# If You (Re)build It, They Will Buy It

## Retrofit, re-control, re-build, re-manufacture: It's all good.

Jack McGuinn, Senior Editor

**It's been said that the best ideas are often someone else's.** But with rebuilt/retrofitted/re-controlled/or re-manufactured—pick one — machine tools — buyer beware and hold onto your wallet. Sourcing re-work vendors and their services can require just as much homework—if not necessarily dollars—as with just-off-the-showroom-floor machines.

According to Jerry Adamski, global customer service director for Gleason Corporation (Rochester, New York), "Many factors can influence this decision, including machine condition, cost to upgrade, project timing, operator knowledge, machine quality history, existing tooling, rebuild vs. new productivity improvements, etc."

And Ken Flowers, owner and vice president of sales of Machine Tool Builders (Machesney Park, IL), elaborates on the points Adamski raises.

"It starts with the machine type and machine issues. For example, a machine which is currently CNC that has an antiquated/unsupportable control, but is producing good quality parts, is a likely candidate for a full re-control for about one-quarter to one-third (the price) of a new machine price. Re-controlled machines can last another 10-15 years if the right candidate is chosen for the upgrade. Gear cutting machines lend themselves well to re-building and re-controlling because, in general, these types of machines are more valuable than machines like mills and lathes. However, size matters; generally machines in the size range of 300 mm diameter and larger provide a larger savings than machines with smaller diameters; this is due largely to the prices of new machines in the smaller size ranges.

**A fully re-built Lorenz LS-180 gear shaping machine that had a custom tailstock/face gear table assembly added to it during the re-build. This machine has five axes of CNC control and one spindle — all controlled by a Siemens 840D CNC (Courtesy MTB).**

"Depending upon the machine type, re-building and re-controlling can produce benefits in the accuracy achieved; the speed; the flexibility; features and functions; lower set-up times; and lower cycle times."

David Goodfellow, Star-SU LLC (Hoffman Estates, Illinois) president, puts things in an economic law of diminishing returns context.

"A re-build averages between 50-60 percent, and a full CNC upgrade re-manufacturing is 70 percent of a new machine price and is generally more applicable to larger machine tools, since there are more parts of the machine that can be reused. CNC re-manufacturing of old mechanical machines is often less expensive than trying to rebuild a machine to the OEM's original specifications for a mechanical machine."

Also doing some math for us is Jim Vosmik, Drake Manufacturing (Warren, OH) president. "Where the machine itself is no longer able to be brought into tolerance by adjusting gibbs, leveling and aligning the base, and other 'heavy' preventative maintenance, a tougher decision needs to be made. If re-manufacturing will cost more than 75 percent of a new machine of similar function *and* the re-manufactured machine is not guaranteed to produce at 100 percent of the speed and quality of the new machine, you are likely better off with the new machine on a total lifetime cost analysis that looks at initial, as well as productivity, operating and maintenance costs.

"Of course, when a new machine of the same function is not available, the math becomes more forgiving. The upfront cost is only one consideration. Over the life of a machine the operating, consumables, and manpower costs generally dwarf the initial, upfront costs of the iron. The main driver of those lifetime costs

**A mechanical shaper that was fully re-built, modified and converted to CNC control. It has five axes under CNC control, using a Siemens 840D CNC. It was modified to use a 2000 Nm water -cooled torque motor to generate the up/down stroking motions. The upgrade also provided CNC-controlled elevation adjustment and high-speed return of the cutter, helping to reduce cycle time from seven to two hours on most parts (Courtesy MTB).**

is stiffness in the cut/grind—stiffness drives productivity—either through cycle time directly or through diminished tool life.

"Another consideration is whether or not the carcass can be automated. Does the physical layout of the machine allow for automation to be utilized in a safe and efficient manner without doubling the footprint of the machine on the shop floor?"

Indeed, carcass hunting today can be a daunting task. Depending what you are shopping for, it's not like there exists a Happy Hunting Bone Yard where one can be readily purchased.

"Many of the carcasses result from plant closures and auctions," says Flowers. "Small machines are easily found on the market, but larger machines are becoming rare."

"Yes, (carcasses are) definitely harder to find," Vosmik affirms. "The large gear equipment has been used to exhaustion to keep up with demand, until a couple of years ago. There are just not too many large thread grinders still out there that have not been CNC-retrofitted."

Adamski says that "Carcasses are found at existing and new customer (locations), on the used machine market and at auctions," but concedes that "Popular models can be difficult or costly to find."

Of course it's ultimately all about — aside from trying to save some money—re-doing a machine to update its technical capabilities and thus make its owner more competitive in the market. But is that a double-edged sword scenario? Is it possible that machine tool technology is advancing at a pace that renders re-dos almost superfluous? The reality is that the risk of sudden obsolescence is minimal. Or is it? Fact is — it depends.

