

Case study

Retrofitting for success

With the right CNC platform, this large, state-of-the-art job shop has discovered "anything is possible"...



Major Tool & Machine has been on track to retrofit over a dozen of its giant milling and turning machines within just two years, all supported by a new Siemens CNC platform. MTM's management says the process has been an empowering experience for the company.

Major Tool & Machine, Inc. retrofitted two of their machining centers in 2010 changing to a CNC technology platform that was completely new to the company. Ten more such large-scale retrofits have followed, bringing increased enthusiasm, momentum and productivity.

CNC upgrade enhances performance and precision

Major Tool & Machine (MTM) is a large job shop, producing precision milled and turned hardware throughout the company's 500,000 square foot Indiana facility. Performance is essential, because MTM contracts with aerospace, energy, nuclear and defense companies on many mission-critical, one-off projects. Owner and CEO Steve Weyreter will tell you openly, MTM is more competitive by way of a significant CNC technology change, starting with an aggressive retrofit strategy.

Günther Zimmermann, CNC Controls Engineer at MTM, says the company's retrofit program and the decision to change to the Siemens SINUMERIK CNC platform have brought a new enthusiasm and momentum to the company. Over the last two years the change has also brought significant time and cost reductions, especially in the areas of programming, maintenance engineering, and machine operations.

"The initial goal in early 2010 was to retrofit two Cincinnati U5 Gantry machines," Zimmermann recounts. "We evaluated two CNC technology platforms and after considerable analysis our CEO Steve Weyreter announced that Siemens would best support the company's future."

The decision to reduce costs by moving to a single CNC platform was the least difficult decision for the company to make, Zimmermann explains. The larger challenge for MTM was the integration of a new CNC technology platform that was new to the company.

Bill Henderson, MTM's manager of large machining and maintenance, agrees that the decision to change to a Siemens CNC platform integrated with advanced part and tool probing was critical, because the shop manages constant changeovers from one complex job to the next, making setup times a critical time/cost constraint for the company. Another big advantage is the increased flexibility by only having to train machinists and maintenance personnel on one type of control.

Henderson went on to say "the decision to change to a new control has signaled higher expectations for the company, along with new challenges for those who program, operate and maintain the company's big machines.

Naturally, there's a resistance to change," Henderson says. "People are comfortable with what they normally run, but after our discussions with the people on the plant floor, they understood the overall objective. Our retrofit program is not finished, yet it's already showing tremendous benefits."

Heads-up interchangeability

Retrofitter Doug Huber says having Siemens as a new CNC technology partner has made a difference for Major Tool & Machine, but it's also been an evolutionary uplift for his own retrofitting company, Indiana Automation.

"Indiana Automation has increasingly retrofit using Siemens controls in recent years, Huber explains. "On a retrofit, we

always try to exceed what the original machine could do, and that's just kind of inherent when you put on a Siemens 840D. Major Tool's first retrofits were the Cincinnati U5 machines, a bridge model and two gantry models. These are five-axis machines and five-axis is the 840D's forte. The processing power of the control is so much better, that it just whips through the blocks faster. So right off, cycle time is a major performance enhancement."

Huber says something else happened this time. As his firm finished retrofitting the first three giant machines with Siemens five-axis controls, drives and motors, the reaction within the company was not just that the machines were now predictably more efficient, but that they performed as very different machines. A new advantage is the ability to interchange machining heads from machine-to-machine, and all driven by the Siemens CNC platform.

"On many of the U5 machines, the axes come off with the heads," Huber explains, "and we rebuilt these machines to accept any one of three different heads. That's one of Major Tool's key strategies. They insist on having flexible machine capabilities, so that they can run all kinds of different parts. They have straight heads for serious metal cutting, contour heads for five-axis work and finesse work. They have 90-degree heads for more flexibility than a straight head, but it's also not as fragile as the contour head. And they wanted to interchange all of these heads to automatically go pick up a head out of the shuttle and, on the fly, reconfigure the axes and the zero positions. To do this, the compensation tables all had to be updated. Everything needed to be done with the macro program so that each head came on ready to run."

An advantage MTM gained by its retrofit strategy has been the ability to interchange heads and rotary tables from machine to machine. Easy-to-use head storage and tool management programming provided by the Siemens CNC platform support the new interchange capability.



The interchangeable head strategy was a challenge, Huber says, because the machines were not originally capable of sharing heads. But with support from Siemens, the strategy has worked, including the ability to interchange rotary tables as well as heads. "Each head or rotary table has a configuration file that has all the settings and compensations and travels with it from machine to machine. So now when you mount that head the control just runs the configuration file that goes with it and its all set up for you. We also incorporated Siemens Tool Management for each machine's 60-pocket tool chain. We used the feature on these machines to manage all the different tooling MTM uses, both in the automatic tool changer as well as the ones manually loaded."

