



STAYING SHARP

| **manager's desk** |

By Keith Jennings

# Hidden costs of growth

**E**xpansion, acquisitions, upgrades. The thought of your shop growing into a powerhouse manufacturing enterprise sounds great, and it's likely within reach for many smart owners and managers—but watch out! Along the way will be a minefield of obstacles and unexpected costs that any manager or owner should be suited up for and ready to defuse. If preparations are made, however, your growth trajectory could rise faster and farther than others.

Obviously, any expansion or growth investment should ultimately yield a return. Without a profit to show for your efforts, there isn't a good reason to go through the motions.

It may be more sensible to maintain the status quo and ride that wave while you can, knowing you may eventually have to find another source of income. If, however, your shop has the smarts and stamina needed to grow, the fruits of your labor can be sweet.

Any growing machine shop normally invests in new equipment, particularly CNC equipment, which ranges from relatively affordable to quite expensive. The first hidden cost in equipment acquisitions is taking the time to shop and meet with machine tool dealers. With an abundance of builders, brands and options this can become overwhelming and time-consuming. Attending trade shows for a concentrated shopping experience can be effective, but successful equipment shopping may also involve numerous meetings with sales people at your facility. However the shopping mission is accomplished, think of questions, concerns and requirements ahead of time. Make the dealer use your time effectively.

A great sales presentation may generate excitement, but be sure to get clarification—in writing—on issues such as requirements for power and wiring, computers and software, networks and cabling, equipment footprint, additional insurance, employee training,

special tooling and metalworking fluids, freight and rigging costs, among other expenses. When all these costs are factored in, you may need to adjust the plan. Suffice it to say, when purchasing equipment, be ready for costs not mentioned in a brochure.

In addition, getting a machine up and running may take longer than expected. If you think you'll be producing chips within 8 weeks, plan for 16.

Facility improvement can be another minefield. Adding to an existing facility or building a new place can be a great investment and take your shop to the next level. It can also bust your initial budget if you're not careful. Along with everything else,

materials, labor and utilities are an ever-growing expense. Also, consider the cost of city or county permits, OSHA compliance, expansion of the phone and security systems, and Internet connectivity.

On the flip side, savings may also be hidden when expanding, so don't hesitate

to contact your chamber of commerce or economic development board and inquire about potential tax abatements or grants. After all, you're adding jobs and increasing the tax base. The worst they can say is "no." If so, check on availability of tax abatements and grants in the next county or city. There are numerous tactics available to the shrewd and persistent, so use them.

Insurance, state and other regulations, taxes, freight and other hidden costs will eventually surface and add to your financial risk. Don't be caught by surprise. Put the armor on, saddle up and prepare for battle. Eventually, one of America's best and biggest machine shops could have your name on it.

CTE

e thought of your shop growing into a powerhouse manufacturing enterprise sounds great, and it's likely within reach for many smart owners and managers—but watch out!

**About the Author:** Keith Jennings is president of Crow Corp., Tomball, Texas, a family-owned company focusing on machining, laser cutting, metal fabrication and metal stamping. He can be e-mailed at [kjennings@jwr.com](mailto:kjennings@jwr.com).

# Beauty is only 0.013" deep

By Bill Kennedy, Contributing Editor

Looks can be deceiving. Producing a simple-looking part can require a surprising amount of effort, skill and expe-

rience. Grinding services provider Arrow Grinding Inc., Buffalo, N.Y., grinds a family of parts that appears simple but require integrated application of various grinding capabilities.

The parts are thin spacers that fit between grinding wheels in a grinding machine wheel pack. A typical application for the wheel pack is plunge grinding. Accordingly, controlling a spacer's thickness and concentricity is crucial. If spacer thickness is out of tolerance, parts will be ground to the wrong dimensions. Out-of-specification bore size or concentricity will create vibration that degrades surface quality of the part being

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B. Kennedy

Arrow Grinding employs various grinding methods to produce steel spacers as thin as 0.013" in diameters from 5.5" to 7.8".

ground and possibly lead to bearing deterioration in the grinding machine itself. Flatness and parallelism are also critical in assuring that the grinding wheels are correctly aligned.

Arrow grinds the spacers to four different thicknesses, with the thinnest measuring 0.013". Each thickness is produced in sets of 21 different diameters from 5.5" to 7.8".

The spacers are made from 16-gauge, low-carbon, cold-rolled sheet steel. A waterjet cuts the sheet into disks matching the spacers' rough dimensions, including a central hole. Waterjet cutting minimizes the introduction of stresses into the 0.059"-thick material, helping ensure that it will lay flat later.

