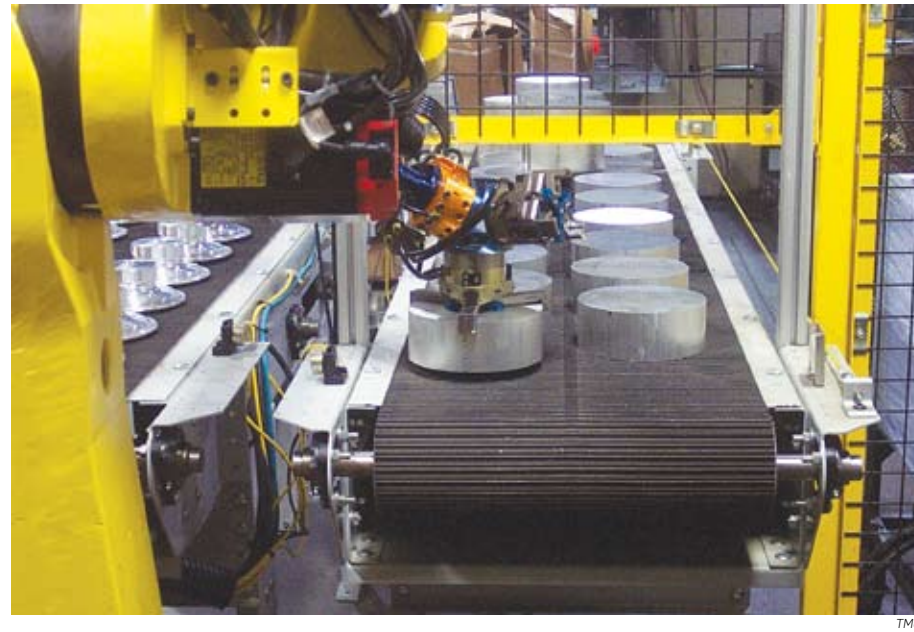
Automation Made Easy

By Dave Nelson, Productivity Inc.

A multitasking lathe, coupled with robotic loading or bar loading, is a simple but effective form of automation.



TMCO

A robot picks up a slug from a conveyor to be placed in a Nakamura WT-300 multitasking lathe at TMCO.

Automation helps manufacturers reduce human intervention when handling parts and materials, leading to an advantage over less automated competitors. That advantage derives from more effective use of labor, improved processes, enhanced reliability or, as is usually the case, a combination of the three.

Parts manufacturers of any size can benefit from automation, and one of the easiest and most flexible ways to do this is through multitasking lathes.

The term multitasking refers to the ability of a lathe to take on the characteristics of a milling machine by adding live tools, such as mills and drills. Multitasking lathes come in many different configurations, with multiple spindles and turrets that add to their machining capabilities. With the combination of turning and milling functions, complex parts can be machined on a lathe in a single setup.

Parts that are both turned and milled are great candidates for automation. Many parts need only a simple cross-hole or a series of holes on the part face. Multitasking lathes create these features easily, with no part transfer from one machine to another. The addition of workhandling equipment, such as bar loaders, gantry loaders or robots, helps to further reduce human intervention. This article examines how three companies have improved productivity by successfully automating multitasking lathes.

Brand Hydraulics

Brand Hydraulics, Omaha, Neb., is a specialty valve manufacturer. Until recently, all of its cylindrical parts were turned on CNC lathes and then drilled, tapped and milled on both manual and CNC milling machines. That process changed when the company acquired a lathe that could machine the parts in one setup.

Brand Hydraulics

A selection of hydraulic parts machined on the multitasking lathes at Brand Hydraulics.

Brand purchased its first multitasking lathe, a Haas SL-20, in September 2006. This lathe allowed parts to be finished or nearly finished in one setup, which significantly reduced the number of unfinished parts on the shop floor.

A second multitasking lathe was recently purchased. This time, a Y-axis and subspindle were required to machine parts requiring off-center holes, milled slots and backworking. The company selected a Nakamura SC-250 MYB for this

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application.

