

▶ BY BILL KENNEDY, CONTRIBUTING EDITOR

# Turning to CNC

Options for small shops looking to upgrade their turning equipment.

**G**iven enough time, an expert machinist can set up and turn just about any part on just about any lathe. However, competitive pressures continually shorten the time available to complete jobs, and the ranks of top machinists are thinning.

As a result, many small job shops and toolrooms are finding they need to upgrade their manual and NC turning operations. That can mean buying a new small CNC lathe, purchasing a used one or equipping an existing machine with a CNC.

No matter which course a shop chooses, though, the main reason they opt for CNC tends to be the same: the need for speed. With CNC, a shop can create, store and recall programs, allowing them to quickly and exactly du-

PLICATE parts. Changes to a part's design are accomplished by simply entering new numbers. Employing CAD and CAM, CNC technology speeds translation of customer files to final parts. CNC also enables one cutting tool to machine contours that previously required multiple tools or special form tools (see sidebar, page 49).

The move to CNC can also mitigate the problem of fewer highly qualified machinists. Canned programs enable less-skilled operators to machine complex features. Conversational and instructional CNC software extends an operator's machining capabilities. And CNC enables a single machinist to run a room full of lathes.

Although CNC technology will never replace the artistry

of the expert machinist, it can help a shop meet customer demands for ever-higher quality and shorter lead times.

## New Opportunities

In response to the market's demand, a number of machine tool builders now offer small lathes with CNCs. One example is the TL-1 toolroom lathe from Haas Automation Inc., Oxnard, Calif. Priced under \$20,000, the machine provides a maximum cutting diameter of 16" and cutting length of 30".

The control features four modes of operation, which are designed to smooth the transition from manual to CNC. In

manual mode, standard handwheels move the X and Z axes while the control provides a digital readout of positional data, displayed to 0.0005". In semiautomatic mode, the lathe performs dual-axis, simultaneous interpolation.

This capability allows the operator to cut chamfers and tapers with a single handwheel. In automatic mode, the control has built-in single- and multiple-pass machining cycles for rough and finish profiling, chamfering, grooving, threading, drilling and tapping. In full



Haas Automation

The Intuitive Turning System on the TL-1 toolroom lathe, which lists for under \$20,000, guides the operator through the steps necessary, for example, to thread a part.



CNC mode, a G-code program controls all axes.

Haas says the TL-1's graphically based, conversational Intuitive Turning System guides the operator through the steps necessary to machine a part. Operations that would be difficult or im-

possible on a manual machine can be accomplished without any knowledge of G-code programming.

before purchasing it. In addition, find out whether the seller offers a return policy or if the sale is strictly "as-is."

Some sellers and rebuilders offer certification programs that include documentation of a machine tool's true condition. These programs may in-

clude limited warranties.

placement cost, said Scott Ashworth, vice president of operations at Kentucky Rebuild. Generally, 50 to 60 percent of the cost of an equivalent new machine is the maximum to invest in an upgrade. Often, the choice between buying new and upgrading depends on the size of the machine in question. The bigger the machine, the greater its replacement cost and the more sensible it becomes to invest in a retrofit.

Randy Ellsworth, owner of motion control and CNC services provider Vision Technology Co., Troutman, N.C., said it's important to compare the quality of the existing machine with the potential replacement. "Does the new machine come from a quality company? If the company is considering replacing a Hardinge with a Chinese or Taiwanese machine, limiting a retrofit to 50 percent of replacement cost is not necessarily a good rule of thumb," he said.

The best candidates have "good iron and an old control," said Keith McCulloch, a Mid-Atlantic region dealer for CNC retrofit provider Centroid Corp., Howard, Pa. As an example, he cited a shop with a Mori Seiki SL-1 lathe that had a 1979-vintage control. "You know what a computer from 1979 is like!" exclaimed McCulloch. The shop owner was spending \$10,000 annually to keep it running.

For \$15,000, Centroid replaced the control with a new one and the control "maintenance costs totally went away," said McCulloch. "Now the machine is actually running better than new, and it has new features and capabilities. When the actual iron is of high quality and in good shape, it makes a lot of sense to retrofit."

That's the "good iron" part of the formula. If the examination determines that a machine is mechanically worn out, it probably would not be worthwhile to replace the control and rebuild the lathe's mechanics. Ashworth recommends getting a second opinion from the machine's OEM, or from a reputable third-party rebuilder, regarding what upgrading a particular machine would involve and whether the move would be economically feasible.



Replacing an old control with a new one, such as this Centroid T-400 CNC for lathes and turning centers, can enable an old machine with good iron to run better than new.

Even with hints of a recovery on the horizon, many shops are reluctant to invest in a new machine tool. One alternative is buying used. Economic conditions over the past few years have resulted in a lot of equipment being offered for sale, everywhere from local papers to Internet auctions.

Buying a used machine tool is like buying a used car. Private-party deals are strictly *caveat emptor*, while buying from a reputable dealer, perhaps at a higher price, brings greater peace of mind. It's advisable to hire a service technician to examine a used machine

include limited warranties.

For example, customers of Kentucky Rebuild Corp., Independence, Ky., can take advantage of the company's KRC Certified program. It provides a complete evaluation of a machine, including spindle condition and runout, backlash, squareness, condition of the ways, guides, covers and lube system, and a vibration analysis. Kentucky Rebuild also rates the machine on a scale of 1 to 10.

#### Retro vs. New

A bargain on a used machine is not really a bargain if it doesn't perform all the operations a shop requires or doesn't accommodate any growth the shop might experience. If the available used machines don't offer sufficient quality or capabilities, the alternatives are buying new or upgrading existing equipment. Upgrading can range from retrofitting an NC lathe with a CNC to rebuilding worn mechanical systems or even remanufacturing the machine.

