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December 2006 volume 2 issue 12

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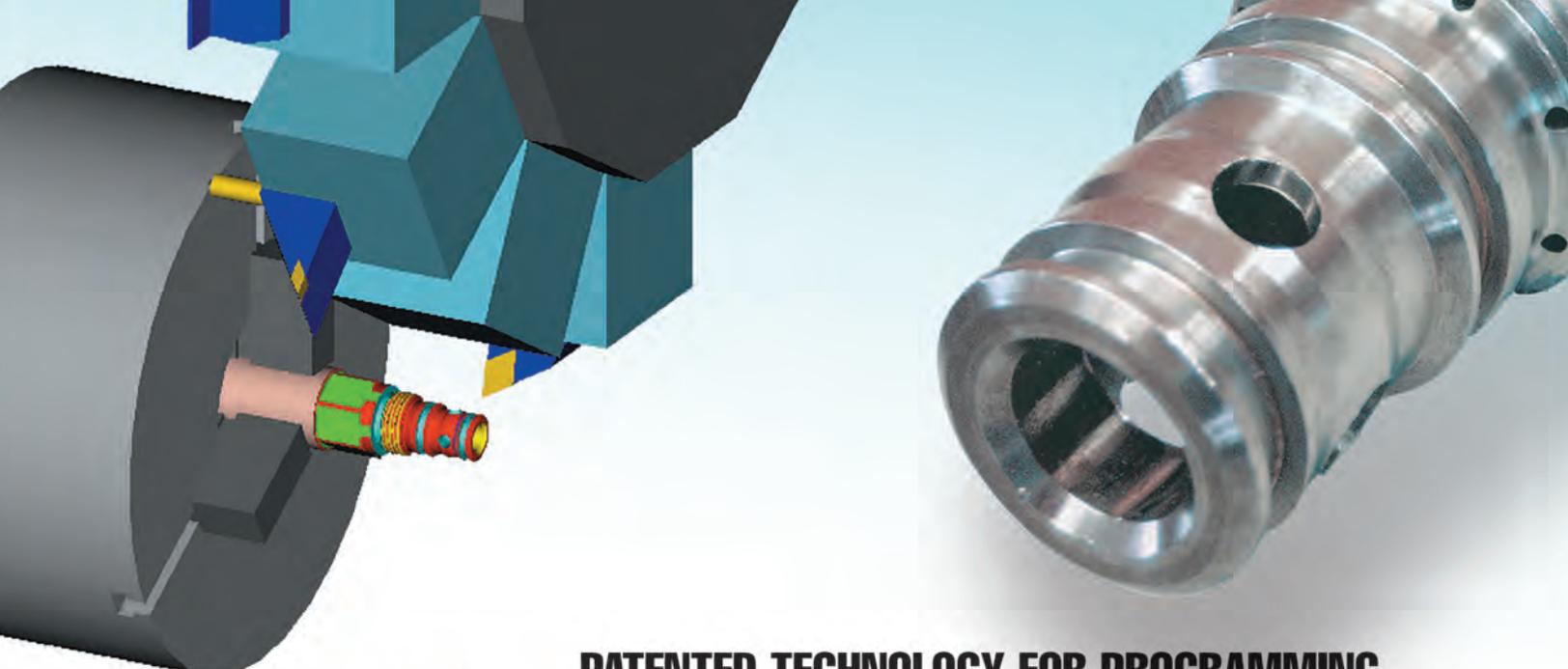


The Art of Printing Parts

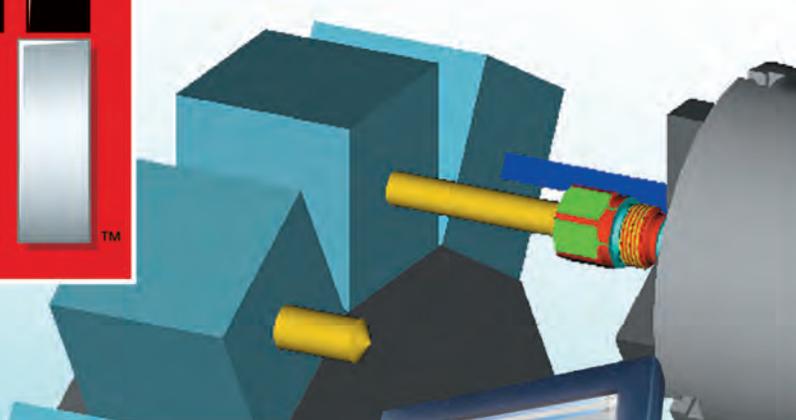
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editor's note

Mission Possible

When I started *Today's Machining World* six years ago, I wanted to chronicle what was going on in the business, but also make intelligent speculations about what was likely to happen in the future. In this issue we feature an interview with Larry Rhoades of Ex One about a potentially dramatic paradigm shift in manufacturing technology.

Rhoades is a visionary who believes that a significant piece of manufacturing will move to the synthetic building of product through a process suggested by ink jet technology, where powder is layered and bonded to make a widget rather than scraped and cut from bar or formed by stamping or forging. The potential savings in energy, raw material, space and labor make this concept stunningly compelling.

We also talk about the short-term future in our annual survey on purchasing plans. A lot of the current macro data from Washington indicates a slowdown in the general economy because of the dampening influence of high energy prices. Our sampling, done with meticulous care by Irwin Broh, an outside consulting firm hired by *Today's Machining World*, gives us a focused view of a sizable sampling of *Today's Machining World* subscribers. As a person who makes his living in the machining world, this is the stuff of decisions going into 2007.

I am absolutely serious about the challenges our industry faces. Recession, outsourcing, collapsing Tier One automotive, technological shifts, shrinking labor supply; these are topics we're not afraid of here.

Somebody needs to interpret the trends of the day. This is our mission.

Lloyd Graff
Editor/Owner

editors note

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Shop Doc Critique

I was enjoying the October edition of *Today's Machining World* (especially the V-S Precision article) until I came to the Shop Doc article (a debate on what type of tool is most effective for centering a tool). I was appalled at the malpractice in the article on spot drilling. I knew the technical source could not be an experienced screw machine tooling engineer – most likely a CNC guy who has never had to get such tooling to perform at very high production levels.

Let's set the record straight for those who have been misled. You want the spot drill angle to be less than the drill angle, so that the outer lips of the drill engage the conical zone left by the spot. A common application requiring a spot, drill, tap sequence on a screw machine would typically be tooled with a standard 90 degree spot and drilled with the standard 118 degree tap drill.

The Doc said to prep the hole with a point that would hit the center of the cut first. The problem with this proposition is twofold. 1: If you look closely at the bottom of any spot cut or any drilled hole, you will observe a flat bottom in the very center. This flat bottom will create a dance floor for a drill if you allow

the drill to hit this center first. 2: By not providing for the outer lip of the drill to engage the conical edge of the hole first, you do not give the drill the pull to center needed to draw a very flexible tool into the central axis of the part.

This same principle applies to following one drill after another and is explained in an old engineering manual published by Index, "Calculating Cycle Times and Designing Cams" on page 34. It states, "In work which is centred, and in the drilling of stepped holes in successive operations, the succeeding drill must centre itself at its outside diameter in the conical portion left by the preceding drill. The centring drill must therefore have the smallest point angle, and the smallest drill the largest."

Using this approach you can even get a multi-spindle with an inherent alignment error of .003 TIR to drill holes at .002 TIR. Unfortunately, many of today's CNC guys never learned what the seasoned screw machine guys know about how you get tooling to really perform at the very highest productivity and quality levels.

Bill Cox
Cox Mfg. Co., San Antonio, TX

Rowe's Rebuttal

I am holding a page from the Hanita (owned by Kennametal) catalog featuring the new 145 degree angle spot drill and their explanation of its design and proposed success. This tool is about two years old, and once I tried it, it made me a believer. This is the concept/theory I have preached ever since. The only thing I have improved on is designing and selling a 3 flute version of the 145 degree spot drill, which makes a truer round spot feature with the blunter angle. This tool is paying big dividends for many customers.

I reviewed Mr. Cox's website on the company his father founded. I commend him for running his family's business for the last quarter century. My career has taken me through screw machine shops, large job shops, captive production facilities and medical machine shops running manual and CNC machines alike. I have run machines as a member of the workforce and a member of management. My career has now

taken me into the technical side of tooling for a tool supply company where I teach machinists on a daily basis.

I wonder why, if my comments were so horribly wrong, that there are so many 120 degree spot drills? Mr. Cox cited an example from an old engineering manual published by Index – I'm guessing World War II era. If we based everything upon theories from 1945, we would still be using bias ply tires. Could it be since the standard from older times was to have a drill point with 118 degrees, the drill manufacturers designed a spot drill with a 1 degree blunter drill point per side to enable the drill's point to engage in the bottom of the spot? With today's high performance drills utilizing 135-142 degree points, it would only make sense to follow suit with a 145 degree spot drill.

I was confused when Mr. Cox wrote, "Using this approach you can get a multi-spindle with an inherent alignment error of .003 TIR to drill holes at .002 TIR." Why would anyone be

running a machine that is that far out of alignment and accept a drill hole to be out .002? We CNC guys use drills today that eliminate the need for reamers due to their accuracy. To end the letter with a .002 TIR remark saying "high production and quality levels" is also confusing and contradictory to me. .002 is like using a blow torch by my standards. Mr. Cox's closing comment was: "Unfortunately many of today's CNC guys never learned what the seasoned screw machine guys know about how you get tooling to really perform at the very highest productivity and quality levels."

I suspect Mr. Cox has a problem endorsing CNC machines and "CNC guys." Typically there are machinists-turned-programmers-turned-CNC setup men, and then there are button pushers who might have a job title of CNC machinist without knowing anything about the machinist trade. Maybe this is the hurdle Mr. Cox is having trouble with.