Huber says, "MTM's ability to smoothly transition to more advanced CNC is largely due to the HMI's ease of use. The Operate interface is a huge help to us and to Major Tool. The HMI helps make better parts. And it didn't take very long for the operators to fall in love with it."

Leveraging the machinist's skills

"I had never used a Siemens control before," admits MTM machinist Mike Burthay. "I have extensive knowledge of G-code and CNC controls and I would say the Siemens 840D sl with the Operate interface is the easiest one I've ever run. It's user friendly, that's exactly the words for it."

Burthay reports several ways in which the Siemens SINUMERIK Operate interface has made his life easier. "There's not as much G-code," he says. "The control does it all for you as long as you put in the parameters as

to size, length, width. Then once you're in Job Mode, there's a screen where you can tool change or jog the machine around to certain positions, or turn the spindle on, turn the coolant on, anything that traditionally required G-code. So now you can push a cycle stop button to pause the machine, enter a change such as turning coolant on, then restart the program.

"Another function I love is Block Search, which allows me to start or restart right in the middle of a program. Say you're finishing a pocket and you have to run the tool two or three times to get a tight tolerance, I can enter in a line number and hit Block Search, the control picks up every line before that, restarts the spindle and everything for you."

Burthay says the Siemens control also enables him to program parts right on the machine whenever necessary, using a simple yet robust program called ShopMill. "I can go into ShopMill, type in some parameters and it will kick out that G-code program for me automatically. Say I want to drill a hole two inches deep. I open ShopMill, pick my tool, tell it the depth and these steps are all interactive on the screen. It even shows me 3D motion images of the tool path, confirms the drill going down as expected into the part. So I hit go and it puts a drill cycle into the program for me."

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Central to MTM's retrofit program has been the Siemens SINUMERIK 840D sl control, which features the SINUMERIK Operate interface. The highly intuitive interface enables both programmers and operators to easily capitalize on the broad capabilities of the control.



Programming as easy as 1-2-3: Using the SINUMERIK Operate interface, a machinist can turn on coolant flow by 1) pressing Cycle Stop to stop the machine, 2) Coolant On and 3) Restart.

Programmed for collaborative growth

Lead Programmer, Tim Hayden, has from the beginning conducted all processor setups for the newly retrofitted machines. Hayden says integrating the Siemens CNC platform has been an empowering experience he had not expected, given the fact that he had never before set up a post processor to run a Siemens control, nor had he ever before operated a Siemens control.

"Now, when I look at the Siemens control, I think man, it would have been so much better to have had it all along," Hayden says, "because the other control I've been using is just a lot more cryptic. The Siemens control with the SINUMERIK Operate interface is more powerful for writing macros and the language seems modern, whereas the other control seems like it is still based on an old FORTRAN type language."

Another example of such HMI evolution is in the area of data management.

"When we post a program, we no longer have to use a G-code based MDI," Hayden explains. "We no longer need to type in T= and enter a nine digit number and then enter M6 to make a tool change. With the Operate HMI, you pick your tool off a screen and hit cycle start. It's just as easy to program going to a position. Instead of doing things the old way by typing GOXOYOZO into the MDI, you open the Operate interface, click position, then click how you want to wrap it and then you just type the numbers into those fields. So it's a lot more user friendly."

Hayden says the Siemens CNC platform has supported greater collaboration at MTM between him and the machinists, and this is helping the company find ways to increase



Work offsets for compound angles can be scaled and rotated using the Frames function of the Siemens SINUMERIK Operate interface. Many advanced machining operations can be managed simply, without the use of time-intensive manual G-code programming.

"Siemens CNC is set-up as an open control, and with that kind of flexibility, it seems anything is possible."

Hayden points to the Frames coordinate and offset programming function of the Siemens interface as an example of improved programming convenience.

"We do a lot of work on compound angles," Hayden explains, "and with the Siemens Frames function, you can scale and rotate your coordinate system on the control, just plug it in with your work offsets. Whereas, on the other control you will see a G54 request, you've got to enter G-code. You can't just plug it into your work offsets like you can with the Siemens control."

Hayden says the SINUMERIK Operate interface brings greater programming flexibility. The HMI enables him to enter G-code using a comparatively more advanced manual data entry (MDI) function; however the HMI has all but eliminated the need for G-code entry by way of its intuitive design and evolved capabilities.

performance and efficiency. He agrees with his coworkers' assessments that shorter setup times and greater operator freedom are making a significant difference.

"One of our production bottlenecks has been programming," Hayden says. "The machinists that run our machines are professionals, they're not button pushers, and with the SINUMERIK Operate interface, we can now rely on them to control and program certain parts right on their machines, while we programmers work on the more complex projects."

"Siemens was the best fit for all of us," Hayden concludes. "Siemens CNC is set-up as an open control, and with that kind of flexibility, it seems anything is possible."

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