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BY MIKE PRINCIPATO

Web sight

Allow me to take you back about 10 years to the Internet's earlier days. Back to the technology that spawned a bazillion wasted dollars' worth of pithy-but-forgettable dot.com Super Bowl commercials and somehow convinced otherwise savvy investors to bet millions on kids who, a few years earlier, couldn't manage a paper route. The technology supposedly would "change everything" about commerce.

Although it's still great sport to poke fun at that era and its icons (who could forget the sock-puppet dog selling pet food online? most of us, it turns out), the soothsayers were absolutely right about one prognostication: The Internet really has changed everything. And you, my fellow small manufacturing company friend, should be more than simply grateful. You should be capitalizing on the unique, new opportunities the Web offers your shop.

For starters, if your Web site is still little more than "brochureware"—geek speak for what is simply an online version of your printed sales literature—you're behind the curve. Or, as my kids would say, quite lame.

If your Web site isn't constantly evolving toward the online communications medium and marketing channel that only the Web can provide, you're missing a huge opportunity to grow sales and improve customer service.

And, if at this point you're ready to dismiss this column for offering advice you can't afford to implement, you're living in the past. While you may have been sleeping, Web sites got cheap. Really, really cheap, especially for highly focused, niche companies.

What just a decade ago was almost the exclusive province of companies with huge information technology and marketing budgets has become affordable to the smallest mom-and-pop shop. The Web has opened doors to business growth that you couldn't have imagined just a few years ago.

It is as ironic as it was inevitable that the Web—the technology that leveled the playing field for companies large and small—has itself become a victim of that leveling, in everything from Web site development to hosting services. Case in point: A fully interactive e-commerce site, complete with online shopping cart that would have cost $25,000 in 1999, now runs about $3,000. Or less.

So let's get with the program. Here are two things your Web site should be doing for you now:

1. Displaying regularly updated content. Notice I didn't say "continuously" updated. I'm guessing you don't have Amazon.com's budget, a computer science degree or lots of time to wile away writing content. Good news: You don't need any of those things to keep a site's content fresh, which, in turn, keeps a site interesting to visitors, both new and old.

What you do need is to make sure that your site doesn't contain any "hard coded" HTML, meaning content sections that only an experienced Web site designer can update. A well-designed and effective site can be easily updated by you or one of your employees simply by keystroking in plain English.

2. Accumulating and using customer data. I'll bet you didn't know that for just a few bucks, your Web site developer can build or sell you a canned version of a nifty little program that connects you to your customers and prospects in a way no other marketing channel can.

Here's how it works: Your Web site should already have a "register" function, which is an application that instructs visitors to log in to use various features of the site. Some better sites ask visitors for data ranging from their snail mail address to business title, all protected, of course, by a clearly stated privacy policy. This data is valuable to your mission of connecting with customers through every possible communications channel.

But what do you do with that data as it accumulates? The possibilities are endless and often quite lucrative, but let's start with the most basic and, certainly, most effective: Using the resulting database as an online mailing list for e-mail broadcasts to those visitors. The nifty little program that my developer created was inexpensive but invaluable for everything from targeted e-mail "blasts" announcing, for example, the addition of a new machine tool, to occasional broadcast e-newsletters.

You should be capitalizing on the unique, new opportunities the Web offers your shop.

The content of these e-mails is created entirely in-house, and with a few keystrokes is instantaneously delivered to hundreds or even thousands of Web surfers who have "opted in" to receive such transmissions. And that's just the beginning.

The next step in the evolution of such inexpensive and simple Web-based technology is what's called "predictive modeling," which essentially "profiles" certain customer behaviors and interests, based on their responses to the content posted on a Web site. Using that data, you can target customized e-mail campaigns to only those prospects most likely to buy from your shop. How cool is that?

Forget lame online brochures. The future belongs to the Web-savvy—and the frugal.

About the Author

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Accessory adds axes

One of the most common accessories for a vertical machining center, which is also applicable to other types of machine tools, is a rotary table. It allows you to do more complex machining by adding a 4th rotary or even a 4th rotary and 5th tilt axis of motion to the existing X, Y and Z axes on your machining center.