Arrow works from customer-provided prints. The center bore is ground first, on a Heald ID grinder. Special fixtures are required to grind the 1.250"-dia. bore to

a 0.001"/-0.000" tolerance. That ground bore is then used to locate the part on a Shigiya cylindrical grinder, where additional special fixtures hold the spacer while its OD is ground to size and concentricity within 0.001."

Next, a 42" Blanchard machine grinds the workpiece to near-final size. For a spacer that will be 0.013" thick when completed, the Blanchard grinder removes stock to a thickness of 0.016". Arrow President John Goller said the surface finish is not crucial at this point, but "We have to keep it somewhat controlled on flatness, parallelism and finish so when we go to finish it on the surface grinder, we are not correcting anything."

Next, the spacers are lapped with 320-grit abrasive to establish flatness. The lapping takes place on a SpeedFam machine. A hydraulic plunger descends on the part, which floats freely on the machine table within a ring larger than the spacer diameter. "After one side is flat, then we can use the magnet on the surface grinder to pull it down and then bring the other side into parallelism and flatness," Goller said. Flatness and parallelism need to be within 0.0003".

A magnetic chuck holds the spacers on an Okamoto surface grinder during grinding, which employs a 2"-wide aluminum-oxide wheel. According to Jim Whistler, Arrow process designer, "Surface grinding the low-carbon, 0.016"-thick material to 0.013" proved quite challenging. Parts that thin don't necessarily stick to a magnetic chuck very well, and if the material-removal rate is at all aggressive, the part will burn due to its thinness." Whistler said selecting the proper grinding wheel, mrr and coolant is critical, as is the operator's skill. The surface grinding imparts a 16µin. R<sub>a</sub> finish.

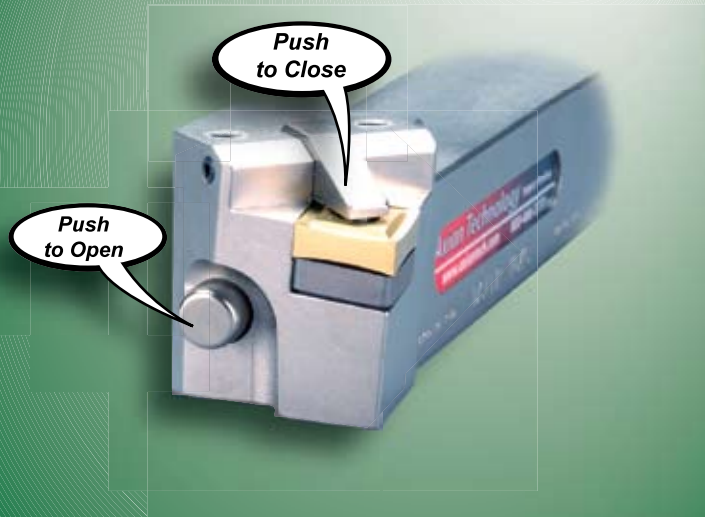
Goller said Arrow's range of grinding

capabilities made the spacer job a good match for his shop. "A lot of other shops didn't want to touch it because it is difficult to hold the ID and OD tolerances, the concentricity and flatness, all while holding a tight tolerance on the thickness and producing a good finish. Bringing all those together is a difficult achievement;

without the right equipment, I don't think you'd even want to attempt it. We handle a number of grinding disciplines in-house and control them all." **CTE**

For more information about Arrow Grinding Inc., call (800) 37-GRIND or visit [www.arrowgrinding.com](http://www.arrowgrinding.com).

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# Credit crisis for manufacturing?

By George Weimer

The recent subprime mortgage meltdown has already cost U.S. homeowners, U.S. businesses and foreign investors untold billions of dollars. The losses are likely to continue into next year. But is there a liquidity crisis developing in U.S. manufacturing?

Judging from comments from various machine tool builders, these are challenging times for capital investment in some markets, while other markets—so far—have had far less difficulty gaining access to credit.

“During the last few months, several large sources of equipment financing have left the market, leaving some customers not knowing who to go to,” said Bruce M. Hill, general manager-customer financing, Mazak Corp., Florence, Ky.

Mazak, like other machine builders, helps customers facilitate machine tool purchases—even with the exit of some second-tier lenders (nonbank financial institutions). “We make [financing] simple for them insofar as we already have the machine order, we know when it will be installed, and we have the invoice, so there is no need to ask them for that data or follow up to monitor shipment or installation status. And we already have a machine deposit that can be partially applied as advance rent or a down payment if needed,” Hill said.