The addition of a Y-axis allows the SC-250 to act more like a mill because the turret can move off center for milling operations. The subspindle reduces secondary work by allowing machining to be done on the opposite end of the part.

"This gives us a huge amount of flexibility," said Dean Pullen, tool and die manager for Brand Hydraulics. "The Y-axis increases capability and helps to reduce costs on our more complex parts."

For many years, Brand's machine operators fed material to CNC lathes from single-bar feeders. This made it possible for one operator to monitor several lathes at once. However, if the operator was occupied with another task, a machine might run out of material and become idle, producing considerable downtime. The addition of bar loaders solved that problem.

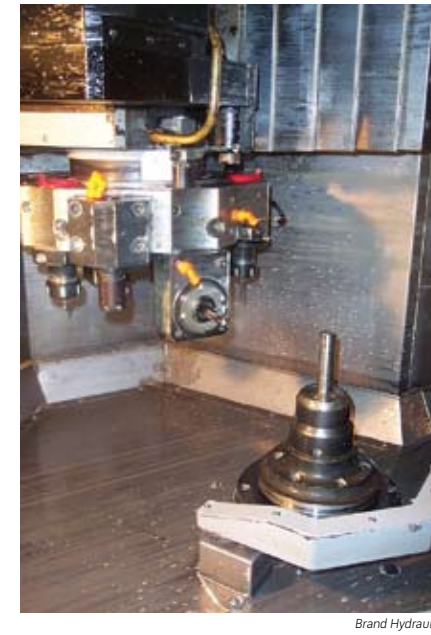
The bar loaders allow Brand's two newest CNC lathes to run unattended, 24/7. "With bar loaders, the machine runs all night and we have a basket full of parts in the morning," said Pullen.

Brand currently operates two bar loaders from LNS America Inc., Cincinnati: an Express 332, which loads bars for the Haas, and a Sprint 552, which loads bars into the Nakamura. Both loaders handle 12' bars. The Express can handle stock diameters from 0.125" to 1.375", and the Sprint handles diameters from 0.25" to 2". Switching bar stock diameters is not a major undertaking, taking less than 15 minutes.

Despite producing short runs of 50 to 250 parts, Breeza Fans decided to automate some of its processes. Demand for its products was growing and it needed to increase production.

"We typically run two sizes of bar stock, and changeout is not a major issue," Pullen said. He explained that it is simple to setup the loaders for different diameter sizes of bar stock. "The loader's channels are swapped, as is the push rod. The rest of the loader setup is done automatically through the settings. LNS has done a great job in keeping it simple."

A remote control on both loaders prompts the operator to enter the shape, stock diameter and the guide channel diameter. Once this information is entered, the loader automatically adjusts the steady rest. The loader also adjusts torque and feed rates for different bar sizes.



Brand Hydraulics

A view of a live tool inside the Haas SL-20 multitasking lathe.

Brand chose the bar extraction option to free operators from having to remove bar remnants from the chip bin. The remnants are pulled from the chuck and dumped into a bin inside the loader, then the next bar is loaded.

The combination of a multitasking lathe with a bar loader creates a compact and flexible automation cell that machines parts in one setup. One program, rather than two, contains all the CNC code needed to make the part. One setup means less downtime, easier scheduling and less scrap.

Both the loader and the lathe can be setup quickly. "Changeovers take from 1 minute for parts within the same

family of parts to 45 minutes for a complete tooling change," Pullen said.

A paradox in automation is that while shops automate to improve the process, the process must first be improved to automate it. For example, tooling issues such as poor chip control or unpredictable tool life must be dealt with prior to automation. Also, if the machine cannot run without a person monitoring the process, it will not be capable of automated operation.

"When running a lights-out process, it is very important to achieve the optimal combination of cutting parameters," Pullen said, explaining the importance of controlling chip breakage and maximizing tool life. "When we started actually producing parts, we found numerous parts of the process requiring further optimization."

Brand initially found that tool life was not being optimized and that in a few cases stringy chips prevented unattended machining. With a few minor changes in feeds, speeds and toolpaths, these issues were resolved.