Adamski reasonably points out that "Again, it depends on a number of factors, the most significant of which is the level of re-build, i.e., basic re-build vs. retrofit vs. re-contol, etc. A re-control with new controls, motors, drives, etc., can bring the machine up to current technology levels."

Those stipulations addressed, Flowers maintains that "Actually, there is little risk at all — especially when you couple the re-build with a full re-control or conversion to CNC." He explains that in the case of re-making a machine for its current user, "If his process (has not dramatically changed), we

**A mechanical (change gear-driven) Modul ZFWZ800 gear hobbing machine that was fully rebuilt and re-controlled to have four axes and one spindle under CNC control. The CNC was Fanuc model 0i-MD (Courtesy MTB).**

can assume that the original proven machine castings will work perfectly for (his) re-build project. The re-control or CNC conversion can use all the latest state-of-the-art controls and, as such, can provide many of the newest technological features and the proper software."

And yet, pulling no punches, Goodfellow allows that in repurposing, "There is significant risk," but balances that in adding that "the cost savings may be justified — especially with multiple machines and engineering utilized across more than one machine. It is always about the money cost."

The mention of software gets right at one of the crucial elements of a successful, worthwhile re-do. The machine's original capabilities must be considered, and more. For instance — who writes the software? That can be tricky — and time-consuming. The good news, however, is that today's sophisticated programs can actually increase the likelihood that a re-do is economically justified.

As Adamski points out, "A re-control will allow the machine to use the most current software and features, which essentially imparts new-machine capabilities," and Goodfellow adds that "Applying a full CNC re-manufacture allows the latest CNC technology to be applied to an old carcass, and often proves cost-effective." But as to sourcing such software, he maintains that "Relatively few rebuilders have good software capabilities, while machine tool re-manufacturers usually do."

"Good, flexible process software can overcome quite a few engineering challenges and help make a marginally productive, manual machine a winner as a CNC machine," says Vosmik. "But again, the original process must have been stable on the machine—the software and CNC retrofit can overcome the inefficiencies of movement, but generally do not add cutting/grinding stiffness."

Flowers says that "Sometimes (software) is outsourced; but two main issues occur there—namely, lack of support going forward, and difficulty finding an expert in the subject matter. After all, many programmers are not machine tool people. It is best to choose a vendor that has a proven track record, because it can take years to develop a robust, proven software package that embodies all the features and functions that a modern machine would possess."

We've addressed some of the critical considerations, but deciding to go the re-do route also requires finding a supplier who knows where the "bodies" (parts) are buried — or not (no longer available). There is indeed a machine age-related tipping point.

As Gleason's Adamski puts it, "Generally speaking, the older the machine, the harder it is to rebuild. This is particularly true when original components need replacement but become more difficult to obtain, and substitutes require a high degree of engineering."

"The single most difficult challenge is to determine how far to update to what would be considered comparable to a new machine," Goodfellow explains. "There are limitations that exist; you can (for example) replace ball screws, but the machine may call for linear guides that create significant challenges."

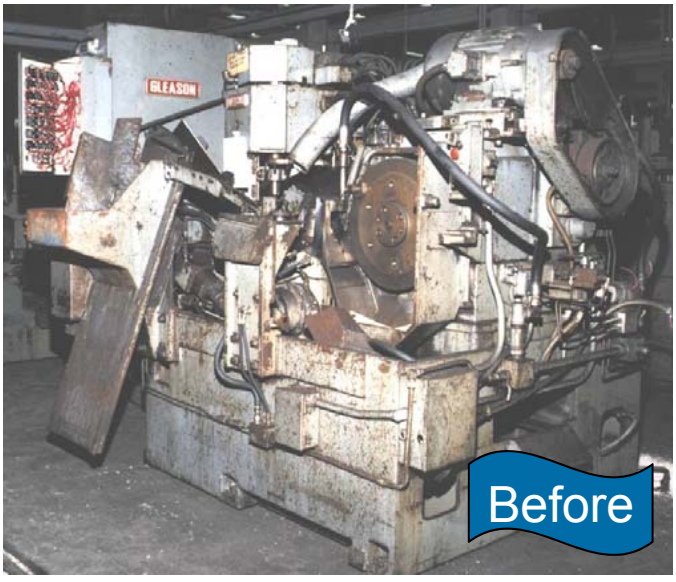
On the other hand, MTB's Flowers maintains that the question's premise is off-base, in that it is not the age of the machine, as it is the beauty of its original design capabilities.