The financing landscape has clearly changed. With an increase in the cost of funds from major banks for machinery purchases, many shops and manufacturers are applying for funding at better terms from machine builders.

One factor driving this trend is that when banks have less to lend, they look for safer loans, and machine tools are not traditionally seen as the safest investments because they can't be easily liquidated. One source noted that the typical machine tool depreciates 10 to 15 percent immediately after installation in a shop.

When it comes to financing, not

all machine shops are alike. Some machine tool builders said their sales are up and the outlook is positive. Financial health depends not just on the size of the customer, but also specific market conditions, according to Harry Moser, chairman of GF AgieCharmilles, Lincolnshire, Ill. He pointed to “low current lease interest rates and the good availability of lease financing” that have contributed to a recent surge in North American sales at GF AgieCharmilles.

“In July, machine shops grew and the delinquency rate on machine tool leases

petrochemical companies and parts manufacturers for oil drilling and processing companies generally have little difficulty finding credit.

Customers of Haas Automation Inc., Oxnard, Calif., are not facing the same problems as suppliers to the housing market, according to Justin Snyder, operations manager for Haas Automation's finance company, CNC Associates, also in Oxnard. “Right now, a very small number are struggling,” he said. “I would have thought there would have been a domino effect by now [but] we see growth worldwide.”

Still, he recalled that the aftermath of 9/11 “was bad, especially for aerospace suppliers. People just cancelled orders for planes.” However, Haas made special payment arrangements for customers after 9/11. What if there is a downturn in the metalworking market due to the subprime mortgage crisis? “We would adjust,” Snyder said.

So are liquidity problems affecting machine tool purchases? Perhaps, but it does not appear to be a problem for everyone. “The liquidity crisis is serious, and I would expect it to drive more banks to merge, some leasing companies to leave the machine financing market and some funding sources to greatly reduce the amount of broker business they entertain,” said Mazak's Hill.

His advice to shops interested in upgrading their machine tools or purchasing new ones is the same as that of other builders. “Talk to us. We have the most motivation to arrange attractive financing to buy the current machine and more machines in the future,” he said. **CTE**

With an increase in the cost of funds from major banks for machinery purchases, many shops and manufacturers are applying for funding at better terms from machine builders.

dropped,” he said. “The delinquency rate on machine tools is about a sixth of the delinquency rate on home mortgages. In some ways, the housing credit crisis has provided some support for manufacturing [through lower interest rates and a drop in the U.S. dollar], partially offsetting the impact of reduced production of household appliances and other housing-related products.”

The housing crisis caused the U.S. Federal Reserve to cut interest rates. According to Moser, “The lower interest rates help keep short-term corporate borrowing costs low and have helped produce a dramatic reduction in the value of the dollar against other currencies. These trends have led to higher exports and lower imports.”

Meanwhile, the AgieCharmilles Machining Business Activity Index decreased to 59 in July from 61 in June. A reading above 50 means business activity is increasing. As previously noted, some markets have ready access to capital. For example, in the current market

## About the Author:

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# Lapping basics

By Frank Marlow, P.E.

Lapping is a machining process that uses loose abrasive materials usually in oil, grease or water. Lapping is done manually or with a machine to:

- Remove tool marks remaining after machining.
- Polish and refine the surface to make it extremely smooth.
- Make adjustments to a part's final dimensions; tolerances from 0.0005" to 0.00002" can be achieved.
- Shape a part rather than just smooth its surface.
- Correct out-of-shape conditions, such as out of roundness, tapers, bell-mouthing, barrel shapes and off-axis conditions.
- Produce two mating surfaces, such as piston and cylinder pairs and opposing flat surfaces in a sliding valve.

Most lapped work is either flat or cylindrical, but tapers and other shapes are possible. Lapping is characterized as

a two-direction process: flat lapping is performed by moving the work in a figure-eight pattern, and cylindrical lapping turns the lap and moves it back and forth along the work axis.

## There are four basic types of laps.

■ Flat lapping plates for roughing are usually made of cast iron with a series of small grooves at right angles about 1/2" apart, in concentric circles or in a helix. These grooves improve the abrasive distribution. Flat laps for finishing are smooth cast iron plates. However, 1/2"- or 3/8"-thick plate glass may also be appropriate for less critical jobs.