Brand monitors tool loads to prevent operating problems. Should a tool fail, the multitasking lathes will automatically stop, reducing scrap and preventing machine damage.

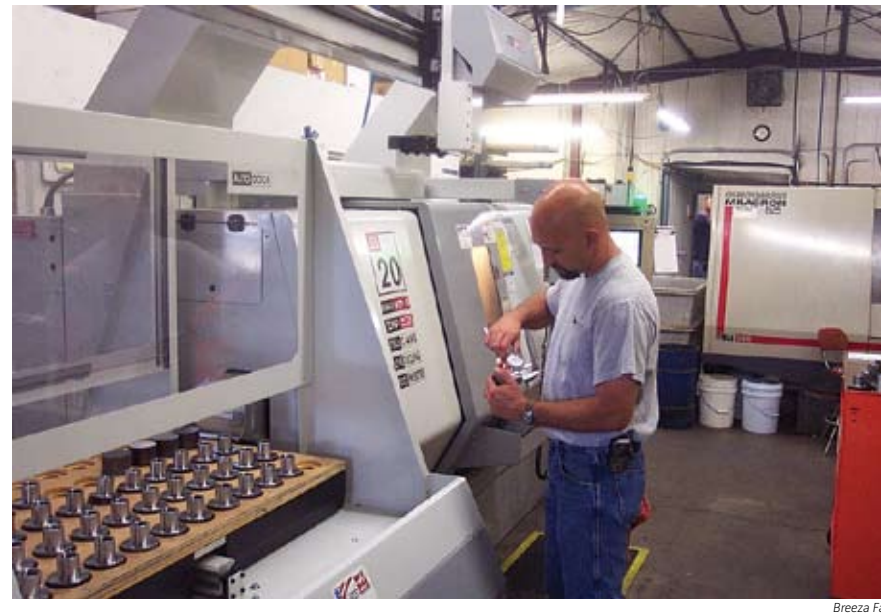
Breeza Fans

Another automation user is Breeza Fans USA, a manufacturer of specialty fans located in the small town of Utica, Neb. Despite producing short runs of 50 to 250 parts, the company decided to automate some of its processes. Demand for its products was growing and it needed to increase production.

"Hiring additional operators was a consideration, but the idea of making better use of our current people made more sense," said Mike Fehlhafer, president of Breeza Fans. "I believe that very few people like going to work; however, if they are given the right tools, respect and a challenge, they will excel."

Breeza Fans purchased a Haas SL-20 multitasking lathe equipped with power tools and an automatic parts loader. The parts loader is a fully integrated gantry loader and has an automatic door and a double gripper, enabling unattended machining.

To program the loader, the operator fills in the blanks on the control screen provided by an Intuitive Programming System. The IPS can "teach" a few locations for pickup, load and drop off by moving the arm into a position where the loader is ready to feed slugs to the lathe.



Breeza Fans

Adam Simmerman, production manager for Breeza Fans, performing a routine check.

"With 60-piece orders taking about 3 hours to run, setup times need to be minimal," said Adam Simmerman, production manager for Breeza Fans. "Setting up a more complex style of automation just wouldn't [fit our operation]."

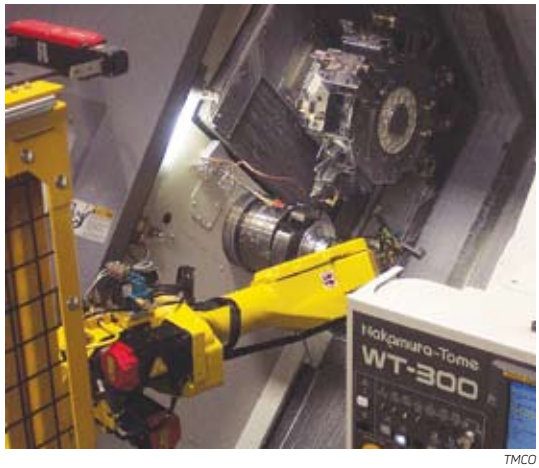
Most of Breeza's parts range from 3"

to 5" in diameter. Parts manufacturing starts by sawing blanks that are then loaded onto the loader's tray. The machine picks up a blank and positions itself above the door until the machine is finished with the previous part. The loader then swaps out parts and puts the finished part on the tray. It starts again with another blank while the lathe machines the next part.