The decision should be based on re-

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## Exploiting CNC

CNC enables a lathe to make cuts that previously required multiple tools, special form tools or perhaps a three-handed operator with a metronome and calculator for a brain. To keep up, toolmakers continually develop new products to take advantage of CNC's capabilities. One example is the MTC system from Manchester Tool Co. MTC inserts combine a double-V top-and-bottom clamping system with a narrow insert shape to provide extended reach, rigidity and versatility.

Manchester, Akron, Ohio, provides the tools in a square-nosed MTC-PT geometry, for plunging and turning, as well as a rounded MTC-PC configuration, for plunging and contouring. The design can enable shops to reduce the number of tools necessary to complete some jobs and save the time needed for tool changes or turret indexes.

Keith Konet, specialist, product R&D for the company, used the example of a turned part with large diameters on each end and a smaller diameter in between. "Using a 35° diamond DNMA or DNMG insert, you'd have to use at least two tools" to complete the part, he said.

Guided by a CNC program, one MTC insert can cut both the large diameters and the small central portion of the part. The tool's rigidity also addresses quality issues. "With a fairly small 35° diamond, clamping is light and sometimes rigidity suffers," Konet said.

Konet pointed out that dogbone-style inserts were popularized by toolmakers in the early days of aerospace machining. Now, these evolutionary MTC versions of the earlier tools are useful in a range of applications at smaller shops. As a result of outsourcing trends, small shops increasingly are called on to make complex parts previously handled by internal departments of larger companies. "Obviously these kinds of tools have their greatest advantage in shops that have the CNC machines that can make the most of the tool," Konet said.

—B. Kennedy



Manchester Tool

MTC inserts combine a double-V top-and-bottom clamping system with a narrow insert shape to provide extended reach, rigidity and versatility.

builders and independent rebuilders/retrofiters offer CNC update kits. McCulloch advised shops to look closely at what each kit contains when comparison shopping. Some kits include just the control box, a screen and a computer. Turnkey kits may have a higher price, but they also include servomotors, amplifiers, a programmable logic controller and an operator control panel.

Bruce Heslop, Centroid's sales manager, said that a shop looking to buy a CNC kit should consider what operations the machine must perform, as well as those it may perform in the future. Typical factors to consider include production levels, the difficulty of the parts being turned, whether C-axis capability is required and the desirability of live tooling or tool-changing capability.

### Manual to CNC

Replacing an old NC or CNC on a

solid machine can pay off. On the other hand, converting a manual machine to full CNC may not be a good investment.

"We tend to not recommend manual-to-CNC retrofits," Heslop said. The change, which requires wholesale changes in the mechanics of the machine, usually is not worthwhile from an economic standpoint.

"A decent CNC package is going to cost approximately \$8,000," said Heslop, "installation another \$3,000 or \$4,000, changing over leadscrews to ballscrews another \$2,000 or \$3,000. Add incidentals and you're at \$14,000. You can buy a brand-new machine for \$19,000."

But there are exceptions, usually based on a shop's unique needs. McCulloch said a particular shop's manual lathe may have a special feature that is unavailable in a new machine at a reasonable price. Examples of these features are a through-hole of a certain di-

ameter, an extremely low gear range or a long distance between centers.

"It is a lot more work, because you're actually into engineering and fabricating motor mounts, ballscrew mounts and that kind of thing," said McCulloch, "but in a case where there's some special thing that a shop needs to do its job, it's worth it."

### Total Costs and Benefits

Vision Technology's Ellsworth said that when comparing the purchase of a new machine with upgrading existing equipment, all costs should be considered. The true cost of a new machine includes the expense of disconnecting and moving the old machine and perhaps hauling it away. There are also trucking and rigging costs for the new machine. If the new machine doesn't use the same tools as the old one, there will be retooling expense. In addition, production rates may suffer while em-

ployees learn new operating procedures. On the other hand, the investment in CNC is somewhat offset by higher productivity of the new or upgraded machine and lower labor costs due to possible unattended operation and operation of multiple machines by less-skilled employees.

For those less-skilled workers, conversational and instructional CNC systems can provide a form of apprenticeship. McCulloch said CNC systems that also offer manual operation with a DRO can lead an operator step-by-step to full CNC. "The guy just starts using it, learns how to turn a diameter, next thing you know, he's programming little simple jobs. Six months later, he's a CNC programmer."

### Competitive Forces

Such a virtual apprenticeship can't take the place of talent and experience. "Fortunately or unfortunately, the computer is taking out the artistry in the industry," Heslop said. "A computer will never replace the guy who can visualize this stuff in his head and just machine it."

However, he added: "Job shops are being forced to go to CNC to be competitive. We have a high cost of living to pay for, and we're competing against people who work for a quarter of our prices. People say, 'You're putting good working machinists out of business with that CNC.' That's a shortsighted view. We aren't; overseas competition is. We need to fight back and figure how to do this in America better and cheaper."

### The following companies contributed to this report:

**Centroid Corp.**  
(814) 353-9256  
[www.centroidcnc.com](http://www.centroidcnc.com)

**Haas Automation Inc.**  
(800) 331-6746  
[www.haascnc.com](http://www.haascnc.com)

**Kentucky Rebuild Corp.**  
(859) 283-8300  
[www.kyrebuild.com](http://www.kyrebuild.com)

**Manchester Tool Co.**  
(800) 237-8789  
[www.manchestertools.com](http://www.manchestertools.com)

**Vision Technology Co.**  
(704) 528-8265  
[www.visionnc.net](http://www.visionnc.net)