■ Internal laps have an outer lapping surface and an inner tapered mandrel or expansion plug. Helical slots are usually cut in the lap so it can expand and contract. Longitudinal slots are fine for many jobs and are used on many shop-made laps for simplicity. Cast iron laps are best for precision work, but brass, copper, aluminum or lead ones are also

used. Many laps have radial grooves for distributing abrasive.

■ Needle eye laps are used for small holes from 0.026" to 0.25" in diameter. The adjustment tool fits into the grooves on the side of the lap and the lap expands when tapped or squeezed. These laps are usually cast iron.

■ External laps may have either helical or longitudinal slits.

## Various abrasives are available for lapping.

■ Aluminum oxide ( $Al_2O_3$ ) is also called alundum or fused alumina.

■ Silicon carbide (SiC) is available in two forms: green and black. Green is not as hard as diamond. The black form, also known as carborundum, is not as hard as green SiC.

■ Diamond is the hardest abrasive.

## The following is a general approach to performing flat lapping.

■ Spread a thin layer of abrasive over

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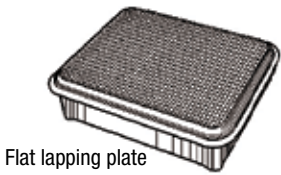
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Flat lapping plate



Cylindrical brass lap assembled



Cylindrical brass lap apart

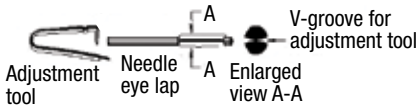


Helical internal lap with radial grooves

Helical internal lap



Arbor for helical internal laps



Adjustment tool

Needle eye lap

Enlarged view A-A

V-groove for adjustment tool



External laps and their holder

Pamela Tallman

A selection of various lap designs.

the lapping plate and press it into the lap with a steel roller. Remove loose abrasive and inspect the lap for a uniform gray appearance. Repeat if necessary. Do not apply or leave excessive abrasive on the plate because it will tend to roll rather than cut.

■ A workpiece is placed on the lapping plate and moved in a figure-eight pattern for 30 seconds to 2 minutes. Never add loose abrasive directly to the lap. Charge it as indicated above. Be sure to examine the work.

■ Lapping may continue using this abrasive or the plate may be cleaned and a finer abrasive applied.

■ Lap with progressively finer abrasive until the desired surface finish is imparted. Do not apply excessive pressure to the work as the abrasive only cuts so fast.

Careful cleaning of the workpiece and lapping plate is needed when changing to a finer abrasive because residual abrasive particles will scratch the work and prevent imparting a smoother surface. Ultrasonic cleaning is often used to remove

the abrasive from the workpiece. **CTE**

**About the Author:** Frank Marlow, P.E., has a background in electronic circuit design, industrial power supplies and electrical safety and has worked for Avco Missile Systems, Boeing, Raytheon, DuPont and Emerson Electric. He can be e-mailed at

orders@MetalArtsPress.com. Marlow's column is adapted from information in his book, "Machine Shop Essentials: Questions and Answers," published by the Metal Arts Press, Huntington Beach, Calif.





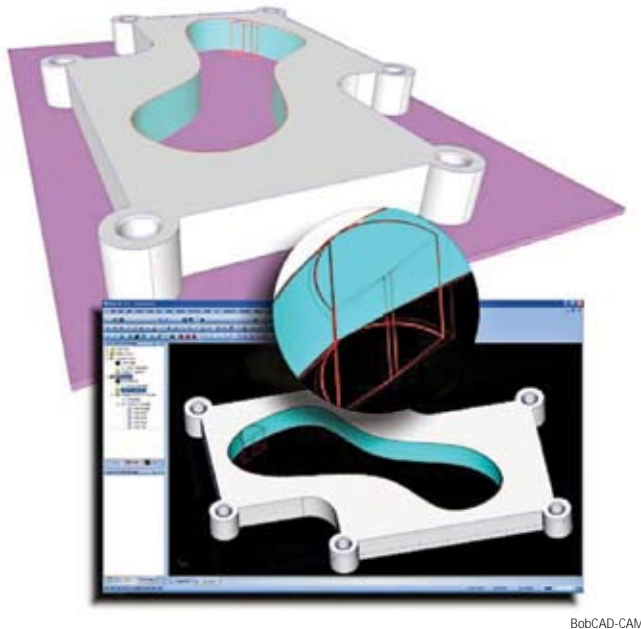
# Wire EDM software and more

This issue's "Get with the Program" examines three new manufacturing software packages.