Machining one tray of parts may only take a few hours, so total unattended time is relatively short. This is not a limitation for Breeza because it has a flexible schedule for swapping parts.

Breeza Fans

Typical parts run on the Haas SL-20 lathe at Breeza Fans.



TMCO

A robot extracts a part from the WT-300 lathe at TMCO.

The operator loads the tray, changes tooling if needed, checks a part and then goes home for dinner. After dinner, he returns to replenish the pallet, allowing the machine to run for a few more hours. Then, later in the evening, the operator can return once more to load and unload more parts, allowing the machine to run a few more hours into the night. Having the operator work an extra hour in the evening in effect provides an extra shift, which gives the operator some time flexibility during the day. Parts are also running during the operator's lunch hour. Running lights-out was not a problem for Breeza because it already ran unattended operations. "Our operators are always multitasking, so programs must run unattended," said Simmerman. "The transition to automation was fairly simple because we are already using proven programs."

TMCO

Total Manufacturing Co., a job shop in Lincoln, Neb., wanted to improve a process used to make a parts family of 15,000 units per year. This motivation led them to automation. In the past, TMCO made these parts in six operations: sawing bar stock, rough turning, drilling, turning each side in a chuck, milling in two setups and polishing.

"Scheduling the parts was a nightmare," said Rhett McMichen, TMCO shop manager. "We looked at multitasking lathes to bring all the operations into one setup."

The shop chose a Nakamura WT-300 lathe with opposing twin spindles and two turrets that can work independently or in concert on either spindle. Both of the turrets can hold live tooling in any station. Each turret has 12 stations, each of which can hold one live tool. Turning tools can be "doubled up" by combining two drills or two turning tools, one facing left and the other right. The upper turret is equipped with a Y-axis. The lathe has two 8" chucks.

The parts to be run on this lathe averaged 7" in diameter, eliminating bar loaders as an option because bar loaders are not made to handle diameters much larger than 3". Instead, a Fanuc M-16iB robot was selected to load the machine. Workpieces are manually placed on a conveyor where the Fanuc 2-D Integrated Robot Vision (iRVision) picks up the location of the next workpiece to load. The vision system is capable of

detecting errors, such as incorrect sizes or missing features.

Once a workpiece is fully machined, the robot places it on a second conveyor where it can later be removed by an operator. The saw is positioned near the conveyors so parts can be loaded directly from the saw and the finished parts are ready to ship.

One of the more time-consuming features of these parts are two angled 5/64"-dia. cross holes. The angles of these holes vary between 30° and 45°. Drilling these holes in the multitasking lathe would require live toolholders that allow for this variance. These live toolholders are essentially miniature spindles that have the added capability of being set to angles within a 90° range (from parallel to perpendicular to the main spindle). This capability comes at a premium price. The cost of these adjustable live tools, including redundant toolholders, would be almost $30,000.

As a result, TMCO took a different approach. "The original plan was to have the Nakamura make each of our parts complete," said McMichen. "We decided some of the live tool operations could be moved to a milling machine," eliminating the need for adjustable live tools on the lathe.

> *No matter what form automation takes, flexibility is a key component.*

The addition of a Fanuc Robo Drillmate milling machine gave the cell added flexibility. Now, the two 5/64" holes can be drilled while the lathe performs other operations. Also, some of the parts in the family do not have small holes, allowing the mill to accept other work.

"This cell has substantially decreased handling and work center queue time," said McMichen. "Cycle times were reduced 50 percent due to the first and second ops occurring simultaneously and the parts in process being reduced."

No matter what form automation takes, flexibility is a key component. The simpler the system, the more likely it is to be versatile. A multitasking lathe, coupled with robotic loading or bar loading, is a simple but effective form of flexible automation. **CTE**

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