There are three primary types of rotary tables: indexer, "semitrue indexer" and true contouring. What mainly distinguishes one from another is how it positions and how it is programmed.

A rotary table designed exclusively to work as an indexer can only position to discrete angles—typically 1º—along a rotational axis.

The semitrue rotary table is essentially an indexer with much finer positioning capabilities (0.001º). The semitrue indexer typically has its own independent control that is programmed separately from the machine control and is actuated via M codes.

The true contouring rotary table utilizes hardware similar to the semitrue indexer, but offers higher accuracy positioning and contouring. However, unlike the semitrue indexer, the true contouring rotary table is always connected directly to the machine's controls as an additional axis, like the machine's X, Y and Z axes. A true contouring rotary table must have this type of interface to allow simultaneous axes movement, a task an indexer and semitrue indexer cannot perform.

A rotary table makes a vertical machining center much more productive by allowing access to more sides of a part. Also, multiple parts may be loaded onto a tombstone mounted between the rotary table and outboard support, allowing you to perform other tasks while the machine is running multiple parts. Another advantage of a rotary table is that it lets you position a part so that a feature can be machined in the 4th and/or 5th axis without additional setups.

The 5th axis of motion is a rotational axis that is perpendicular to the 4th axis. There are two common types of 5th-axis rotary tables. The most common is an integrated package that combines the movement of both the 4th and 5th axes into a single table. It is often referred to as a dual-axis trunnion-type table. The second type is modular and involves adding the 5th-axis table onto a 4th-axis table.

The biggest benefit a rotary table can provide is to improve simple machining tasks. Let's say you have a prismatic part that must be machined on all four sides. Each side requires five separate operations: facemilling, spot drilling, drilling, tapping and chamfering. Without a rotary table, you would have to place the part or set of parts in a vise and machine the first side. This would require you to make five tool changes to machine a single side. Then, you would need to reposition and clamp the part.

If dimensional relationships needed to be maintained from side to side, you would need to either use a probe to locate the part or have special locating features in the vise or fixture. In addition to several minutes of downtime required to manually rotate the parts, you would have to make a total of 20 tool changes.

Now, consider the advantages of having several parts mounted on each side of a tombstone that's affixed to a rotary table. With a single tool change, you can reach up to three sides of each part. An added benefit is that the fixturing is simple and the rotary table maintains location accuracy.

And with a flat plate-type fixture, machining can be performed on the backside, or fourth side, of a part mounted on the other side of the fixture. By placing parts on a plate fixture so there are spaces on the opposite side of the plate that are not occupied, machining can be performed through the plate to access the backside of the part. In addition, machining can be performed at any angle.

The Tsudakoma RN-150R is a 6"-dia. rotary table used to rotate the attached trunnion-style fixture with tailstock support and baseplate.

In the near future, direct-drive rotary tables are expected to supplant worm gear-driven units. This type of rotary table does not utilize a worm gear, spur gears or belts to drive the rotary faceplate, thereby eliminating backlash and the need to replace worn worm gears and belts. Direct-drive rotary tables are driven by the servomotor directly. The servomotor is mounted behind the faceplate, so the rotary table is much more compact than a worm gear- driven unit. Similar to machining centers with linear motors, direct-drive rotary tables are fast. They rotate fast enough (250 rpm or faster) to apply single-point tools and be used like a lathe, yet have the ability to be positioned and locked for drilling, milling or other secondary processes.

Special thanks to Mike Ortman, vice president of sales and marketing for Technitron Inc., Cincinnati. For more information about the company's turnkey rotary table installations, call (513) 531-2926 or visit www.technitroninc.com.

The long view

BY BILL KENNEDY, CONTRIBUTING EDITOR

In the mid-1980s, scientist and engineer Danny Hillis pioneered massive parallel computing techniques that became the basis for blindingly fast supercomputers. Now, in response to what he calls society's "pathologically short attention span," Hillis has designed the world's slowest computer: a 10,000-year clock. He wants the clock to be a symbolic counterpoint to today's "faster/cheaper" mindset, and thereby, promote "slower/better" thinking.

