

Virtual Machining Nixes Mysteries, Protects Costly Machines

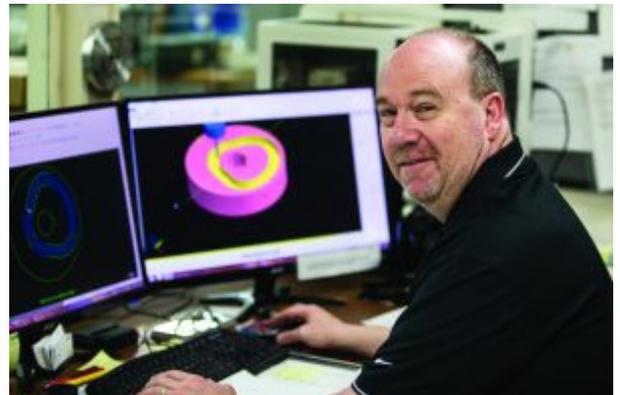
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Mallory Industries in the last few years invested heavily in its machinery, adding three high-speed vertical mills with full rotary tables that can handle parts up to 20" (508-mm) diameter, a twin-pallet horizontal machining center, two multi-axis lathes, and the wire EDM machine.

While it's daunting to spend hundreds of thousands of dollars on anything, the folks at Mallory look at it as a calculated risk because they could verify a part's ability to be machined prior to it actually being put through to the machine due to the verify utility of its CAD/CAM software, Mastercam (from CNC Software Inc., Tolland, CT).

"When we quote jobs, we look at how we're going to machine it, the process to do so, and then program it to go through these machines," said Operations Manager Ken Fogler. Whether the part goes through the multi-axis lathe area of the shop (there are two which combine milling and turning), the three or four-axis machining center area, or the two-axis cell area, depends on the constraints of the machine itself. Jobs are modeled in Solidworks and imported into Mastercam, where the wire frame geometry is created. "We verify the final program in Mastercam so that we'll see exactly what will be



At Mallory Industries, jobs are modeled in SolidWorks and imported into Mastercam software, where the wire frame geometry is created. "We verify the final program in Mastercam so that we'll see exactly what will be produced with no surprises. The verify function allows us to detect any discrepancies, measure and analyze, as well as perform collision detection. With the cost of today's equipment, I wouldn't do it any other way," Operations Manager Ken Fogler said.

produced with no surprises. The Verify feature allows us to detect any discrepancies, measure and analyze, as well as provide collision detection. With the cost of today's equipment, I wouldn't do it any other way. Once we know it all looks good on the computer, we'll post it and send it out to the floor," said Fogler.

The Farmington, CT-based precision machine shop specializes in grinding, high-speed vertical milling, CNC turning, and wire EDM machining of stainless steel, aluminum, titanium, and high-temperature alloys.

Black Hawk On-Screen

Fogler and his team use Mastercam 2017, which not only includes the software's Dynamic Motion technology but also radial chipping, which people were doing manually on the side via spreadsheet.

"You can certainly get a program out quicker than in the old days using some of the advanced tools that the software has to offer," he said. "And Verify helps us out a lot."

The team programs the part and then cuts it on the screen in one form via two modules—one for programming and one for verifying that the toolpaths will, in fact, work in real life.

"It helps us on our end to know that what we see on the computer, we will see out on the floor so there are no mysteries," Fogler said. "We use that daily."

The ability to run the machines fast and perform a virtual run prior to the actual run has given Mallory the edge when taking on complex aerospace projects.

One of the company's favorite jobs involved the dashboard frame for the Black Hawk helicopter, an exceptionally large piece that was machined in several steps.

"We had a couple of programmers working on it," Fogler said, "and, because it was so massive, we worked on one side and then the other, creating a program, verifying it, using the Dynamic toolpaths. We programmed one half, then the other, and merged it all together at the end, but we were all verifying on the screen exactly what we were doing and the final product was a good product right out of the hopper."