Jim Rowe

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*Something on your mind?
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Have a Blessed Holiday Season

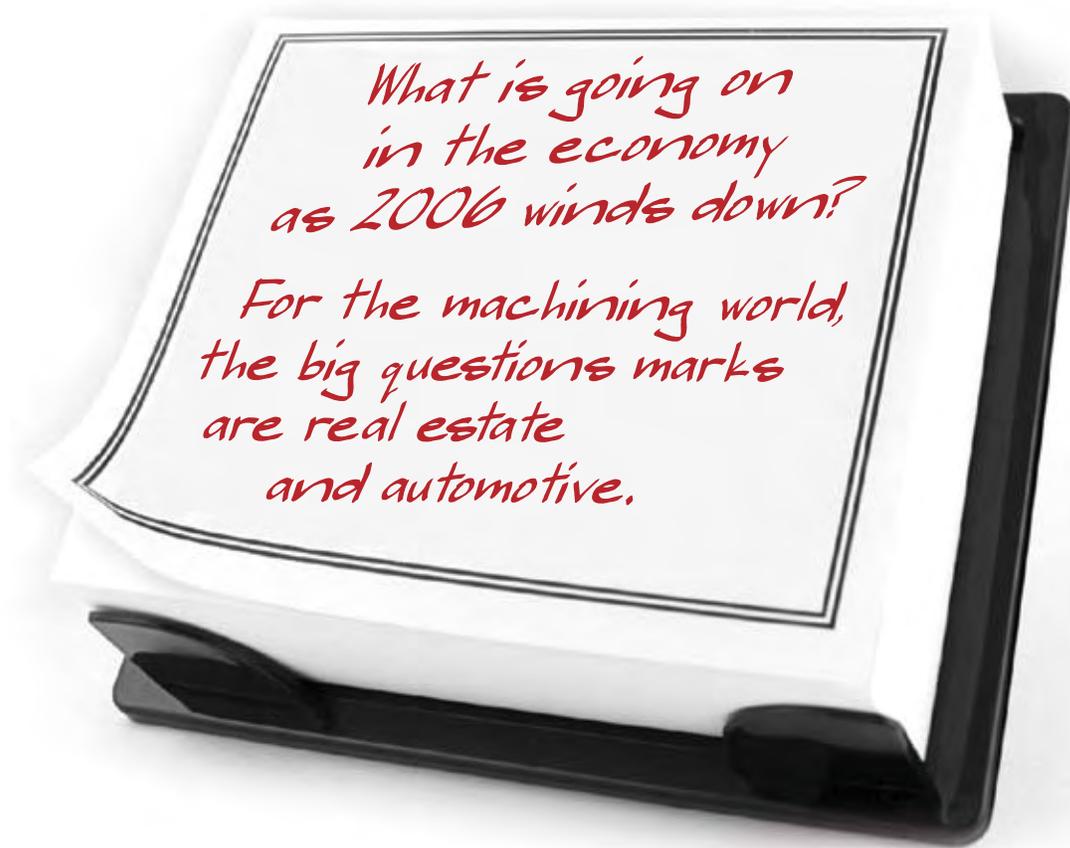


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2006 – A Recap

Homebuilding is now just north of awful. The post-Katrina bounce is over, the condo market is saturated, the spec buyers have gravitated to paintings and corn, and the homebuilders are not exercising their options on fresh ground. This means less plumbing, fewer dryers and a shriveling market for Bobcats. When will it stabilize?

Possibly when Ben Bernanke starts cutting short-term interest rates and gasoline hits \$1.75 a gallon. I think both are likely to happen later in 2007.

We are in commodity price retreat. Copper is at \$3 as I write this. It will hit \$2 a pound before it hits \$4. Steel sheet shipments are falling fast, but bar users are not seeing price relief yet. With Mittal now the Saudi Arabia of steel, we may not see lower pricing for awhile.

The macro stats show manufacturing is softening in the U.S. Nevertheless, the *Today's Machining World* survey is bullish about 2007 (see page 33). Our readers are evidently still

getting bullish signals from the marketplace.

Automotive from my vantage point is chaotic. The Dura bankruptcy in November is another jolt to remind us how riddled Tier One still is. Ford is in shambles. The big question is how long can it last at the current cash burn rate. GM and Ford have both been forced to pledge assets to support their credit lines. The total world demand for vehicles continues to expand but Toyota is chomping up the increase. For the machining world, the big issue is how fast can you start playing with the winners – i.e., Toyota, Honda and Nissan. And when will either GM, Ford, or both be building cars for the Japanese companies.

At this moment I am looking at a soft start for 2007. I am hoping that lower interest rates and profligate spending by state and federal governments in defense and infrastructure plus a boom in aerospace and firmness in agriculture will save us from a recession.

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The Wall Street Journal of November 8, 2006 published a well-done piece on the social history of a 100-year old warehouse on the Near North side of Chicago.

The story depicted the change in the usage of the 1.5 million square foot original Montgomery Ward building to show how Chicago has changed over the last 100 years as reflected by the current tenants in the now redeveloped property.

Where once young men on roller skates glided down the long aisles of catalog merchandise like buggy whips and fly swatters – today commodity traders and printing brokers stare at computer screens. Bankers Life has 200,000 square feet of office space, and Wrigley recently put their marketing department in a big chunk of space.

The Montgomery Ward property is a dynamic lesson in the fluidity of business today. Those of us who just want their work to stand still are doomed to fail.

The machining world is smack in the middle of the shifting climate.

Changing materials, foreign sourcing, new technology, internet connectivity, attrition of workers, bouncing currencies, challenge our world.

So how can you keep up with the swirling tides? With all the change, many of the basic truths of business prevail. I'll name a few:

Personal relationships. People still buy from other people. The decisive factor in establishing long-term customer relationships is often the one-on-one. The relationship will get you in the door. Then the performance must be world-class to justify the continuation of the relationship.

Specialization. Understanding what you do extremely well and building on that. If you do broaching better than anybody else out there, look for the broach jobs. If quick change is your forte, play that card. You cannot be good at everything, which makes it essential that you know what makes you money – and then market that part of your business zealously.

Branding. Your company has to stand for something more than a line item on a spread sheet. A brand is an enduring, authentic story about your firm, which is bigger than the parts you sell or even the personality of the owners, though they may be parts of the brand. Your advertising, your stationery, your packaging, receptionist's smile, building, salesmen's demeanor, are

swarf

all pieces of your brand. Even if you are a one-man band, you need to continually develop your brand.

Location. It helps to be accessible. Whether you are in San Diego or Sandusky you need to be available and responsive. Part of your location is your web visibility. You do not have to be next door to your client. You only need to feel like you are next door to him or her.

Chicago and the 100-year old Montgomery Ward building prosper today because they have the right brand, the right location. The building owners have developed personal relationships with key tenants, which bring new tenants. Chicago's brand as a dynamic, beautiful city that works keeps pulling young people into the old neighborhoods, which brings businesses who hire them and sell to them.

A building, a city, a business need leadership and creativity to project the authentic story, which ultimately brings the opportunity for success.

Adidas, the big German sports apparel company, recently bought Reebok for \$3.4 billion. Since buying the company they have spent only \$7 million for marketing the brand.

What are they thinking?

Sports apparel is all about the brand. Nike sends fabulous sums on their swoosh. Under Armour® is super aggressive in building its presence with edgy TV and print advertising.

Reebok used to be a viable number two player when Paul Fireman, who started the company, ran it too. Adidas spent a ton of money on its acquisition, then proceeded to starve it.

It isn't that unusual, even in machine tools.



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Fadal used to be a top brand in the small machining center space. Haas Automation became the Nike of the field with focused, relentless marketing. Fadal's founding family sold out to Giddings and Lewis, which fumbled the acquisition, and then dished it off to a German buyer who Reebok-ed it.

Now Fadal has been shuffled off to a New York buyout firm, which is trying to rejuvenate it, but the company is one of many in a highly-competitive market dominated by Haas.

The Adidas-Reebok debacle is a dramatic reminder of the fragility of brands, even powerful ones.

Another vivid example of flawed marketing in the North American market is DMG. The company seemingly changes its CEOs here almost monthly. It spends mountains of money on IMTS and then hibernates until the next big show. And then the Germans wonder why their market share stinks. Until DMG figures out and executes a consistent, relatable message for this huge potential market they will be an afterthought to Mazak, Mori, Haas and Daewoo, who connect with this machining world.

Adidas now admits that they have bobbled the Reebok takeover. Heads will roll. Money will be thrown at the problem. But once a brand is badly tarnished, it's not easy to quickly polish it up.

The Delta Faucet Auction, Chickasha, Oklahoma, orchestrated by Hilco on November 1, 2006 was a cameo of the market for screw machines and Hydromats. 1-1/4" RA-6 National Acmes, new in the 70s with threading brought \$6000-9000 with the buyer's premium. 1" RAN-6 Acmes of similar vintage brought a couple thousand less. A 2-5/8" RB-6, 1976 fetched \$12,500. Two 2" RB-6 National Acmes rebuilt by Ecorse in 2003 with direct drive and double threading by Logan sold for \$12,000 each, a stunningly low price compared to the cost of an Ecorse conversion today.

The Hydromat market showed some strength. Two mid-90s machines with dated Allen-Bradley CNC units brought around \$300,000 each. A non-CNC 1993 16-station sold for \$220,000. A disconnected HB 45-12, 1996, brought in from Delta's Jackson, Tennessee factory sold for \$175,000.

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There were several Buffoli transfer machines set up for plumbing parts. The machines would be difficult to retool. Chinese factories nibbled before the sale but the auctioneer struggled to find bids for the big machines.

Toolroom and quality control equipment brought strong market prices. Surplus raw material reflected the high current scrap prices. Bar racks and pallet racking sections in big lots sold for high auction prices.