"A machine might never be too old," he counters. "But the machine design could be such that it does not make a good candidate for the re-control or re-build process. For example, the castings (which we always reuse) may not be suitable for the modifications required to implement the conversion to CNC. Another problem may be the structure of the machine is too odd and flimsy, or the machine is simply not going to be rigid enough to provide sufficient process improvements to justify the re-build."

Staying with that point, Drake's Vosmik agrees that "Physical age is not too important. Go back to productivity—it does not matter how old or new the iron is, so long as it is stiff enough to use today's cutting tools and abrasives."

OK: age—not so important. But the market is now flooded with machinery boasting a much smaller footprint to accommodate today's factories, job shops and their lean manufacturing cells. Is a "lean machine" always the answer? Not so much, actually, if you know your cutting machines.

"Ironically, the older gear cutting machines have smaller footprints," Flowers reminds, following with a point that may surprise. "It's the newer machines that are larger and consume more floor space."




**Gleason straight bevel REVACYCLE machine**


**These before-and-after photos from Gleason demonstrate the dramatic results of a machine update (courtesy Gleason Corp.).**

For Vosmik (addressing machinery in a broader context), gear cutters aside, "(Size) is another driver of the economics. In the past, stiffness was often achieved by mass and over-engineering the statics. Today, the dynamics can be achieved by other means and one can have a small, compact machine that performs better than the old, massive machine."

But Adamski makes the point that "It can be (a problem), but in many cases the rebuilt product is returned to the same space it came from."

Three other points not yet addressed are biggies: price, warranty, and delivery.

Regarding what you'll pay, know this — it varies. As one might expect, cost depends on what you are buying and what you will use it for; logistics are key as well.

"It depends on the customer's requirements, Adamski says, also pointing out that "(Another) major consideration is the transportation expense to send the machine to Gleason and to have returned to them when the rebuild has been completed."

Flowers stresses that "(Cost) depends on the (carcass) price. Rare, hard-to-find machines can fetch a steep price, even if bought as a carcass." But he also says that some creative horse —or is it carcass? — trading can help. "Taking the customer's machine in trade can offset the additional expense of the carcass purchase, provided the customer has a machine to trade in."

As for warranty, one year is the typical industry standard.

As for delivery time—there's nothing "typical" about it. And up to a year is *not* atypical.

"It depends on many things, including the complexity of the product, condition you start with, customer requirements, and availability of parts and resources that may be hard to find." says Adamski.

Up to a year is accurate, Flowers allows, while managing to somehow creatively invoke Henry Ford in his response. "The main difference lies in the roots of the mass production concept laid down by Henry Ford. Once it is designed, you just build many duplicates of it — you can benefit from economies of scale; familiarity; JIT (just-in-time) manufacturing and stock; optimized production facilities, etc. Re-building is just a very time-consuming process."

The bottom line here, according to Goodfellow, is that CNC work will require the most time, "due to the stripping out of the old mechanical and re-designing and building into the carcass the new technology."

All of the above reflects the presence of a mature market here in the U.S. for machine re-builds and their variations. We've been doing it here for a very long time and doing it well. But how about, say, Asian countries?—China, for example.

We'll defer to Vosmik on this one, given that he happened to be in China on business when we caught up with him for this article.

"Almost (no market exists) in China—they want new," he states flatly. "They want productive; and, as important, the Chinese government makes it difficult to import used equipment — even retrofitted and remanufactured.

"While 'they want new' sounds like a fashion statement, those demands actually helped us (Drake) to discover how much more productive our new machine designs could be vs. the CNC retrofits and remanufactured machines. The dynam-

# Metrology Products Help Repurpose Rebuilds, etc.

## Supplier provides machine tool users assistance for retrofit and upgrade.

Frank Powell, product manager, Marposs Corp.

Marposs supplies precision metrology equipment for improving productivity and reducing cost in manufacturing. And while the company's products—such as gauges, sensors and probing systems—are used on new machines, the same products are also widely used for the retrofit and upgrade of existing machines. Marposs supports individual machine tool users with hardware, software and service where a retrofit or upgrade may be accomplished on-site and in coordination with the customer's in-house maintenance staff. Marposs also serves as a supplier to many machine tool OEMs and integrators, but, as with the above, companies that specialize in rebuilding and remanufacturing machines as well.

In some cases, it is possible to incorporate these products in existing machine tools without machine modification, as Marposs products are designed specifically for the machine tool environment.

When a retrofit application is presented, the machine needs to be evaluated—both mechanically and electrically—to understand the capability of the existing machine. For example:

- Is there a place to mount the new device?
- Is the machine control capable of working with the new device?
- What will be impact on the machine operation?
- Most importantly, how much will this affect the machine operator's job?

