, 4- and 5-axis control that enables firms to mill 3D contours up to ten times faster than before--on their existing milling machines and machining centers. The control, which is available for retrofit or OEM applications, delivers state-of-the-art machining performance at a fraction of the cost of a new machine tool.

The control has an advanced look-ahead capability that automatically maintains near constant feed rate and surface speed without compromising cutting accuracy. Its Digital Signal Processor (DSP) measures and updates position commands 30 times faster than other high-speed controls. Block transfer times are as short as 220 microseconds, resulting in throughputs of over 4500 blocks per second. It can communicate with CAD/CAM systems 1000 times faster than conventional Direct Numerical Control (DNC) systems.



**Sagittarius owner Norm Hervey (right), operator Carl Collins (center) and CNC Manager Ellis Jarrell review a 3D machining program created at the Creative Evolution control with WorkNC CAM software.**

A demonstration of the Creative Evolution control on a machining center at CTC's Arlington Heights headquarters convinced Sagittarius of the validity of the performance claims for the control. Sagittarius bought the control as part of a more comprehensive retrofit package.

The retrofitted machine joined the shop's two newer VMCs and a high-speed electrode mill--the shop also operates EDM machines -- that was purchased shortly after the firm moved into its new building. From the onset, all 3D milling was scheduled for the retrofitted machine because of its faster machining rates.

"Where our other VMCs would do 3D milling at 10 to 30 ipm, the machine retrofitted with the

Creative Evolution CNC can contour mill at 80 to 200 ipm, which has significantly reduced overall machining time," Jarrell continued.

"We can machine 3D mold components in five to six hours that would take 1 1/2 to 2 days on either of the other machines," added Carl Collins, who operates the retrofitted machine. "On a finishing cut in a 4140 steel cavity, we've been able to achieve cutting rates of 180 ipm with no loss of accuracy.

"In fact, the Creative Evolution control allows us to hold closer tolerances," He noted. "Before, our machinists would leave as much as 0.005 inch of unwanted stock in the cavity to avoid gouging. The Creative Evolution doesn't need that safety net; it can cut closer to finish dimensions, which reduces the amount of metal that must be removed later. The spotting press crew has been very appreciative of the Creative Evolution control because it has considerably reduced the amount of time that they must spend sealing the mold."

As the 3D machining backlog eased, concern shifted to a different but related problem: the shop's programming system. Programs for the shop's two VMCs were prepared off the shop floor on a Unix-based workstation, and downloaded to the machines via the shop's DNC system.

The arrangement had seemed adequate for the two machines, but problems began to surface when the high-speed electrode mill was installed. First, it increased the programming load. Second, programs were downloaded to the electrode mill via the DNC system just as for the other two machines. However, the electrode mill's control processed programming data faster than the DNC could supply it, causing the mill to stop periodically to wait for more data.

Addition of the retrofitted mill, with the still-faster Creative Evolution CNC, aggravated the problems. "I couldn't produce programs for our four machines fast enough with our existing workstation and CAM software," Jarrell recalled. "Parts were backing up in the shop. I was working long days and weekends creating programs to keep the machines running five days per week. We wanted to be able to operate the machines six and seven days per week. We needed to add another workstation and programmer, or find some other way of increasing our programming capacity."

One of the alternatives considered was a 3-D CAM software called WorkNC, produced by Sescoi USA, Southfield, MI, which installs on a PC-based machine control or shop floor PC for programming right at the machine by the operator. The software is graphics-based. The operator uses the graphic representation of the part on the screen to identify the area to be machined, makes appropriate menu selections and keys in numerical data where required. Using that information, the software automatically generates the desired tool path. The operator can edit the program and post process it to run on other CNC mills or VMCs. Hervey was reluctant to add another programming system because of the investment in hardware, software and training that had already been made. But the existing system had proved inadequate, and if WorkNC could eliminate the shop's programming backlog, slash programming time for all future 3D work, and eliminate the cost of another (more expensive) off-line programming seat and another programmer, it was worth a try. Hervey bought the WorkNC software.