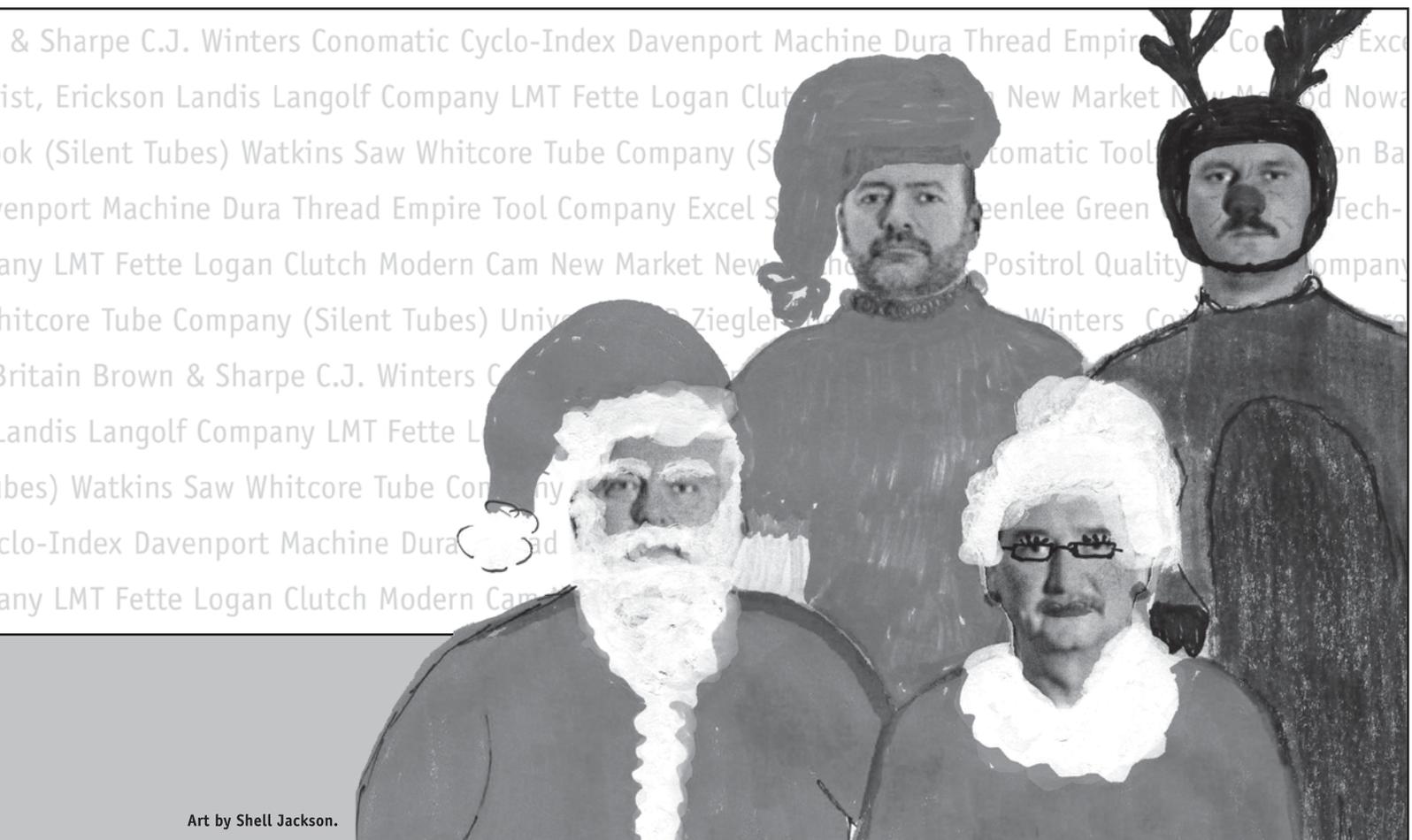
Michael Lewis, author of *Moneyball*, is my favorite writer on the planet. His piece on Bill Parcells of the Dallas Cowboys in the November issue of *Play*, the new sports magazine of the Sunday *New York Times*, is a masterpiece. Appearing the day after the death of "Red" Auerbach of the Boston Celtics, it is a picture of the totally driven joyless coach.

Lewis takes us into the daily anguish of Parcells as

the coach looks for weaknesses in his opponents and in his own guys. Parcells is a boxing nut. In the off-season, his idea of a good time is to hang around chloroxed fight gyms. Parcells sees the world through the prism of boxing. He believes games are often won and lost because one team quits at a crucial tipping point. Parcells cherishes the clippings of a long forgotten fight thirty years ago between Vito Antuofermo and "Cyclone" Hart, which Lewis relates to us through Parcells.

Hart was the better fighter, and he knocked Antuofermo all over the ring for four rounds. But Antuofermo absorbed the punishment dealt out by Hart, his natural superior. He did it so well that Hart became discouraged. In the fifth round, Antuofermo sensed Hart's discouragement and quickly attacked. Hart went down for the count.

Lewis recounts Parcells quoting his long saved yellowed article about the match: "When the fighters went back to their makeshift locker rooms, only a thin curtain was between them. Hart's room was quiet, but on the other side he could hear Antuofermo's corner-man talking about who would take the fighter to the hospital. Finally he heard Antuofermo say 'Every time he hit me with that left



Art by Shell Jackson.

hook to the body I was sure I was going to quit. After the second round, I thought if he hit me there again I'd quit. I thought the same thing after the fourth round. Then he didn't hit me no more.'

At that moment, Hart began to weep. It was really soft at first. Then harder. He was crying for the first time because he understood that Antuofermo had felt the same way he had and worse. The only thing that separated the guy talking from the one crying was what they had done. The coward and the hero feel the same emotions," quoted Bill Parcells to Michael Lewis. Parcells then ended with this comment, "This is the story of our last game. We are Cyclone Hart."

Bill Parcells, at this point in his career, can still synthesize the DNA of winning. The portrait that Lewis paints of Parcells, the man, makes me wonder if a sour, sullen, totally driven coach can mold a group of players into winners who will absorb the punishment and then deliver the decisive blows.

As I read Michael Lewis's piece I thought of "Red" Auerbach who knew how to savor a win. He would light a long chubby cigar on the bench when his team was comfortably ahead. It became his trademark and symbolized one of the greatest sports dynasties in the history of pro sports.

Auerbach loved his players. Bill Russell was his star and ultimately his protégé and successor as coach of the Celtics. Both men loved to win, and they also loved to laugh and celebrate. Auerbach loved the players and remained involved with the Celtics for 60 years – until the day he died.

I finished the Parcells article wishing the old football coach could absorb some of the Auerbach aura. Bill Parcells has won in every job he's had for forty years. Coaching is his life. It's his everything, and he can't allow himself even a smile, much less a cigar.

One of the great things about doing this magazine is finding out that people actually read it, and some even like it.

I received a call from Paul Ikasalo, the manufacturing

manager at F.H. Peterson of Stoughton, Massachusetts. Paul liked my Swarf piece in November when I declared my self-exile from the email world. He called me at 708-535-2200 and on my cell phone (708-380-8530) to say hello and endorse my email boycott. He hates the sterility and pollution of web messaging. We had a hearty conversation for twenty minutes discussing the business approach at his sixty-person job shop near Boston. Peterson does short-run stuff. Medical apparatus is an important component of their business. They run old school toolroom equipment, but have invested in CNC Toshiba boring mills in recent years, which are now their core machining capability. Business is good. They have been able to hold on to their machinists over a long period of time because they pay well and listen.

I also had a great conversation with Scott Volk of MetalQuest in Hebron, Nebraska, near Lincoln. He wanted to talk about my "radical proposal" Afterthought column regarding enlistment of young people in the machining world. He is heavily involved in an outreach effort at a local high school and junior college to tell them about the cool opportunities available. He says there is an active group of grass roots communicators in Nebraska and Kansas who are quickly getting traction in recruiting students into a manufacturing track. Their approach has been to get to know career counselors and invite kids into their factories for show and tells. When kids see the fun stuff in today's CNC shops, they bite. He says local junior colleges have filled their manufacturing-oriented classes to overflowing, because kids can see the payback.

Paul and Scott love the thrill of making things that are important. This is the story of manufacturing which has been so poorly told to the uninitiated french fry fryers of America. The new world of customized manufacturing, which is coming soon to a company or a war near you, is going to open up more opportunities, as making things when and where they are needed eliminates the advantage of off-shore manufacturing.



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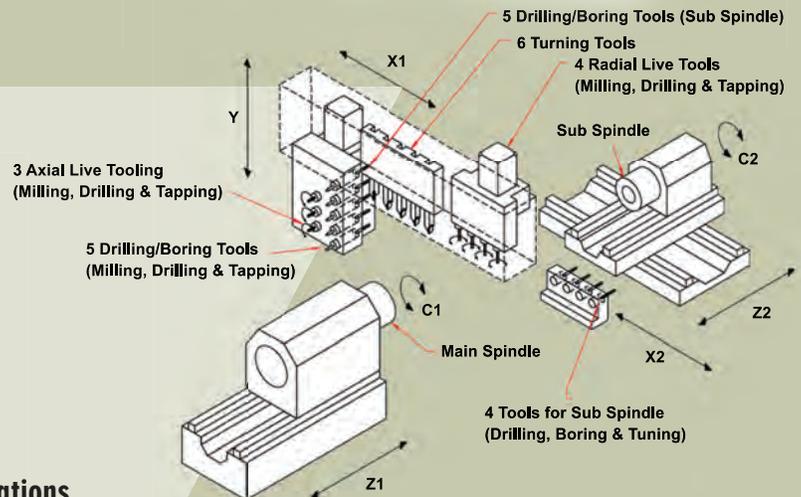
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book review

BY JERRY LEVINE

Enough

Juan Williams begins his controversial new book *Enough* with a short anecdote about an animation of Dr. Martin Luther King on the Cartoon Network's "Boondocks". In the cartoon, King stands on a pulpit preaching to gangster rappers in a fistfight, high school dropouts calling each other "nigger" and unmarried black teenage mothers dressed like prostitutes. King's face is twisted with disappointment, and his voice drips with disdain over what has become of his dream.

The cartoon's contents were gleaned from Bill Cosby's 2004 NAACP speech commemorating the 50th anniversary of Brown vs. Board of Education. Cosby, who has a doctorate in education from the University of Massachusetts, has been vilified for his speeches on the state of black education. Now Williams, an Emmy Award winning writer and radio and television personality, has come to his side. While the animated Dr. King was disappointed, Williams is angry and Cosby is livid.

Williams maintains that while there has been phenomenal progress in civil rights over the past 50 years, there is still much to be done, but it is being undermined by self-serving leaders, a culture of failure and a litany of phony excuses. Williams raises the banner of proud black traditional values – self-help, strong families and belief in God – that sustained black people through generations of oppression and flowered into the modern civil rights movement. He takes particular aim at such leaders as Jesse Jackson, Al Sharpton and Marion Barry, who he claims put their own vested interest ahead of the black community.