Version 22 BobWire is Clearwater, Fla.-based **BobCAD-CAM's** new 2- and 4-axis wire EDM CAD/CAM software. BobWire is a solids and surface CAD system with an expanded list of import file types, and operators can bring in an outside design or use BobWire to design the part in-house. Built-in toolpath associativity between the part geometry and the wire machining features in the CAM tree manager make on-the-fly geometry edits or modifications of cutting variables easy, according to the company.

New features include automatic open- and closed-shape machining, operator-definable cutting conditions for different machines and the ability to specifically assign cutting conditions to part files for future use. Other features include multiple wire approach types, land and taper options for 2-axis part making, as well as match point features that enhance control when programming complex 4-axis parts.

In addition to standardizing wire EDMing technology in CAD/CAM, the new version offers hole programming capabilities to be built into the system if a shop has a separate hole-making machine.

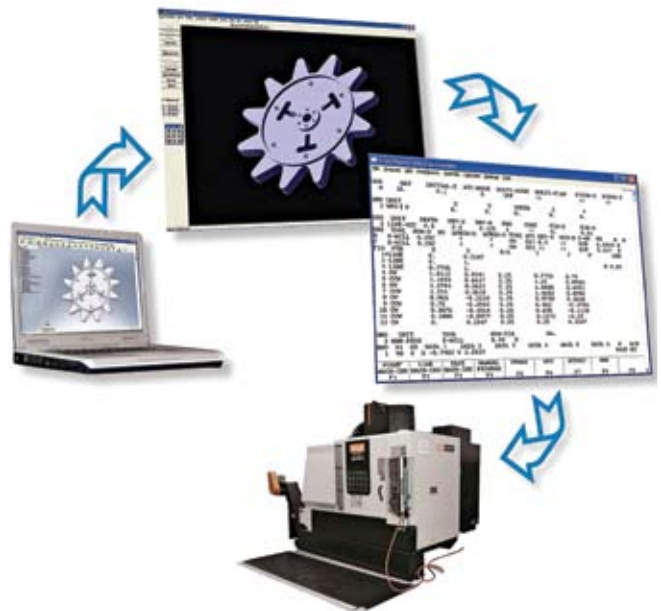


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Call BobCAD-CAM at (877) 262-2231 for a free demonstration or visit [www.bobcad.com](http://www.bobcad.com).

**SolutionWare Corp.**, San Jose, Calif., has released MazaCAM CAD/CAM and Editor—Matrix Edition Version



SolutionWare

4.6. This latest edition of MazaCAM includes enhancements to help shops with Mazak machines program those machines or convert programs from one machine to another. One enhancement converts a 3-D Mazatrol program into another Mazak control. With this feature, rewriting 3-D Mazatrol programs manually to another control is eliminated, reducing programming time and expense.

With the increasing cost of programming and reprogramming parts already proven on other machines, SolutionWare says Mazak shops are looking for ways to improve productivity and delivery time. And although most Mazak controls can up-convert the prior generation or two, converting to Matrix is a more extensive task than with previous generations, according to the company.

Anyone can convert by copying the program by hand and entering it into the new Matrix control, but that's a tedious and error-prone method. MazaCAM transforms the legacy Mazatrol programs to the new Matrix controls, saving time and minimizing labor.

Many customers who buy a milling-based Mazak e-Machine also have an earlier turning-based Integrex machine. MazaCAM converts between these different control families while handling literally hundreds of tricky nuances, according to the company. MazaCAM handles Mazatrol programs from the earlier generations of Integrex: T3, T32, T-Plus, Fusion640MT and Fusion-MT-Pro.

For more information, call (888) 322-3226 or visit [www.solution-ware.com](http://www.solution-ware.com).

Vericut 6.2 is the latest version of **CGTech's** CNC

machine simulation and optimization software. It includes enhancements that increase the ability of manufacturing engineers to develop, analyze, inspect and document the programming and machining process.

A new "NC program preview" offers an option to process an NC program in Vericut without actually simulating material being removed. This quick check uses less memory. When in preview mode, the software displays a tool trace of the NC program over the design model. Preview mode checks for collisions, gouges, minimum excess and instances where axis limits are exceeded. At the end of the preview, Vericut enters NC program review mode.