When looking at the machine to decide what would be used in a gauge retrofit, we start with the machine itself. Some of the things that we evaluate include:

- Determining available space within the tooling to install the gauge
- Accessibility to the feature of the part to be gauged
- Available clearance to load and unload the part in the machine

That last item is very important, especially when the machine is manually loaded. If a new device is added to an existing machine, and it impedes the operator's normal routine, the

ic performance gains we were able to achieve with our new designs—designs initially made for the China market—drove new productivity advancements around the globe."

As for re-doing thread and form grinding machines, Vosmik believes that "The productivity of our new machines vs. the retrofits has basically led our customers — and, consequently, us — out of the re-manufacturing business. The productivity of a new thread grinder is in its stiffness and the ability to utilize modern abrasives. The productivity and finish gains from a new thread grinder far outweigh the savings from a remanufacture and CNC retrofit, in most situations. (But) we still perform in-plant CNC replacements where a machine's electrical system is outdated and unreliable but the machine is still productive."

Will the re-build industry remain economical—and in demand—a decade from now? And what will it look like?

"(It is) moving toward CNC replacements and linear rail/truck replacements — almost a heavy-maintenance type of approach," says Vosmik.

As for Adamski, "As the price point for new machines continues to drop it may be more challenging for the re-build market to sustain growth. Re-controls and machines with unique capabilities where there are not newer alternatives will have the greatest success."

As for MTB (where re-working is its predominant business model), Flowers acknowledges an awareness of a landscape that is rapidly changing while projecting an eagerness and ability to adapt to it. In not too many years hence, re-builders will be incorporating the newest "wine" (technology) into what will by then be older "bottles" — OK, carcasses.

"Re-building will not go away," he states. "But the machines that are being rebuilt will have a different mix. The technology has advanced so much that the re-builders will have to step up their game to stay current and be able to tackle the problems associated with direct-drive systems and torque motors; gear grinders with on-board inspection capabilities; shapers with electronic guides, etc. All these candidates will at some point become targets for re-building and re-controlling."

Goodfellow couches his answer in a historical perspective. "It will always be with us, as it has for the last 60 years."

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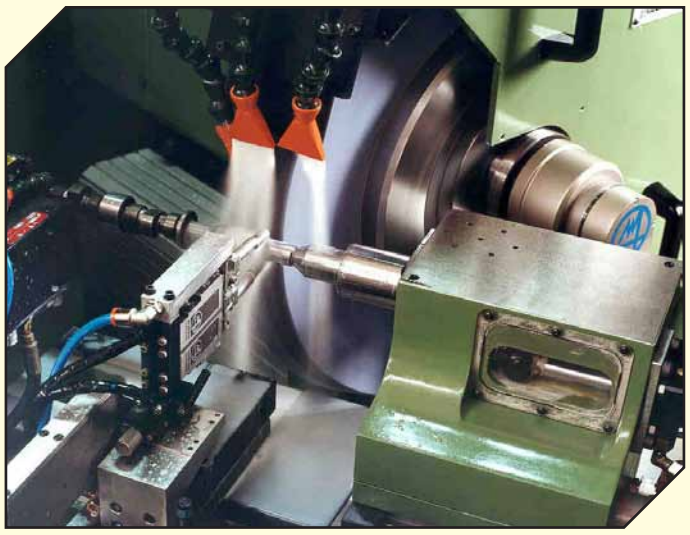

**The grinder shown was originally upgraded by Marposs in the 1970's, using an in-process gauge for automating the original, manually operated machine. It is an example of an existing machine that could be a candidate for modernizing again, using the latest state-of-the-art technology to add renewed life and performance.**

system will never work. The best possible scenario for installation of a new gauge on a machine is that it is transparent to the machine operator. Once it is determined that there is a place for the gauge, the next step is to evaluate the machine's control capability.

If the machine has an existing device that we are upgrading, we need to see if it is possible to connect to the existing interface; this way there are no requirements to change the machine as it is currently running. If we are adding a new device to a machine that never had one, then we must make sure the machine control has the support systems in place for the new device. This may require modifying software in the machine, and/or adding solenoids, flow controls, piping, etc. to operate the device. In some older machines with OEM proprietary controls, the OEM would need to be consulted on possible modifications before proceeding with the upgrade.

Unfortunately, many OEMs of older machines are no longer in business, so a new control may be required. In that case, Marposs will work with an integrator of the customer's choice.

Once the machine environment, function and customer needs and expectations are established, Marposs application engineers will design the proper system that will work with the machine and process. Through numerous applications annually, many manufacturers find that new life can be put back into an existing machine by installing modern gauges, sensors and/or probing systems as part of a retrofit, rebuild or remanufacture program.

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