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June 2006

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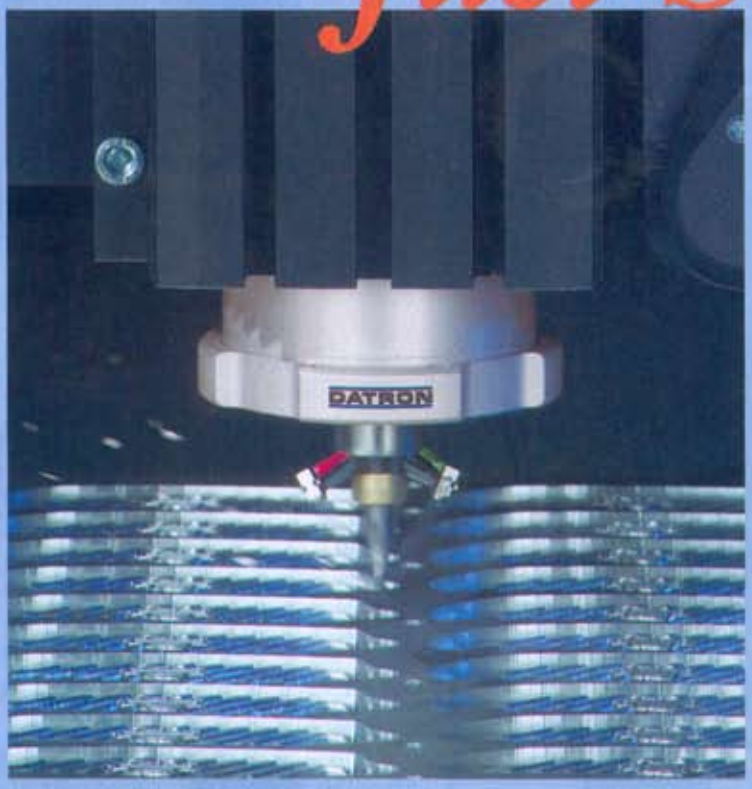

Batches of knife handles are produced on four different machines with a single operator due to the large bed size and the untended capability of the VelociRaptor VMC.

Jim Lorincz
Senior Editor

The most straightforward of machines, the VMC has morphed into variations in design that can accommodate the most intricate workpieces for medical devices, the longest workpieces for aircraft, and produce the smoothest surfaces for critical mold and die applications.

There isn't an industry or manufacturing segment that hasn't been affected by the versatility of VMCs. The automotive industry as well has benefited from the ability of VMCs to fulfill high-volume production requirements for such parts as transmission components, engine blocks and heads, and valve bodies.

The route to design changes in machine configuration hasn't followed a straight line, however. Machine tool builders have responded to their customers with "done in one" machining of parts, eliminating the need for multiple fixturing and secondary operations fed by hand or by complicated and expensive material handling systems. As a result, VMCs routinely sport high-speed spindles, tilt spindles, trunnions, and rotary tables mounted on trunnions for precision contouring machining.

In a cellular configuration or fed by palletizing automation systems, VMCs provide the capability to machine one-off parts or groups of parts for production machining, often extending the number of tools that can be brought to bear on families of parts.

"I can't think of a machine tool category that has more competitors than the vertical machining center segment,"

says Chuck Birkle, vice president CyberTech Div., Mazak USA (Florence, KY). "The solution is to provide machine tools that improve the customer's competitiveness, that are more productive. The typical ways of doing that are to provide automated loading and unloading, increase spindle utilization, and find cost-effective ways of adding more axes to the machine," Birkle says.

Parts such as aerospace blades are well suited for more efficient, more accurate machining with Mitsui Seiki's dynamic five-axis fixture-offset software function.

"Whenever you add more than three axes, you give customers a chance to reduce dependence on forgings and castings that are increasingly difficult to get these days. They can machine from a solid block of material," he explains.

Mazak's most recent addition to its line of five-axis machining centers is the Variaxis 730 five-axis VMC. It features a 50-taper spindle for heavy-duty roughing and machining of castings, forgings, steels, and stainless. In a cutting test comparing it with a 40-taper Variaxis model, the 730-5X achieved cycle time reductions of 24% in machining an identical workpiece.

Lean manufacturing principles and VMCs seemingly go hand in hand with techniques developed by Datron Dynamics Inc. (Milford, NH). "Over the last several months and quarters, we've seen a definite change among our customers who are now looking to lean manufacturing techniques to remain competitive," says President Walter Schnecker. "Our customers after all are competing with China, a country with an endless supply of labor."

Datron Dynamic's machines employ high-speed spindles to 60,000 rpm with small tools typically one quarter of an inch (6.35 mm) or under on a 30 × 40" (762 × 1016-mm) machine bed.

"What our customers can do with that real estate is what really matters," says Schnecker. A cutlery plant simultaneously produces batches of knife handles on four different machines with a single operator due to the large bed size and the untended capability of the VelociRaptor VMC. Datron's VacuMate workholding is a nonmechanical way of quickly securing the knife handle fixture so that batches of 28 handles can be finished with custom engraving.

Five-axis machining presents unique challenges when it comes to keeping track of the spindle and tool tip in space, and those challenges can affect the fixturing on a five-axis VMC. Mitsui Seiki USA (Franklin Lakes, NJ) has addressed the issue with its exclusive advanced five-axis dynamic fixture compensation function available in the Fanuc 31i control on its Vertex 550-5X VMC as well as other models.

Scott Walker, Mitsui Seiki USA president, explains that four and five-axis simultaneous machining of complex shapes, particularly simultaneously contoured aerospace and medical device parts, can sometimes be difficult to run in production because part form accuracy and surface finish are often the direct result of how well the part is fixtured.

In many applications, the part datum must be aligned perfectly at the "programmed center points," which takes into account the orbiting points of the rotary axes, otherwise the part program must be reposted to offset the error in setting up subsequent parts. The results are usually the same: either the manufacturer has to utilize very elaborate fixtures, or the operator must be diligent enough to set the new parts perfectly back on center.

The Vertex 550-5X is equipped with the new Fanuc 31i control which optionally incorporates the advanced five-axis dynamic fixture compensation function. The operator can simply apply a work coordinate offset adjustment, and the control will continuously track and update the part