Williams contrasts the current black political and religious leaders with Booker T. Washington, Frederick Douglass, W. E. B. DuBois, Dr. King and Thurgood Marshall, who led people to educate themselves, strengthen their job opportunities and maintain solid families. Williams accuses today's black leaders of failing to make education relevant to the lives of black young people. He repeats Cosby's challenge, "What the hell

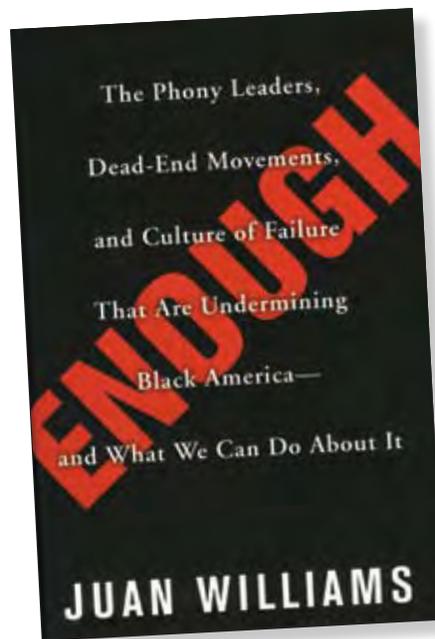
good is Brown if nobody wants it?" Williams and Cosby's solution revolves around personal responsibility and accountability. Williams complains that civil rights leaders never focus on parenting and the message that black families have the power to improve their children's education.

Today's black leaders prefer to call for increased spending. Williams calls this strategy shaky, because studies show that in most states, per student spending is higher in big

city school districts with large minority enrollments than in the rest of the state, but performance is still worse. Williams points out the close political alliance between civil rights leaders, Democratic politicians and teachers unions; their key concern is more pay for more teachers. What happens to the students takes a back seat.

Williams and Cosby keep asking the question, "How can one get out of poverty?" Surveys show that both blacks and whites agree that if you want to get out, you can. The 1996 Welfare Reform Act and the Earned Income Tax Credit provide considerable help, but Cosby's answers are even more plain and straightforward: 1) Graduate from school, 2) Be careful when you have sex and when you get pregnant (be over 21 and married), 3) Do a better

job of parenting, 4) Stay away from drugs and crime. To quote the Bible, "The Lord helps those who help themselves."



Comments? You can email Jerry at jerrollevine@yahoo.com.

Multi-Talented

Tornos Multispindle by Hydromat has introduced the MultiAlpha 6x32. This Tornos Multispindle by Hydromat has added 3 axis independent counter-spindle with 5 backworking tool positions and Integrated Independent Motorspindles. The MultiAlpha 6x32 unit is a 'ground-up' re-design featuring a 1.260" (1.340") diameter bar capacity with the work spread over 6 spindles. Each spindle functions independently of the others for



cutting RPM, spindle stops and indexing. With every position potentially being used as a C axis, transverse milling or drilling operation can be performed at any time and on all spindles. These spindles can be synchronized in angular fashion.

For more information, contact Hydromat, Inc., 314-432-4644 or visit the company website at www.hydromat.com.



Royal Treatment

Royal Products is now offering an expanded line of Accu-Length™ CNC Collet Chucks and accessories. New chuck models include 3J A2-5 and 3J 100mm small body chucks designed specifically for sub-spindles, and an S-26 A2-5 model that provides a large 2-5/8" gripping capacity for smaller machines.

Royal Accu-Length™ Collet Chucks are suitable for both main and sub-spindle applications and have a runout guarantee of 0.0003" TIR or better. The low-profile nose geometry has been optimized for tool clearance while maintaining high strength and rigidity.

For further information, please contact Royal Products at 800-645-4174 or visit the company website at www.royalprod.com.

fresh stuff

Featuring Fadal

Fadal Machining Centers has introduced a CNC vertical machining center designed for die/mold makers and parts producers. The new Fadal 2216FX addresses elements of rigidity, speed, and controls standardization/capability at a price of \$39,990 (excluding taxes, shipping and installation).

The machine features rigid box-way construction, Steinmeyer ETA+ dual-mounted ball screws for high accuracy, and 8,000 RPM spindle speed. The GE Fanuc Fadal oi-MC Control has over 200 advanced programming, operational and troubleshooting features.

For more information contact Fadal Machining Centers at 818-678-2286, or visit the company website at www.fadal-fx.com.



More From Mori

Mori Seiki has announced the release of the NV6000 DCG™, a mid-size vertical machining center with DCG (Driven at the Center of Gravity) technology, where the net driving force acts through the center of the axis. The NV6000 DCG contains five ballscrews – two on the Y-axis, two on the Z-axis, and one on the X-axis – that enable a significant reduction in vibration without sacrificing speed for accuracy.

Through the implementation of DCG technology, the NV6000 DCG is able to achieve a roundness of 1.59 μm in contouring. This level of accuracy is said to be 40% superior to what is attainable on conventional machines.

For more about Mori Seiki, please call 847-593-5400, visit the company website at www.moriseiki.com.



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Hardinge has introduced new Plate and Cube Trunnion Rotary Systems, which offer multiple part positioning. Plate and Cube Trunnions are made of free-machining steel for ease of milling, drilling and slotting. Hardinge 5C, 16C and 3J Rotary Systems are fully automatic, programmable rotary positioning devices that can be connected to a wide variety of host machines.

The Cube Trunnion is available for, or with, a Hardinge 16C/3J High-Precision Rotary System and provides four 4" x 19" (101.6 x 482.6 mm) mounting surfaces. Plate Trunnions are available for, or with, a Hardinge 5C or 16C/3J Rotary System.

For more information please call 800-510-3161, or visit the company website at www.hardinge.com.

Iron Tough



Sandvik Coromant has introduced GC1020 and GC3220, two new grades for the cast iron milling area, but provide reliable and secure performance in other tough milling

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Today's Machining World

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operations as well. Offered in a wide variety of inserts, both new grades will enhance already existing insert geometries.

GC1020 can be used when machining nodular cast iron and wet cast iron. The insert uses a unique PVD coating. GC3220 contains the thickest protective coating for a milling insert. The grade works for the dry machining of grey cast iron.

For more information, please contact Sandvik Coromant at 201-794-5223, or visit the company website at www.coromant.sandvik.com/us.

EXO-LENT



OSG Tap & Die, Inc. has announced a line of EXOCARB® Thread Mills for machining exotic materials like Inconel, Titanium and High Nickel Content Alloys. OSG combines special sub-micrograin carbide, which provides high hardness, and the multi-layered TiAlN coating, resulting in long tool life and excellent heat resistance.

Using only one thread mill it is possible to produce varying thread diameters of the same pitch, create right or left-hand threads, create internal or external threads, or use the tool for blind or through-hole applications. The EXOCARB® Thread Mills are available in standard inch and metric sizes and feature most thread types.

For more information please call OSG at 800-837-2223 or visit the company website at www.osgthreadmill.com.



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Mayfran International has introduced its VacuFilter™ cool-
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 all types of cutting fluids and lubricants. The VacuFilter is
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 The unit draws contaminated filters through a filter media
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For more information, please visit the company website at www.mayfran.com.

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The W55 Roughness Measurement System from Detroit Precision Hommel is designed to operate within a production line, acquiring and archiving measured values of roughness, profile and waviness, as well as tolerances for any parameter, or to continuously monitor production processes and to upload data to the user's statistics network.

For more information on Detroit Precision Hommel please call 248-853-5888 or visit the company website at www.dphgage.com.

Anti-Spatter



PICO Chemical Corporation has introduced PICO WELD KOTE, an environmentally-friendly water-based anti-spatter compound for protecting metallic surfaces against hot welding spatter.

PICO WELD KOTE contains no oil, petroleum, waxes, silicones, nitrites or any known carcinogens, and is non-staining, non-tacky and non-foaming. It can be sprayed or flowed on surfaces at ambient temperatures before welding to prevent hot spatter from sticking to work surfaces, welding gun nozzles, tips, jigs, and fixtures.

For additional information contact: PICO Chemical Corporation at 708- 757-4910 or email jmanfreda@picochemical.com.

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3-D Thinking

An interview with **Larry Rhoades**,
who thinks his on-site 3-D layered printing
could change the machining world.

LG: WE ARE TALKING WITH LARRY RHOADES, EX ONE'S CEO. LARRY, WHEN DID YOU GET THE IDEA OF DOING THIS LAYERED METAL PROCESS TO BUILD PRODUCTS?

LR: I've been involved since 1994. We were invited to join a consortium of companies developing the three-dimensional printing process MIT had invented with the objective of making plastic injection mold tooling. The group included United Technologies, Motorola, Hasbro, Johnson & Johnson's Ethicon Endo-Surgery group, and AMP, now part of Tyco.

WERE YOU INVITED FOR A PARTICULAR EXPERTISE?

We had experience working with United Technologies developing new manufacturing methods and were known for our skills at finishing – improving surface roughness. We were experienced in developing new manufacturing methods, then bringing them to industry. We ultimately learned enough about the process that we took on the task of implementing this technology. That meant a lot of refinement – from university level work to building a robust industrial manufacturing process.

COULD YOU DESCRIBE THE TECHNOLOGY AS SIMPLY AS POSSIBLE?

3-D printing assembles particles with a device like an ink jet printer. We spread thin layers of particles, from 50 microns to 500 microns thick, then send out little droplets of glue or binder from the print head. The glue droplets bind together the particles that will become the work piece. It's a constructive process – layer-by-layer manufacturing. On each layer we assemble the particles together that represent the cross-section of the work piece at that layer, then lower the "build box" one layer thickness, spread another layer of particles and do it again. The droplets seep through the printed layer to the previous layer so the part is all stitched together. In the end you have a box full of powder, most of it loose, but buried within the loose powder is the article you want glued together firmly enough to aggressively get the loose powder separated from the glued together stuff. In some cases that becomes the work piece in itself with no

BY LLOYD GRAFF



Photo: Larry looking into a sand-casting mold and core package of a vintage automotive engine.

further processing, which is what we do for sand molds – glued together sand particles. The ultimate metal part is made by pouring molten metal into the bonded sand mold to make a “casting.” For “direct metal” parts, we glue metal particles together, then put them into a furnace for a thermal cycle to sinter them. Either we sinter to full density and allow the workpiece to shrink about 15 percent in each dimension, or often we’ll just sinter lightly to fuse the particles without shrinking and use a second furnace step to infiltrate the tiny spaces between the fused particles with a metal having a lower melting point. Either way, we metallurgically bond them together, making a fully functional metal part.