The project is being driven by the Long Now Foundation, where Hillis is a board member. The foundation was created to foster long-term thinking through activities such as creation of the clock and development of best practices and core standards for digital archiving technologies.

The clock's binary digital-mechanical timekeeping system is engineered to be accurate within a half day over 10,000 years. It self-corrects by "phase locking" to the noon sun. The correction capability is provided by a key element of the system: An organically shaped cam that is a 3-D representation of the Equation of Time.

The EOT mathematically describes the constant variation in the relationship between local noon, sunrise and sunset. The solar day is, in fact, not always 24 hours, because the sun moves at a variable rate relative to earth. Constant change is a result of the tilt of the earth's axis, the elliptical shape of its orbit around the sun and the influences of the moon and other planets. The cam adjusts the mechanical movement of the clock to reflect true solar time.

Development of the clock is ongoing. Present plans are to house a 30'-tall version in a white limestone cliff in Nevada. The clock's EOT cam will be 5' tall. To publicize the clock, the Long Now Foundation is preparing miniature (about 6" tall) bronze replicas of the cam for display. The replicas will be cast in a mold made from an aluminum model machined at Applied Minds Inc., Hillis' R&D company in Glendale, Calif.

To begin the model-making process, Applied Minds' programmer Steward Dickson used Mathematica engineering software to transform the mathematical model of the equation into a 3-D stereolithography file, which was converted into a 3-D NURBS (NonUniform Rational B-Splines) surface file. Applied Minds' NC machinist Brian Roe then used surface and solid manipulation software to add the lines and numbers that are engraved into the cam.

"This is a display piece, so they put lines and numbers on it so you can have an idea of what it is," he said. "One line represents the winter solstice and the other the summer solstice. Then there are marks for the years." Roe generated a toolpath for Applied Mind's Deckel Maho DMU 80T 5-axis machining center using CAM software.

Raw material for the cam was a 3½"-dia. × 11"-tall piece of 6061 aluminum stock. It was clamped in a lathe chuck mounted on the milling machine's rotary table. The stock was nearly twice as long as the finished cam to provide clearance for the machine's B-axis head. "I had to keep the stock up high enough so that when the head went to 90° to do the engraving, it didn't strike the table," Roe said.

The first operation was facemilling the top of the part with a 3"-dia., indexable-insert cutter from Ingersoll Cutting Tools. The cutter accepts seven square, positive-geometry, uncoated carbide inserts. Roe ran it at a 6,000-rpm spindle speed, a 30-ipm feed rate and a 0.050" DOC.

Next, Roe roughed the cam's shape with three passes of a ½"-dia., 2-flute, square-bottom, uncoated carbide endmill from Hanita Cutting Tools. "The first cut varied from about a 0.150" to 0.375" DOC," he said, "because I was taking that odd shape out of the round. In some places, I was taking hardly anything out, and in other places, I was taking out a lot. The other two passes were at a 0.150" DOC." All three passes were run at 8,000 rpm and 60 ipm. "I had it programmed for 100 ipm, but it was really reaching only about 60 ipm with the rotary table and the five axes all going together," Roe said. Step-over was 0.300." The facemilling and roughing consumed 18 minutes.

Applied Minds

This cam, a 3-D representation of the Equation of Time, is a model for a cam that will enable a mechanical clock to be accurate within a half day over 10,000 years.

Then Roe made two semirough cuts with a ¾"-dia., 2-flute, uncoated carbide Hanita ballnose endmill. This tool also ran at 8,000 rpm and 60 ipm, but with a 0.100" step-over. "I had 0.150" left when I finished my roughing passes, and it was in a real 'steppy' form," Roe said. "I wanted to leave 0.010" for the finish pass, so I took a 0.070" DOC off in each semirough cut." The finish pass was again made at 8,000 rpm and 60 ipm, but Roe reduced the DOC and step-over to 0.010" each. It took 91 minutes to complete the three passes.

Considering the length of the part above the chuck, Roe said, "I had to creep into my final finish pass. If you hit it hard with a heavy tool cut, the whole thing would vibrate because it was sticking up so tall."

