Mazak Case Study

Enabling A Future For Manufacturing

By Brian J. Papke
President, Mazak Corp.
Member, AMT Board of Directors

At the request of AMT President John Byrd, our company conducted research on the productivity improvements of a selected line of our machine tools. The results revealed our newest line of vertical machining centers are more than four times more productive than our machines of 10 years ago, with the cost being roughly equivalent, adjusted for inflation.

Now what is supposed to follow is a plea for continued replacement of capital equipment to maintain national productivity increases, keep inflation low, and achieve economic prosperity. But the reality we see with our own eyes and live every day demands a different response. Productivity increases of 400% over 10 years, or 40% annually, are not enough to stop the flight of manufacturing work from North America to non-regulated, low-wage locations around the globe. For a future in manufacturing to be possible, production must be totally reconceived to reflect productivity leaps of two or three thousand percent compared to today's status quo. And I am here to tell you it's possible.

Where machine tools are concerned, the lowest purchase price or the highest spindle speeds and most powerful motors by themselves will not result in a manufacturing company's success, much less a nation's or region's manufacturing dominance. What's demanded from manufacturing technology providers is a total

change in thinking to enable process change for their customers. Machine tools and attendant technologies such as new tooling materials and configurations, material-handling automation, robotics, and more powerful programming and IT tools are levers that can lift entire manufacturing operations to percentage throughput increases in the hundreds or thousands compared to today. It's the difference between thinking "How can I cut this part faster?" and "Is there a way to produce it that eliminates not only multiple setups and machines, but entire steps? What advantages does this bring to my company?"

History is part of the problem. Simultaneous five-axis machining, for example, is not new. Five-axis machines used in the defense industry in the 1950s were enormously expensive and required highly trained specialists and custom programs. The time savings inherent in simultaneous five-axis machining did not offset the time and costs necessary to program and run them.

That's not the case today. Now, machine tool manufacturers, tooling suppliers, CAM software writers, and the entire manufacturing supply chain face the same global competition as manufacturing industries. The result is an intense, ongoing mission to make more technology accessible to broader segments of the market.

Consider also that products are becoming more complex and, at the same time, life cycles and lot sizes are drastically smaller. Complex surface machining isn't just for aerospace structures, but for detergent bottle molds. And when mold customers say they need a new mold tomorrow, they really mean it. Business is won or lost based on delivery as well as mold quality.

Employees are another consideration. Button-pushers are easily obtained anywhere in the world, but empowered employees contribute process knowledge with each job. Since ability, training, and experience is becoming increasingly rare, the

challenge becomes making productivity increases possible for manufacturing organizations of all sizes.

From Months to Hours

Consider educating customers to the advantage of machining a mold from a solid instead of a casting. Production that normally might require months to complete due to forging and casting can be reduced to days. In a single setup, a multi-axis multi-tasking machine could produce both cavity and core from a single piece of material. Cooling holes could be milled on the side faces of both cavity and core; cooling holes and grooves could be milled on the back face of both cavity and core, and a tilting spindle makes it possible to process face milling from any angle. The number of machines required is reduced from three (two vertical machining centers and a vertical with a rotary table) to one, with a corresponding reduction in the number of necessary operators. Machine setups are reduced from 16 to one, number of programs are reduced from 16 to one, and in-process time is cut **from 32 days to 2.** For deep-cavity applications such as injection molds, stamping dies, or even porting engine blocks, cavities can be machined and finished to such a degree where there is no need to cut electrodes for EDM processing. Bottom-line, there's a lot more creativity that's available to produce a complex part in less time.

Take the idea of a non-mold machined part. Possibilities exist today for an electrical generator component that would normally require an NC lathe, vertical machining center, horizontal machining center, and vertical with special features, to be produced on a single multi-tasking machine in a single setup. Besides the change in production throughput from 47 hours to 6 hours and 43 minutes (600%+), consider the benefits this change brings to numerous aspects of a manufacturing operation:

- **Profit.** Cash flow considerably improves.

- **Lower Direct Expenses.** Machines are reduced from four to one, fixtures from six to one.
- **Lower Overhead.** Operators and attendant benefits are reduced from four to one.
- **Part Quality.** Going from six setups to one greatly reduces accumulated precision error.
- **Lower Indirect Expenses.** Having a single machine uses floor space more effectively, environmental impact is reduced, and movement of material through the plant is made more efficient.

Rethinking American manufacturing to make process change a reality should be the singular issue of our time for manufacturing technology providers. Real-world examples are emerging and should be broadly disseminated to prove this is not theory but an emerging reality. Efficiency leaps of hundreds or thousands of percentage points changes our mindset of keeping up with the competition to establishing a new manufacturing benchmark. It enables a bright future.

Photo caption: A multi-tasking machine's ability to machine on the main spindle (first photo) then transfer the workpiece to a second spindle (second photo) allows all machining processes out of one setup.

Processes show the original workpiece, machining from the first spindle, and machining from the second spindle.

The finished component.

The Integrex *e*-410 H that produced the component.