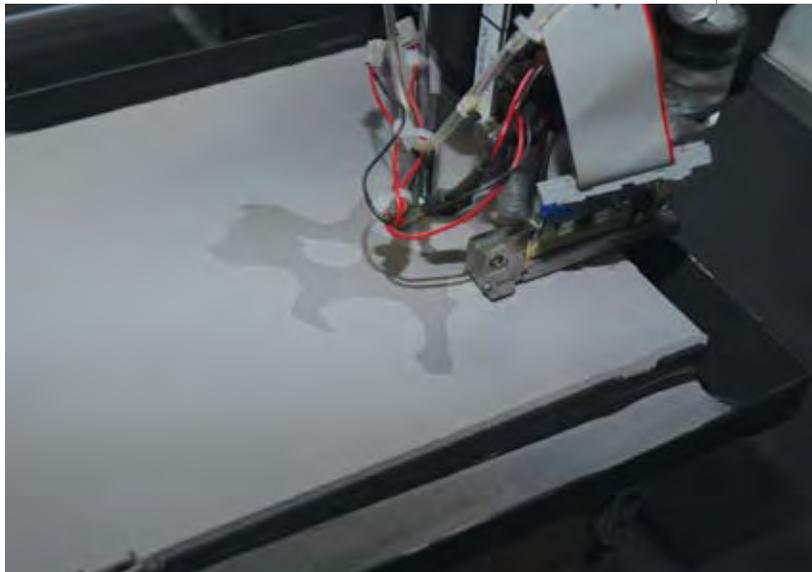
WHAT DO YOU THINK THAT THE SHORT-TERM, MID-TERM AND THE LONG-TERM POSSIBILITIES ARE FOR THE TECHNOLOGY YOU’RE DEVELOPING?

We’ve chosen three initial focus applications on the three critical dimensions of the process that we’ll continue to improve: speed, materials and accuracy. Our first initial application is sand molds for sand casting using big machines that build 30 cubic feet of product per day.

Our second focused area is plastic injection mold tooling. We can make complex internal passages, which provides thermal transfer and cooling within the mold. The challenge is to make very strong, hard materials. We’ve developed a fully sintered M4 tool steel material that can be hardened to 63 Rockwell C fully capable of doing plastic injection mold work with a 99% density. We make components that have complex internal passages that let you manage the surface temperature of the mold. This allows you to control the sequence and speed at which the injection molded parts are formed, improving precision and productivity.

The third initial application is making dental crowns, which we’ve launched after several years of development and a year long Beta test program with eight dental labs. This process makes gold “copings,” the foundation of a dental crown that must fit precisely on your tooth and prevents food particles from getting underneath the crown, causing decay. We can make these copings more precisely than present methods within a few hours, as opposed to three days. There are 40 million dental restorations done in the United States every year; three-quarters of those are gold copings onto which porcelain is then applied to make it appear like a natural tooth. Gold is chosen because it’s anti-bacterial and helps to prevent decay and infection.

In time we hope to converge these three dimensions of resolution, material performance and speed that these three initial focus applications are pioneering. We want to combine the ability to make all kinds of metal and ceramic products that have the net-shape resolution and precision we’ve learned to do in dental crowns with a



Above: Fabricate by 3D Printing: (1) Three-dimensional CAD information is converted into powder metal, ceramic or sand layer-by-layer by bonding loose particles with binder, (2) creating a physical object identical to the original CAD file, (3) that upon finishing results in a final Art, Part or Tool.

broad menu of high performance materials, like the tool steel that we've demonstrated in injection molds. Finally, we'd like to have the kind of productivity we demonstrate in producing sand casting molds – producing precise, complex parts at production rates measured in cubic feet per hour.

CAN YOU TELL ME THE ECONOMICS TODAY OF THE SAND MOLDS VERSUS THE OLD METHODS?

The principal cost driver for sand molds is the expense and time required for the production of patterns. Normally, sand molds are made from resin coated sand packed into patterns, which is then cured and hardened with an activator. For an automotive engine, design and production of prototype patterns typically take six weeks to six months and cost \$30,000 to \$150,000. That cost then gets amortized over the number of parts you're making, so the economics are volume-driven. In our process, volume and scale are relatively transparent, so times one or times 1000 doesn't matter that much. If you're making small volumes, our method is a much more efficient way to do it. You have them faster with much less labor involved.

WE SAW THE SAND MOLD MODEL YOU HAD IN THE IMTS EXHIBIT. IS THE MATERIAL BONDED TOGETHER OR CURED WHEN YOU PUT IT THROUGH A FURNACE?

With our process of producing sand molds the curing occurs in the printing, so there is no subsequent operation needed. We print the resin directly into the sand that has been pre-coated with an activator. When the resin and the activator combine, it cures. You need only to remove the surrounding loose sand in the build box to get your sand mold.

WILL THIS TAKE THE FOUNDRY BUSINESS BY STORM?

There are plenty of applications now that bring low volume castings into the game where previously they would have been whittled out of blocks of solid material. The process also allows the casters to get prototypes in the hands of customers sooner, so designs can be optimized quickly. Prototypes are made with the same sand, the same binder and with all the same characteristics present with pattern packed sand castings in full production, if the volumes are high enough to lead to that. We're finding applications where our molds can be used in production casting, especially for complex production cores to make internal features.

TELL ME ABOUT THE INTERSECTION OF ART AND THE PRODUCT YOU'RE DOING.

Artists have relatively unconstrained minds. Part of his or her mission in life is to explore boundaries and

reach beyond them; maybe there's some analogy there. Engineers are more constrained, since there is often great complexity involved in actually making things in production. The artists immediately "get it" and exploit the geometry freedom that this process allows, enabling them to make articles that couldn't be produced otherwise. The artists help us to demonstrate the potential design freedoms to the engineers making functional parts while reducing the amount of material used and reduce part cost.

DOES THIS MEAN THAT A ONE OF A KIND SCULPTURE MAY LOSE ITS VALUE SINCE IT'S NO LONGER GOING TO BE A ONE OF A KIND?

Well, it's still one of a kind as long as you don't make another one. I think it allows people to express themselves more readily than they could if they had to chisel their concept out of a block of marble or make a mold and cast it in the old way. I think it allows the artist to spend more time being creative and exploring ideas and less time being a craftsman executing the idea. It's the ultimate extension of Andy Warhol's factory.

CHRIS ANDERSON HAS WRITTEN A BOOK CALLED *THE LONG TAIL*. THE THEORY IS THAT, INSTEAD OF LOOKING FOR THE BLOCKBUSTER PRODUCT ALL THE TIME, THE MONEY IS MADE WITH THE LONG TAIL. YOU MAY HAVE THE SPIKE ON THE GRAPH FOR THE BLOCKBUSTER, BUT IF YOU LOOK AT A GRAPH, THE TAIL GOES ON AND ON AND ON. WHEN AMAZON GETS AN INQUIRY LOOKING FOR DANIELLE STEEL'S LATEST NOVEL, THE BUYER MAY ALSO BE INTERESTED IN STEEL'S SEVENTEENTH NOVEL. WHEN TRACKING WHAT THEY'VE SOLD, THEY FIND MONEY IS REALLY MADE ON THE LONG TAIL OF PRODUCTS, NOT THE BLOCKBUSTER. THIS "CUSTOMIZATION OF MANUFACTURING" APPROACH YOU HAVE IS IN SYNC WITH THIS LONG TAIL IDEA.

There are some immediate applications. When you think of vintage cars, aging weapons systems or out-of-production tools, there's a "long tail" and currently a big expense to supply spare parts. Even spare parts for your new Chevrolet – you go to the dealer and he never has the damn thing in stock, so it gets air freighted in from a warehouse somewhere. In the end, you spend more on airfreight than the cost to make the part. The cost of distribution exceeds the cost of production, and I find that out of balance and a big opportunity. We're after FedEx's money in the 3-D printing business. It's not just making the part, it's making the part so that it's where it should be when it's needed. There are no inventory risks, storage or transportation costs. We can customize it for the needs of a particular user, leading to what's called "point of use production."

WE DID A PIECE ON THE MASH HOSPITAL FOR HUMVEES IN IRAQ AND KUWAIT USING A MAZAK MACHINING CENTER. ORIGINALLY THE PLAN WAS TO HAVE A LASER POWDER MACHINE IN THE TRUCK, BUT THE TECHNOLOGY WASN'T THERE YET.

I can't comment on the laser sintering machine, but I would say one of our 3DP machines for making sand casting molds could be in that truck. You wouldn't need to carry an inventory of bar stock, just a furnace and material you can melt and pour into the casting mold, then do the finish machining with the machining center.

IS THERE POTENTIAL FOR DOING THIS ON THE MOON OR ON A SPACE STATION?

As long as you've got gravity, I think that's a very real possibility. This process even allows you to recycle, so if you have the ability to re-melt, refine and re-atomize the metal back into powders, you can keep making things from locally recycled materials. Whether it's a space station or a village in Wyoming or a battlefield or an oil rig, there is great value in having what's needed when it's needed with as little baggage as possible.

IT'S SOMEWHAT AKIN TO STARBUCKS IN THE CUSTOMIZED DRINK APPROACH.

Starbucks is pretty labor intensive in doing that. I think it reflects the customized manual method where manufacturing started. That's why we call it "manufacturing," because it was manual. As we began to automate the production process, we became more dependent on scale. That dependence led to the agglomeration of production, which led to what we now have in our societal structure around cities. These new processes change that. They allow you to de-scale and return to a village and have what's needed at the local general store that doesn't have inventory other than raw materials. That doesn't apply to everything, but that's really where the decentralization of production takes us. I think within our time we will see spare parts being produced locally with one-off design licenses from the original design owner. The owner gets his toll for his design effort, and we have a protocol that allows only one article to be made that way.

YOU ENVISION A ROYALTY ARRANGEMENT ON THE MANUFACTURE OF THE ARTICLE?

Well sure, you have to reward the designer, but the design can be done anywhere on the planet. It can be transported virtually for nothing and virtually instantly.