The excess stock at the bottom of the part was left for the casting house to create the spur needed to pour the bronze alloy into the mold. So, after the finish pass with the ballnose endmill, Roe fed the ½"-dia., square-bottom endmill into the cam below the finished area at 8,000 rpm, 20 ipm and a 0.040" DOC to create a 0.750"-long × 0.875"-dia. shaft between the cam and the rest of the 3½"-dia. stock. This operation took 9 minutes.

The final operation involved engraving numbers and lines with a ⅛"-dia., 30°-point, single-sided Micro 100 solid-carbide engraving tool. Roe said the two lines that wrap around the cam to represent the summer and winter solstices weren't on the surface model he received, and they presented a programming challenge. "I ended up taking ¼" horizontal slices of the model, and then at each of those slices I drew a line between the two widest points on the cam. And where that line hit the cam, I was able to take those points on each side of each slice and link them all together with a Bézier curve to create that vertical curve."

Roe engraved the numbers and lines at a 0.005" DOC, 10 ipm and 12,000 rpm. He noted that throughout the engraving process, the machine compensates and keeps the tool perpendicular to the part as it curves in and out. The engraving operation required 8 minutes.

Machining the cam doesn't take long. "The entire project probably took me a good week to program and do test cuts. But I can machine one in about 2 hours now," Roe said.

For more information about Applied Minds, call (818) 545-1400 or visit www.appliedminds.com. For more information about the Long Now Foundation, call (415) 561-6582 or visit www.longnow.org.

Estimating the estimator

BY DAVID GEHMAN AND GREGORY FARNUM

There is nothing like a computer for quickly and accurately adding up figures—and that, in a nutshell, is why more and more shops are turning to cost-estimating software.

Accurate estimation of the cost to produce a part is central to a shop's operations. Winning a bid is no good if you lose money on the job because your bid was too low. And bidding too high because you are unsure of just how much cost you'll need to cover can mean you lose jobs, especially with OEMs who often use cost-estimating software to help them evaluate the bids they receive.

Accurate data is paramount. It has to capture all the steps of your manufacturing operation. Material, machine usage and labor are the key costs, but an array of secondary costs have to be included as well, such as the costs associated with load/unload, transport and queuing in front of bottlenecked processes.

Accuracy, however, can be elusive. That is where cost-estimating software comes in. "The old way to estimate costs relied on folders filled with notes," said William C. Brown, CFO at Micro Estimating Systems Inc., New Berlin, Wis. "These folders, supposedly, contained all the costing information, but it was hard to know whether all the costs were captured or whether the captured ones were accurate or complete. With a good software package, you know what assumptions are behind your figures. You just can't be assured of the same degree of completeness with notes in old folders."

Cost-estimating software falls into roughly three camps: the do-it-yourself approach with spreadsheets, stand-alone cost-estimating packages, and estimating modules in shop or enterprise requirement management software. All three can provide valuable information.

The spreadsheet approach, however, assumes you know where and how to assign costs—not as simple as it may seem at first. It hinges on how disciplined and accurate you are in entering all of the required information.

Prebuilt, or stand-alone, cost-estimating packages or requirement management packages with cost-estimating functionality do much of that work for you. Using pre-existing calculations for many hundreds of costs that have been identified by the developer with input from many of the package's users, costs are presented that you might not otherwise consider. Though not effort-free, user input is typically simplified through a fill-in-the-blanks approach whenever possible.

Jerry Ash, national sales manager for Micro Estimating Systems, stressed the importance of cost-estimating software's built-in data. "With our software, we're able to mathematically emulate most any CNC machine you'll encounter, as well as a great many of the manual machines of the last half century. The software knows what the maximum acceleration, deceleration, slide travels, tool-change times and the other machining parameters for that machine are, so the user can accurately calculate without having to make trial cuts or simply guess."

Frequently, the software's suppliers act as mentors as well. "When we train a shop on Costimator [our cost-estimating software]," said David LaJoie, vice president of sales and marketing for MTI Systems, West Springfield, Mass., "we build their workcenters into the software. With 2,000 materials already in our database, plus a broad range of cost centers, a good chunk of our startup training focuses on making sure the software's settings are appropriate for the shop."