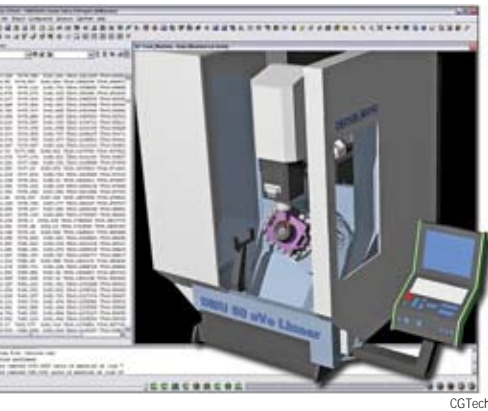
CGTech has added several new utilities to the NC program review window, including calculator, user-configurable text coloring, syntax checking and block renumbering options. The syntax check enables users to check the NC program for syntax errors based on user-defined criteria. Users can turn on or off Vericut-defined syntax checking rules (error conditions) and define custom syntax checking rules. Users who manually create and edit NC programs can now trans-

ferred to enable users to describe the shape, position and orientation of a waferjet cutter or a tap in a tapping tool assembly.

In addition, the software now supports simulation and analysis of tapping operations. Tapped holes are visually dif-

ferentiated from other drilled, bored or reamed holes. Vericut checks for the correct feed rate and direction when applying a tap and detects if the tapped hole was predrilled too small.

For more information, call (949) 753-1050 or visit [www.cgtech.com](http://www.cgtech.com). CTE



CGTech

fer NC blocks from the MDI window directly into the NC program.

CGTech has added a turret setup wizard to the milling tool setup wizard introduced in Vericut 6.0. The turret setup enables users to load, change tools or change tool positions in a turret. Users can also create a swept model of a turret.

The tool manager has also been en-

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When Second Best Won't Cut It





By Michael Deren

# To get new ideas, offer rewards

Does your facility recognize and reward employee suggestions and achievements? If so, how is it done? Does the supervisor at least provide a pat on the back for a job well done? Or does a manager recognize achievement during a company meeting? Or, better yet, are employees financially motivated to contribute? Companies may not get viable ideas from their employees when they provide nothing in return for those ideas.

Suggestion boxes are an inexpensive way to solicit ideas. A few locked suggestion boxes placed throughout the plant and office areas will do the trick.

Also, select a suggestion plan committee that meets monthly. Committee members should represent both the shop and office. The authors of suggestions that are acted

on should receive a monetary reward. No managers should be on this committee—they only impede the process by causing other members to be intimidated from voicing their opinions. I once allowed a manager to observe a suggestion plan meeting. What a disaster! Everyone became intimidated and self-conscious. Conversation did not flow as it normally did. In addition, the manager went beyond his observer role and made comments and suggestions about award amounts. Eventually, I had to ask him to leave the meeting because he was interfering. The next day, he apologized after realizing what had happened.

The possible exception to this rule is a human resources manager. The HR manager can act as a facilitator but without voting rights.

When I was chairman of a suggestion committee years ago, monthly meetings lasted no more than an hour, depending on the volume of suggestions. There were five of us on the committee, representing about 75 employees. Having an odd number of committee members prevented having a tie during voting. Also, a suggestion's author was never mentioned until after an award amount was determined to eliminate any

possible bias. Suggestions varied from safety issues to more direct money-saving ideas.

We awarded cash for all winning suggestions. The minimum amount was \$20, while the largest was 10 percent of the company's savings during the first year of implementation. The largest award, back in 1986, was \$9,500 for a new way of sealing plastic floats. Today, I suggest presenting cash for awards more than \$50 and gift certificates for lesser amounts.

Suggestion plan results were posted within a week of our meeting. The results listed the suggestion

authors, their idea(s) and the amounts awarded. If your company publishes an employee newsletter, the results can also appear there. Posting the results is an incentive for others to begin making suggestions.

Another method for

recognizing employee contributions is an "employee of the quarter" honor. No, I'm not talking about the type of photo placed prominently on a wall at the local burger joint every month. I'm talking about a write-up that's posted on the company bulletin board or the company newsletter. Where I work, the employee is given a monetary award plus a paid day off of their choice.

These plans are for nonmanagement employees. As such, management should not be allowed to participate either as part of the selection team nor as those providing suggestions. Managers also should not be nominated for awards in the company. Their suggestions are expected. After all, they get the "big bucks." Otherwise, the recognition plan would appear to be management favoritism. These awards should only be for the hourly and salaried nonmanagement personnel, the ones who could really use them.

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Companies may not get viable ideas from their employees when they provide nothing in return for those ideas.

**About the Author:** Mike Deren is a manufacturing engineer/project manager and a regular CTE contributor. He can be e-mailed at mderen1@roadrunner.com.