DOES THIS POINT TOWARDS PIRACY ISSUES?

It could if we don't develop a protocol to protect design rights. I think establishing a protocol and a global polic-

ing system that prevents pirated articles from coming back into the market they were created in is within our ability. I think for markets that don't respect intellectual design property rights, their entire economies should be penalized with an overall tariff rate that's related to a country's respect for design rights, as well environmental issues and human rights issues. All of that can be grouped into a system that provides incentives within the exporting nation for compliance. There are solutions to the inequities of the emerging global economy. Making millions of parts halfway around the world and shipping them, with the added expense and inconvenience, just doesn't make sense long-term.

WHERE'S THE SEED MONEY COMING FOR THIS PROJECT? IS IT MOSTLY BOOTSTRAPPED BY YOU OR FROM GOVERNMENT OR UNIVERSITIES?

It's a combination of all those things. It comes from our customers who have articulated what they've needed. There is seed money from the government, which is a large customer for defense products. It is in the position of being the only customer for many products, so it wants to see the methods used be as efficient as possible.

When you think of what the Defense Logistics Agency has to deal with – weapon systems that were designed in the 1940s and are still in use – how do they manage? They need to respond to military situations that they can't predict and then need a near immediate response with parts they don't have. They've made considerable investments in technologies that can accelerate the responsiveness of the industrial-base and reduce the risk of being "without" in the battlefield.

The process and many of its improvements were conceived at MIT, and we work with a number of other universities to further improve it. At this point, most of the investment in developing and launching this process has been mine personally.

THIS IS TERRIFIC AND UTTERLY FASCINATING. I'VE BEEN BLOWN AWAY BY WHAT YOU ARE DOING AND WHAT IT SUGGESTS.

I think that manufacturing is at a critical juncture, because conventional assumptions can be questioned and reconsidered. You can look back and see the evolution of how we got to where we are, and suddenly there's this breakpoint driven by processes like this. This process is driven by the fact that an ink jet print head and its controls can handle huge amounts of instructions every second and grow things from assembled particles.

IT SUGGESTS TREMENDOUS MEDICAL POSSIBILITIES TO ME.

That is the next wave and is what excites me the most. We have three programs now, and I'm looking to invest

in others, where our processes can make tissue scaffolds that become bone, tissue and, ultimately, organs. Organ assist devices are already in animal testing, and the possibility to make new organ scaffolds, which are incorporated into the human body and repopulated with the patient's own cells, is on the horizon. Making a pancreas is high on our list, and we're working on livers and lungs. Being able to make a tissue scaffold that is then infused with the patient's own cells to become a functional part of his body is, I believe, achievable within ten to twenty years.

WHERE DO YOU DREAM THIS TECHNOLOGY WILL TAKE US IN 25 YEARS?

I try to imagine a world in which conventional machining and 3-D printing were created at the same time. In conventional machining, there's probably more cost attached to tool storage, changing and maintenance than to manipulating the tool and the work piece. A manufacturing facility probably has nearly as much space devoted to tool calibration and maintenance as it does to actual machining. Because of the complexity of having all those different tools, each one having its own feed and speed information, its own cutter path profiles worked out ahead of time, conventional machining takes really big upfront planning effort that's the economic equivalent to "hard tooling."

When you think of what's involved in our process, assembling particles layer by layer, in many ways it's

much simpler. Layer by layer, we do the same thing over and over again. You don't have tool wear, and you don't need to wait for bar stock of a certain size to whittle down. All you need is powder. You can blend powders to make alloys, or selectively print alloying agents in the binder droplets – just like printing colors. I wouldn't be surprised if in 25 years about half the things that we make out of metal with conventional machining could be made more efficiently this way.

Whether you look at subtractive multi-tasking machining centers or Ex One three-dimensional printing systems, they are headed in the same direction – highly flexible machines that can make just about anything when it's needed, where it's needed, without all the waste of distribution. This new direction will make life easier, especially in places people want to live, close enough to the countryside to enjoy it, without having to tolerate getting in and out of places they'd rather not be. All the inherent technology and automation that enables this change, I think will bring us, ultimately, closer to Nature.



Right: Copings are made by assembling gold powder particles in layers, each 50-microns thick.



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2007 Annual Survey & Forecast

The annual survey of *Today's Machining World* indicates 2006 has been a strong year for the companies in our audience. It also shows a sense of positive momentum going into 2007.

This confirms the anecdotal evidence of an upbeat IMTS and a continuing positive tone to purchasing managers' data. Despite the huge trade deficit in manufactured goods, gasoline prices which tax the economy from top to bottom, and a bankruptcy a month in automotive land, the respondents to our survey still remain generally optimistic.

The questionnaire was mailed to 2000 subscribers of *TMW* who were selected randomly by a leading market research firm, Irwin Broh and Associates of Des Plaines, Illinois. Broh mailed the study on October 19, 2006. No incentive was included to promote a response. By the cutoff date of November 8, 2006, 375 surveys had been returned, representing a 19 percent response rate, unusually high for such inquiries, according to the Broh firm.

The respondents were 71 percent from job shops and 13 percent from captive operations. The bulk of the replies, 66 percent, came from people who described themselves

as "top management," with "manufacturing" the second largest category at 20 percent. More than 90 percent of the respondents specified that they had buying responsibility.

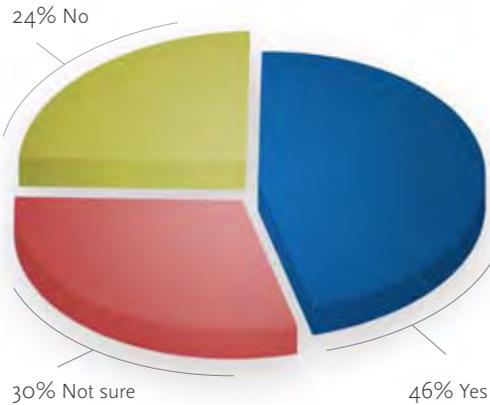
The data reveals that 67 percent of the respondents showed an uptick in business this year, while only 18 percent saw a slowing in their operations. This data was anonymous, which adds to its credibility. 19 percent of the growing firms project 20 percent or higher sales volume, while 61 percent were in the 5-20 percent category of increased sales in 2006. So the bottom line is that 2006 has been a kind year sales-wise to the readers of *Today's Machining World*. The survey did not factor in the possibility of higher prices because of raw material increases passed on to customers. It does not ask any direct questions about profitability and cash flow, but the plans to buy equipment in 2007 are strongly suggestive that 2006 was a generally profitable year in the machining community.

Another bullish signal is the expectation of sales growth in 2007 by 58 percent of respondents. 35 percent of those who look for growth next year are looking for greater than a 10 percent boost.

BY LLOYD GRAFF

Hiring Expectations

Nearly half (46%) of the respondents said they plan to add employees in 2007.



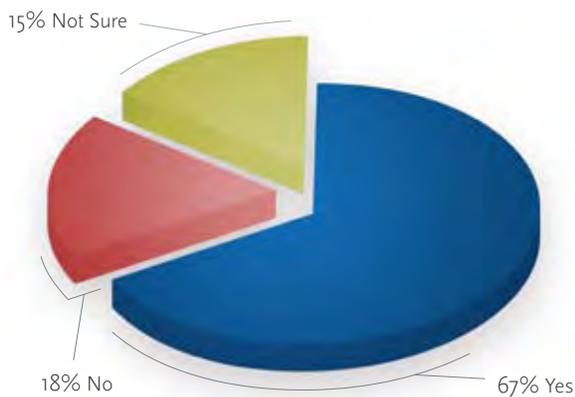
The products likely to be bought in the coming year mimic those of last year's survey. Inspection equipment, CNC lathes and machining centers are each in the plans of 40 percent of the respondents. One category which saw a bounce this year is chip processing, which is likely a direct consequence of escalating raw material prices. If your chips are as valuable as your parts, chip processing becomes a primary activity.

I was interested in the training number, which showed 24 percent of respondents investing in training in 2007. My experience in the machining world makes me skeptical about that figure. In job shops, such plans often are overwhelmed by the immediate need to turn out product on schedule. Training usually takes place when new machinery or software is bought, so perhaps the training number runs parallel to the purchase of machining hardware and new programming tools.

Estimate of 2006 Sales Volume

Two-thirds (67%) of the firms expect their 2006 sales volume to exceed 2005 levels, primarily by 5-10%. One-in-five (19%) of those expecting an increase project it will be an increase of 20% or more.

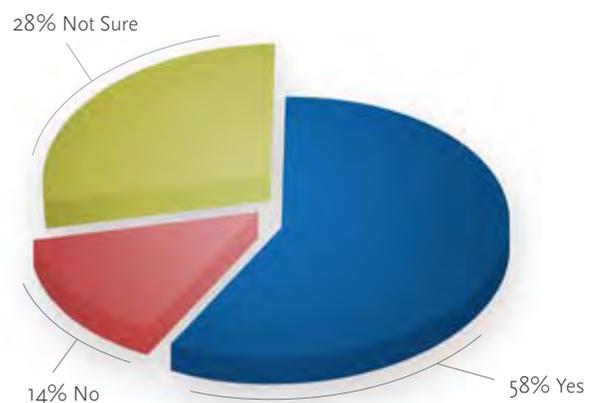
Will 2006 exceed 2005?



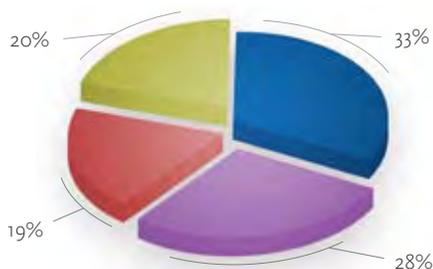
Estimate of 2007 Sales Volume

Over half (58%) of the firms estimate their 2007 sales volume will exceed that of 2006. Almost half (47%) predict an increase of 5-10%, with only 9% stating it will increase by 20% or more.

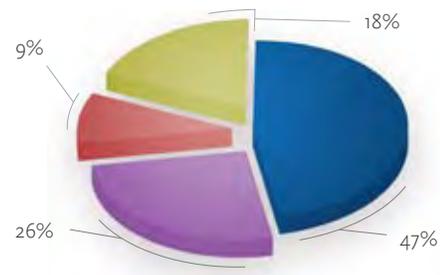
Will 2007 exceed 2006?