Significantly, Costimator is often used by top-tier OEMs to gauge the bids they receive. "It's a two-way negotiating tool," LaJoie pointed out. "The OEM can ask for lower costs and the shop can compare notes. The result for the latter might be methods to reduce costs or it may be the basis for renegotiation with the OEM, if the OEM is pushing for unprofitable pricing."

Clearly, the functionality provided by cost-estimating software is desirable, but it is underutilized, according to Dave Gallagher of COSS Systems Inc., Toronto. He claims that "three-quarters of the shops out there are not using modern software."

COSS offers COSS Manufacturing, a comprehensive requirements system, and Simply Manufacturing, which is for smaller, growing manufacturers who need to pinpoint costs of production, production bottlenecks and resource utilization. Both link cost estimating with a broad range of other features. "The right system captures the data and manages it for rapid recall."

Gallagher feels that stand-alone estimating packages are not comprehensive enough and, therefore, don't present a true picture. "The full set of data you need is drawn from accounting, manufacturing, inventory—every shop department," he said. "We think you gain tremendous benefits from assessing everything you can."

How do you make the right choice? Gallagher sees it this way: "Every package focuses on functionality and most software implements the core concepts you need. The ultimate requirement is a complete relationship with the software vendor. That relationship requires a software provider who knows your market and how shops the size of yours are run. You don't want to wait 2 years for a custom report."

The upshot is that you are likely to gain by using a stand-alone estimating package or module in a requirement management package, whether your primary aim is to deliver reasonable and profitable quotes, to control costs in your own operations or to align your bids with a key OEM's expectations. As Gallagher said, "If nothing else, the software frees you up to do what you know best, making things, and it can help you do it in the way you want, which is to make money."

About the Authors

David Gehman has been writing about manufacturing and software for more than 20 years as both a journalist and a marketing communications specialist. Gregory Farnum is a Detroit-based journalist specializing in industrial and scientific issues.

Cryptic blueprint reading brainteaser

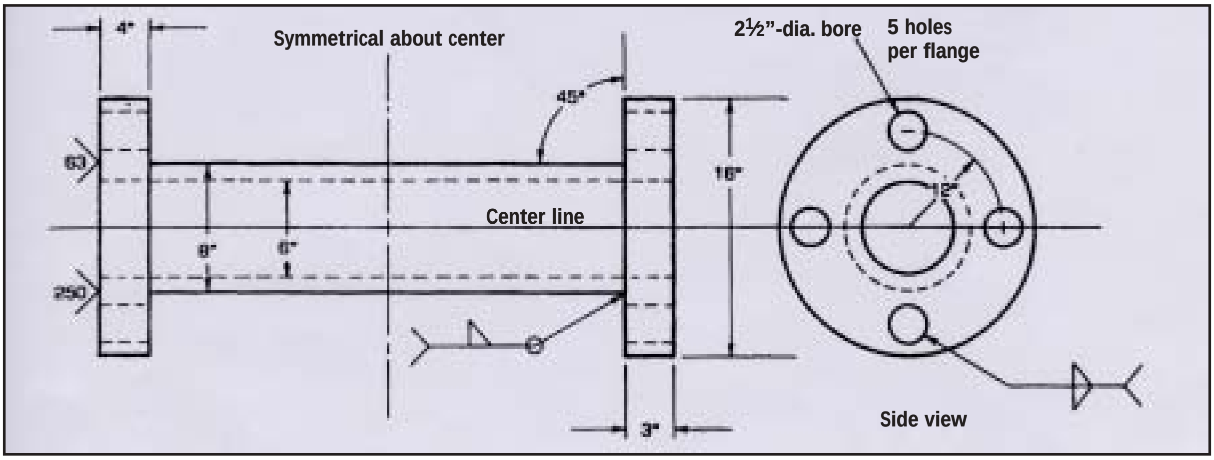
BY JOHN P. STEWART

Editor's note: The following brainteaser was submitted by a CUTTING TOOL ENGINEERING reader.