**The combination of the high-speed Creative Evolution control and the programming of all of the shop's 3D machining at the retrofitted mill saves the shop so much time that Hervey is quoting mold deliveries two weeks earlier than before---a competitive advantage that helps explain the big smile.**

Reservations about WorkNC quickly disappeared. "Before, when a complex 3D job was set up on the machine, it might run for 10 or 20 hours; the operator would just stand there monitoring the operation," Jarrell explained. "Now, he not only prepares the 3D machining programs for his own machine, but all of the programs for the electrode mill as well.

"WorkNC also enables the operator to become more involved in the machining of the part and to take more pride in the results," Jarrell continued. "It provides more programming flexibility; the shop doesn't grind to a halt when a programmer calls in sick, goes on vacation, is called away because of a family emergency, and so forth."

"WorkNC also provides the most logical division of responsibilities," Collins added. "Engineers may be strong in design, flow factors, solidification rates...but they usually don't have much hands-on machining experience. WorkNC puts the responsibility for machining the part in the hands of the person who is most knowledgeable about machining and proper tool selection--the operator. It's the ideal arrangement."

Hervey identified the operations that are benefitting most from the Creative Evolution control: "Before, for a mold with a 4-inch-deep, contoured cavity, I would typically quote 110 hours of machining, 70 hours of handwork and 50 hours of spotting. With the much faster Creative Evolution control, I can produce the same mold with 70 hours of machining, 40 hours of handwork and 20 hours of spotting--a savings of 100 hours.

"Machining of a complex, contoured mold cavity at feed rates of 10 to 25 ipm on one of our newer VMCs took as much as three days," he continued. "We can machine a similar cavity with the Creative Evolution CNC at feed rates of 100 to 180 ipm in one day. And machined finishes are two to three times better.

"The Creative Evolution control gives the retrofitted machine a level of performance that makes us more competitive," Hervey emphasized. "It puts us on an equal footing with firms that are operating newer and more expensive machines. Best of all, we were able to buy that performance for just a fraction of the cost of a new machine.

"But the benefits of the Creative Evolution CNC don't end with performance and economy," he hastebled to add. "Machine tool control technology is moving rapidly, obsoleting proprietary

controls that are just a few years old. For example, our two 5-year-old VMCs are perfectly good mechanically, but their controls are dinosaurs. Nothing can be done to make these original controls run faster.

"By contrast, the Creative Evolution control is a PC-based, open-system control," he explained. "If a component must be replaced, you can go to the nearest computer store and buy a replacement part at a competitive price, instead of having to go to a builder of a proprietary control and pay five times what the part is worth--if it's available.

"I can't praise the open-system control enough," Hervey emphasized. "It helps us solve problems faster. Before, if we had a problem with the control, we'd have to wait a day or two for a service technician to fly in. More often than not, he would not have with him the replacement part needed to fix the control; he'd have to order the part from the factory, which meant more delay. All the while, the clock on the service charges continues to run.

"Now, our control problems can be handled by local computer service people. Parts are readily available and inexpensive, and our machine can be back in service fast.

"Also, the Creative Evolution CNC can be upgraded to incorporate the latest improvements," Hervey added. "For example, if a 300 MHz mother board became available tomorrow and there was some advantage to adding it to our Creative Evolution control, we could buy one and install it.

"Unlike the proprietary controls on our other two VMCs, as CTC develops improved versions of the Creative Evolution control, we are able to upgrade our control accordingly. Our control need never become obsolete; if we choose, we can continue to upgrade it to give it the capabilities of the latest CNC control, both in hardware and software.

"Good as the control is, addition of programming software makes it even better," Hervey stressed. "With the WorkNC software, instead of the operator just standing around during the 70 hours or so of machining time required for the average mold, he can probably use about 30 of those hours to prepare programs for his machine and for the electrode mill. Thus, in addition to the 100 hours originally saved with the control, we get 30 hours worth of programming as a bonus.

"It's hard to go wrong with the Creative Evolution CNC for 3D machining, particularly with the WorkNC programming software," Hervey insisted. "Before, we quoted 14 to 16 weeks for a complex mold with a contoured cavity. Now, with the programming and machining time we're saving, we can quote 12 to 14 weeks for the job. The faster delivery time is a significant competitive edge. The Creative Evolution control and WorkNC programming software have been a smart investment," he concluded.

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