By how much?



By how much?



Percentage of Increase Less than 5% 5% to less than 10% 10% to less than 20% 20% or more

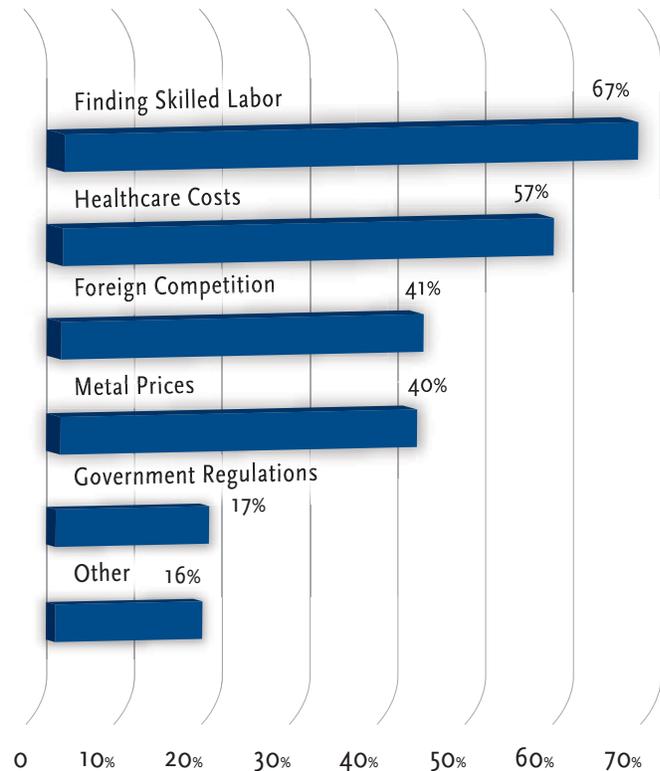
The hiring expectations question also confirmed the bullishness. The question asked if respondents were going to add employees in 2007, not implying replacement. Almost half of the surveys returned said they were putting on more people. This also indicates confidence that they will be able to find them in a labor market that is tight for machinists in most places.

The respondents are cognizant of the tight labor market. The issue of largest concern for the *TMW* audience is finding skilled labor, according to 67 percent. Healthcare cost was next, followed by foreign competition, metal prices and government regulations.

Of personal interest for me as the editor and owner of this magazine was the publication readership data. *Today's Machining World* had the highest regular readership of the respondents at 78 percent of those who receive the magazine. Almost all of the people who acknowledged receiving the magazine said they read *TMW* regularly. The next highest readership was *Modern Machine Shop* with 57 percent of those surveyed, saying that they read it regularly. *Automatic Machining* showed 44 percent readership amongst the respondents, and *Production Machining* showed 39 percent readership of our respondents. This survey was sent only to *TMW's* subscriber database, which skews the results somewhat in our favor.

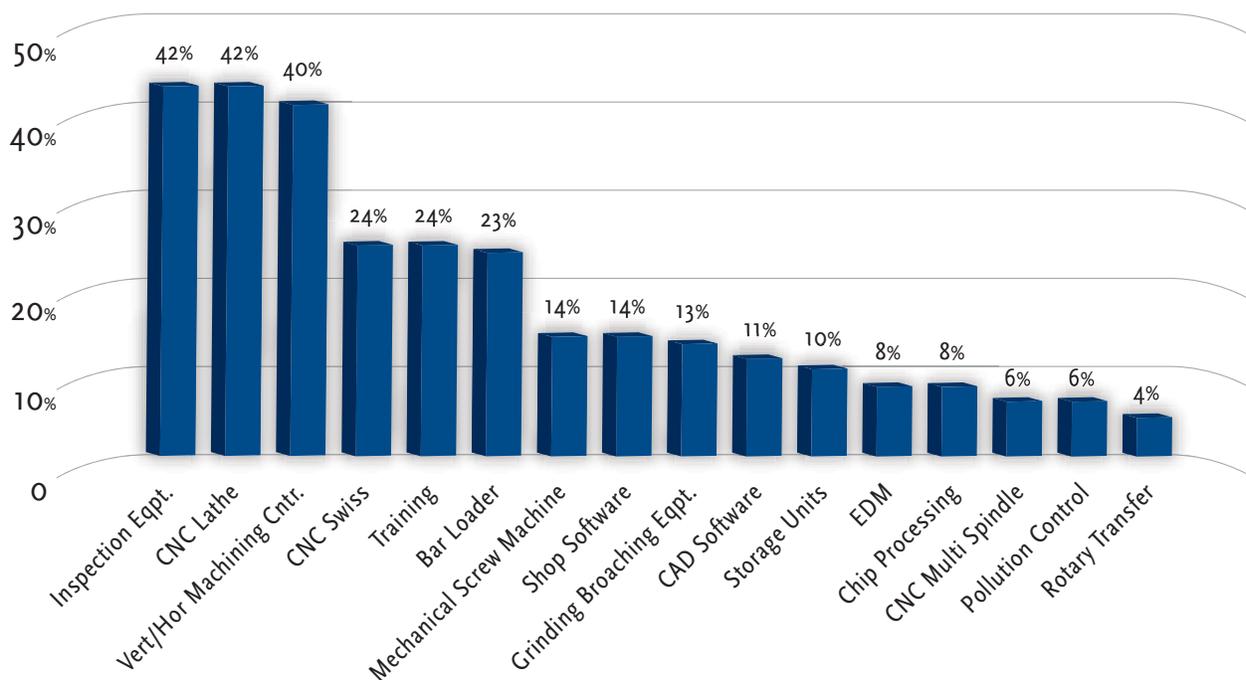
Issues Most Concerning Business

Finding skilled labor is the issue respondents are most concerned with, followed by healthcare costs. The least concern of our five categories is placed on government regulations.



Purchases Planned for 2007

Four-in-ten respondents reported their firm plans to purchase Inspection Equipment, CNC Lathes and Vertical/Horizontal Machining Centers in 2007.





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A continuing column in which we ask smart people to discuss their views on topics related to the future of manufacturing

next

BY NOAH GRAFF

In 2007, the DARPA Urban Challenge will take place. Over 80 self-driving cars will face off to complete a 60-mile urban area course in fewer than six hours. In the race, robotic cars must autonomously obey traffic laws while merging into moving traffic, navigating traffic circles, negotiating busy intersections and avoiding obstacles.

In 10 years, will cars commonly be intelligent enough to drive themselves?

The technology exists today. The issues are legal, institutional, safety (autonomous vehicles operating in traffic with existing cars and drivers), and driver behavior (teaching drivers how to appropriately use these new technologies). In the next 10 years, we will be much closer to a future without traffic delays and without accidents and road fatalities. In-vehicle systems and road and transit systems will communicate in real time, providing us travel information that allows us to take the best route to our destination, avoiding traffic tie-ups and arriving on time and safely. We will be better connected and better protected while we are mobile.

Neil Schuster

President & CEO of Intelligent Transportation Society of America
Washington, DC

While automotive safety systems are advancing rapidly in their ability to reduce collisions, being able to navigate roadways and stay within the lane won't be possible for several generations. Cameras and sensor systems for avoiding potential accidents with other vehicles and pedestrians will reduce the number of fatalities by half within a decade. However, the technology for tracking vehicle location

the facts:

In 2003, there were **6,328,000 car accidents in the U.S.**, causing **2.9 million injuries and 42,643 deaths.**

www.car-accidents.com

The DARPA Grand Challenge was a competition for driverless cars, sponsored by the Defense Advanced Research Projects Agency (DARPA), the central research organization of the United States Department of Defense. At the second DARPA Grand Challenge in 2005, the Stanford Racing Team's self-driving car Stanley, completed a 132 mile, obstacle filled course in the desert Southwest in six hours, 53 minutes.

www.wikipedia.org

In the National Defense Authorization Act for Fiscal Year 2001, Congress mandated that **"It shall be a goal of the Armed Forces to achieve the fielding of unmanned, remotely controlled technology such that...by 2015, one-third of the operational ground combat vehicles are unmanned."**

www.darpa.mil/grandchallenge/index.asp

through GPS systems lacks the precision necessary for navigation systems to be able to automatically direct vehicles to safely turn. It will take billions of dollars in investment and research to create the bi-directional communications with intelligent roads needed for automated driving. At best, we may have some initial test of intelligent roads that monitor traffic flow within 10 years.

John Gartner

Automotive technology writer for Wired News
West Linn, OR

Features related to autonomous driving will start showing up with a clear understanding that the driver still remains responsible for his vehicle, similar to the help a pilot gets from modern aircraft. Fully autonomous cars, those that do not need a driver, despite being technically close to possible in 10 years, are rather unlikely from a liability perspective and would probably be prohibited very fast after traffic jams became unbearable. This situation might occur when people start sending out their autonomous cars to be loaded at supermarkets without concern that their driverless cars would have to wait hours in traffic jams caused by other errand running cars. Independent of the availability of autonomous cars, I expect we will reach our destinations faster from better balancing traffic over available roads thanks to communication between cars, and between cars and traffic signals.

Ganymed Stanek

Vehicle Lead Engineer of Stanford Racing Team
(DARPA Urban Challenge)
Volkswagen of America, Inc. Palo Alto, CA

The 2006 model Honda Accord will offer the option of a new safety system: LKAS (Lane Keeping Auto Assist). It is designed to handle the specific case of drivers falling asleep at the wheel. It detects whether you're gripping the steering wheel, and if you let go for a few seconds it kicks in to actually steer for you.