Occasionally, a draftsman makes a drawing error on a blueprint, which eventually reaches the shop floor despite the formal double-checking of the blueprint en route. Workers who are able to detect design errors before beginning a job are worth their weight in tool steel and can save their employers thousands of dollars in needless repair costs.

In this drawing, simple industrial drawing errors have been purposely included in the design. Searching for these errors and correcting them is an exercise that obliges the reader to study all the views to arrive at the correct answers.

The drawing contains eight errors. Can you find them? If so, e-mail the answers to alanr@jwr.com. Answers will appear in CTE's April edition.



J. Stewart

BY MICHAEL DEREN

Safety first

Too many individuals take shop safety for granted. This applies not only to shop personnel, but management as well. The pervasive attitude in many shops is that as long as no one is getting hurt, everything must be fine. I would be willing to bet that if I walked through your shop, I could find a number of safety hazards.

Let me ask you, as a machinist, how many times have you tripped over material lying on the floor near your machine? How many times have you bumped into a cart by your machine and, perhaps, tore your pants, only to miss your skin by a fraction of an inch? How many times have you slipped because of coolant or oil on the floor? The answer is probably dozens of times. Just a part of doing business, you say? It doesn't have to be.

Many times, a safety hazard doesn't get corrected unless a member of management trips over that material or bumps into that cart and tears a pant leg. Therefore, you should take steps to protect yourself and others in the workplace. First, let's look at why these hazards are allowed to happen.

One of the biggest reasons simple safety hazards don't get corrected is the "I didn't put it there" attitude. It was the operator on the next machine or the other shift that put it there. So what if the other person put it there? Are you really willing to risk getting injured because you were so obstinate that you wouldn't put the material or cart where it belongs? Give me a break!

Another reason that ranks right up there is the "I don't have the time" excuse. Many times, you are working flat out with barely the time for a bathroom break. How much longer does it really take to put the completed part in the box, bin, basket or whatever, where it belongs? Then it's out of harm's way. Incoming raw stock should be placed in a position that allows easy access for loading the machine. When a container is filled with parts your workstation has completed, take it wherever it needs to go. If a container cannot be moved or if you have to wait for someone to move it, put it out of the way.

Another common safety issue is coolant overspray or oil leakage. Overspray occurs when coolant is kicked up from a tool cutting at high speed and it sprays over the work area. This usually happens on equipment that has no guarding. Typical examples are knee and bed mills and large horizontal boring mills. These machines are available with guarding from the factory, but guards reduce the machines' work envelopes.

Many aftermarket supplies can help reduce this overspray. For knee and bed mills, acrylic shields with magnetic bases can be purchased inexpensively. They can be fabricated for large boring mills as well. Catch trays are available from the manufacturer or they can be fabricated in-house if you have the capabilities. These are mounted at the bottom of the machine or below the table. A hose is connected and drains back to the coolant tank. For any excess, simply sprinkle some oil dry or kitty litter to absorb the excess and provide traction. Why someone would want to leave all this moisture on the floor of a shop is beyond me.

An oil leak can be treacherous as well. To deal with the problem, contain the leak using oil dry or absorbent socks or bags. Then, fix the leak. What is so difficult about this? I can't tell you how many times I have seen oily footprints tracked through a shop knowing that that individual is an accident waiting to happen. A little water on a linoleum or tile floor combined with oil-soaked shoes spells disaster.

It's easy to say a safety hazard is someone else's fault. But if you don't do anything about that hazard, it is your own fault if you get injured.

So you shut the machine down for a little while. Big deal. Is taking no action worth an injury? Oil leaks cost the company money because leaking machines have to be refilled constantly. Let's not even talk about what happens to the machine if the oil runs out completely.

It's easy to say a safety hazard is someone else's fault. But if you don't do anything about that hazard, it is your own fault if you get injured. Not only can you suffer a lost-time accident accompanied by the inevitable pain involved, but the company takes a hit on its workmen's compensation insurance. Too many of these hits and your company pays higher insurance premiums, which translates as lower profits, which means smaller or fewer raises. I don't know about you, but I want a safer workplace. △

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