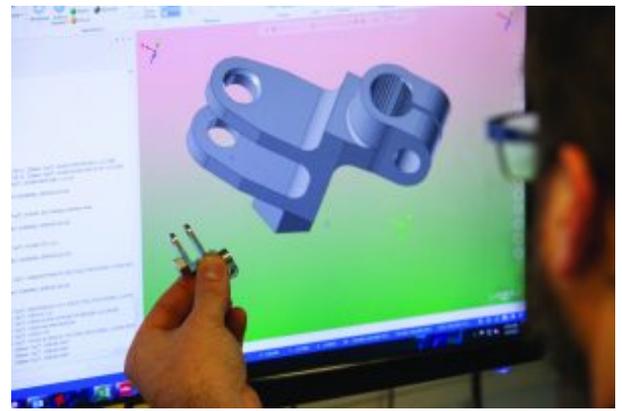
Tedious-but-Flawless Process

While the process was tedious, it was flawless and was not possible without the Verify and Dynamic Motion toolpaths available within the software, Fogler noted.

The part was machined using one three-axis machine. The team started with a 6' x 2' x 1" (1828 x 609 x 25.4-mm) thick piece of aluminum weighing 275 lb (125 kg) and implemented the toolpaths for the very first time. The Dynamic Motion toolpaths removed the material quickly, due to proprietary algorithms in the software that intelligently sense changes in the material, allowing the tool to remain in constant contact with the material with little or no stepovers.

Because the tool is constantly engaged with the material, there are fewer tool breakages, as well. The team was able to whittle that piece down to 9 lb (4.1 kg).

"You don't have to go old school. With stock recognition, Mastercam knows where the material is, which allows the software to make good decisions relative to toolpaths. It certainly makes it easier," Fogler said. They were able to push their machines to their full capacity by knowing what the machining process would look like through Verify and by relying on the toolpaths' to cut time-consuming air cutting.



The team at Mallory programs a part, such as this aerospace lever, and then cuts it on the screen in one form via two modules—one for programming and one for verifying that the toolpaths will, in fact, work in real life.

Confidence to Perform Dynamic Jobs

The team was also able to accept jobs it otherwise would never have considered because the risks to the machines were minimized.

For example, when a \$400,000–\$500,000 machine gets “banged up,” the costs to repair include a service call and often a \$30,000–\$40,000 spindle. The software functions gave the team more confidence to produce a better product in less time.

“Because this is a very capital-intensive business, you have to take care of the equipment by managing the software. So, the more we know about the software, the better our results are on the floor,” Fogler said.

Mallory relies on their Mastercam Reseller, MACDAC Engineering Inc. (Somers, CT), for training and support.

“I think it is foolish not to have that support because sometimes you have projects that, if you didn’t have that support, you would not get them done,” Fogler said. He finds MACDAC’s expertise especially helpful when working with 3D models.

It would seem that when pushing the machines faster, and cutting large swaths of material down to smaller sizes, tool costs would go up. Not so.

Mallory continues to use the same carbide end mills, carbide drills, and other carbide tooling they have always used because they simply do not break when they are constantly engaged with the material and adjust to programmed changes in geometry.

“When you break an end mill, not only is there cost associated with that, but the part may be scrapped and the machine goes off line. All these problems compile the cost,” Fogler said, noting that they are saving costs on consumable items and scrap—and even human resources—while realizing better throughputs and cycle times. The shop’s current job board is about three-fourths full with new orders.

Investing in the Future

The National Fund for Workforce Solutions recently named Mallory one of 11 Young Adult Employer Champions in the US. The Fund’s mission is “to drive practices, policies, and investments that enable workers to succeed in good jobs, provide employers with a skilled workforce, and build more prosperous

communities.”

Our Piece of the Pie (Hartford, CT) partnered with the fund to help urban youth acquire all of the skills necessary to gain and retain employment through relationship-centered internships and programming. According to Fogler, the internships serve to help the students decide whether manufacturing or engineering is the right career path for them. “I have interns from local high schools in every year trying to decide whether they want to get into engineering or not.”

Mallory is also committed to the future of manufacturing. If its employees can encourage kids to get the proper training and education to replace the skilled labor that they know will be retiring soon, manufacturing will stay strong.

The company in recent years retained some students, with some staying and some leaving to pursue four-year degrees.

Edited by Advanced Manufacturing Media using information provided by CNC Software and Mallory Industries.



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