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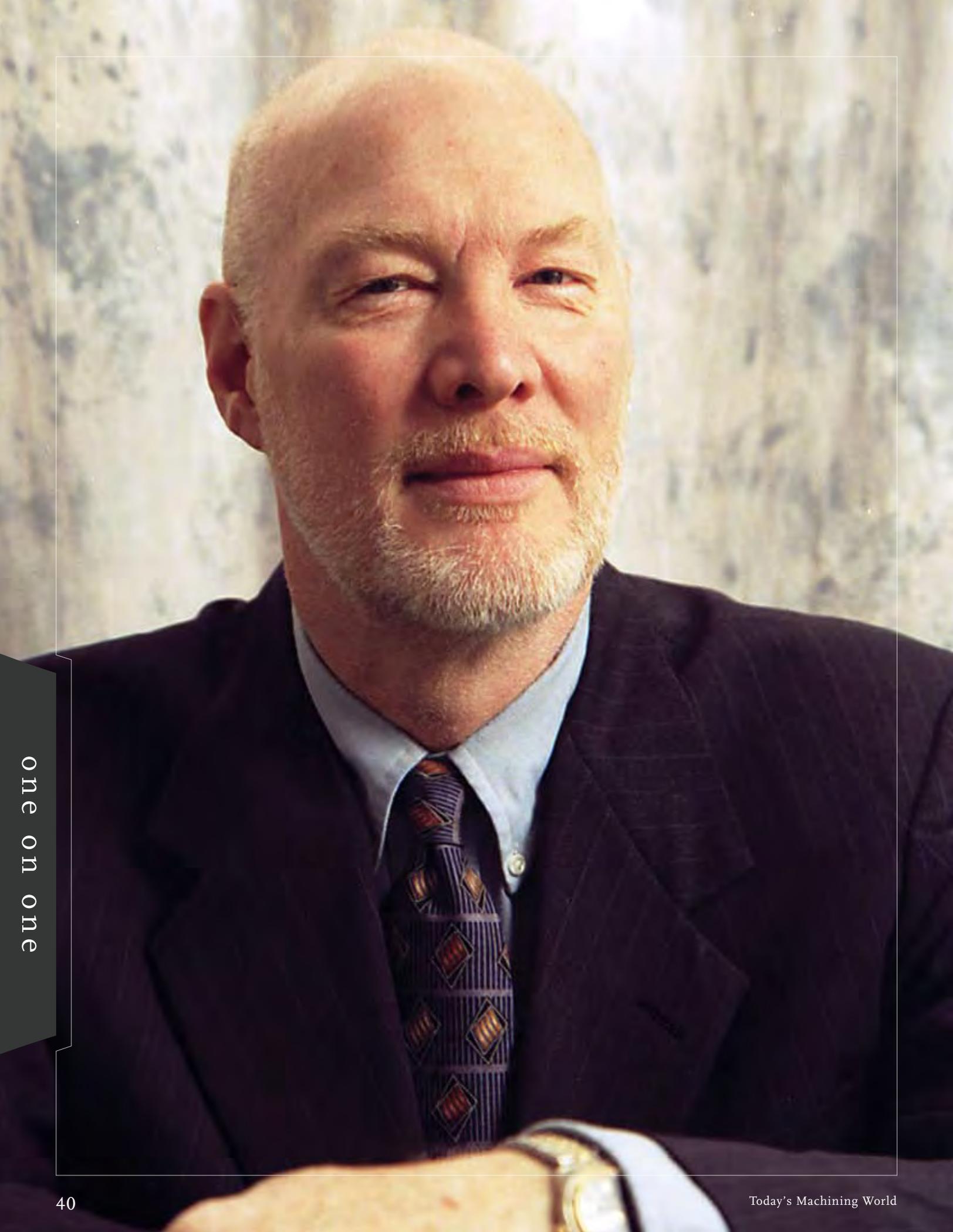


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one on one

Dr. William L. “Red” Whittaker is the Fredkin Professor of Robotics at Carnegie Mellon University. He has developed robots for tasks such as space exploration, volcano interior exploration, and assessment of the damage at the Three Mile Island nuclear disaster. He was the team leader for the Carnegie Mellon Red Team whose self-driving robotic cars, Sandstorm and Highlander, finished in second and third place in the 2005 DARPA Grand Challenge, a 132 mile race for driverless cars through the desert Southwest. He is the team leader for Carnegie Mellon’s Tartan Racing team in the 2007 DARPA Urban Challenge. (See Next for details on Urban Challenge)

Why are robots important for the world?

Robots will alter the way we develop the world, secure the world, feed the world and explore other worlds. Everything that we have came ultimately from farming or mining, and robots have great roles in that.

What is your biggest challenge in preparing for the DARPA Urban Challenge?

The biggest challenge is developing the computer skill for passing, merging, and driving in intersections, and combining those skills for driving a complete route. The robot is required to blend those skills to create a performance that we would call driving.

How did you feel not finishing first in the DARPA Grand Challenge?

The technological achievement is what mattered – that we came away with a clear sense of a rock solid comprehensive technology.

How do you think most people see this technology?

People are very intrigued and very hungry to see it and experience it. It goes with any breakthrough technology. It was no different in the age of the Wright Brothers with flying machines. How about cars – in 1906, the Model T wasn’t even thought about. There were just a couple of experiments in garages. It’s the same thing with computers. They all start the same way. They go on to change the world in bigger ways than the pioneers perceived. And the people who begin the work are not the ones who play because they’re paid, they play for the love of the game. And almost no one really sees the end use and the enterprise that results.

But what about entrepreneurs like Thomas Edison who invented things to make money?

You’re right that there are Edisons of the technology, and Henry Fords. And I want to make it very clear that no one who I’m speaking about or represent is allergic to money or is resisting the

tremendous pull of the market. But what you want to see is that each of those different kinds of people bring different dimensions to the evolution of a movement. Robotics or automated driving does not yet have its Bill Gates or Henry Ford. It does already have its Wright Brothers and maybe even its Charles Lindbergh.

Do you see robots ever being able to think like human beings?

No, but in some cases much better than humans.

What kind of car do you drive?

Because I’m a farmer, there’s some pretty rough hardware in my stable, everything from beat-up dump trucks to bulldozers. My daily beater is a 1991 GEO with 225,000 miles on it, and it gets hammered.

Have you always been a farmer?

No, I chose it about a decade ago. And I didn’t have any experience whatsoever with farming. So I took it on with my muscle – not my mind, giving it everything that I had and not letting myself think about it in the interim.

Did you do it to get away from machines a bit?

God no! I don’t know where people get that kind of stuff. No, I love machines. I love the physical world, teams and groups and institutions and day jobs. It’s just wonderful to have something that’s just solitary and physical and in a different world. A consequence, by the way, is the invention of the first farm machine automation.

If you could be any machine, what would you be?

A tractor. It develops and feeds the world, and it is so incredibly connected to history and people. And because it has the power and the diversity and persistence to do great things from nothing.

how it works

By JILL SEVELOW

Office Party 101



A guide for the partiers and the perplexed

It's getting to be that time of year again – bad karaoke, lampshade hats, scandalous flirting and John Travolta imitations on the dance floor – also known as the annual holiday party. As party seasons go, December produces an inordinate amount of blackmail-worthy moments. My advice? If you're going to do the party scene at all (and there's something to be said for canceling the party and rerouting those funds into bonuses or giving additional time off) do it well.

Selecting the party mode that works – one that allows people to have fun without sacrificing reputations or

sanity – is problematic. Although people within a company spend an incredible amount of time together – around 2000 hours a year – throw office workers, shop foremen, operators and CEOs together into a social setting and they freeze, having absolutely no clue what to say to each other. Add spouses, dates and a hearty dose of liquor to the mix, and all kinds of awkwardness and/or mayhem can ensue. Most of you probably have that “moment to remember” from a past holiday party; and when you behave badly, people love to remember.

Illustrations by Ed Wexler

In a recent survey on bad company party behavior, readers of BizBash Style Reporter (a New York publication serving the event planning industry) reported the following infractions sighted:

- Taking more than one gift bag: **86%**
- Showing up at event without an RSVP: **82%**
- Getting over-intoxicated: **79%**
- Stuffing yourself with hors d'oeuvres: **79%**
- Talking through a speech: **73%**
- Showing up with uninvited guests: **71%**
- Taking centerpieces without permission: **69%**
- Having a loud cell phone conversation during the party: **68%**
- Dressing inappropriately: **62%**
- Moving a place card for a better seat: **54%**
- Dancing provocatively with random people: **42%**
- Smoking anyway at a non-smoking event: **32%**
- Having sex at an event: **16%**

Gulp. And there's more trouble. Lloyd Graff remembers his father's holiday party gone wrong: Leonard Graff threw

an end of year party in 1943, but it turned out his employees attempted a coup to unionize his shop the next day, resulting in an immediate cessation of what was once a lovely holiday party tradition (it was the first and last).

But there's hope. There's a slew of websites out there dispensing office party advice, and while they vary in ideas and execution, they are united in some basic office party rules.

Hilka Kinkenberg, founder of Etiquette International, a firm which specializes in domestic and international business etiquette, says to remember that "no matter how festive the occasion, it's still about business." She reminds you to never risk damaging your personal reputation with one party filled with blunders, innuendos, off-color humor and/or sexist, racist or inappropriate jokes. Which brings me to rule number 1:

Eat, drink and be merry – but not too merry! It's been said "In wine, truth" (oh, Mel, I shudder) but alcohol loosens not just the tongue, but inhibitions as well. You don't want to be breaking it to the CEO and the mailroom clerk that their paths "intertwined" that evening! Even worse, you don't want to be one whose behavior is water cooler fodder Monday morning. Repeat after me, "I will not get drunk at the office party, I will not get drunk..."



Before asking your date or spouse to accompany you to your office party, remember to ask who is invited to the event. Some companies allow spouses and guests, others don't. Check this out before you bring your "others" – it's uncomfortable for everyone involved to have to say "no" to someone – especially if they are at the party door.

Knowing that the majority of our readers are male, I won't admonish you about not wearing your mini skirt and feather boa. This is a simple rule to follow: ask what the dress code is. If you're treated to a cocktail/dinner party on a yacht, it's a good bet it's black tie. Likewise, a restaurant party across the street is code for business casual. The office party is still a business-related event, so dress appropriately. Save the boa for later.

When deciding what to call your event, consider your employees' diversity. While you may feel slighted about not using the word "Christmas" for your holiday party, the greater joy is for everyone to feel included. Promoting a "holiday party" is the very best way to be all-inclusive. As someone who does not celebrate Christmas but is told to have a merry Christmas for a month straight every year, I

can vouch that it's important to be culturally sensitive. If you know someone celebrates Christmas, by all means, wish them a Merry Christmas! But if you're unsure, a neutral "happy holidays" fits the bill.

If you work within a large company, your company party may be the only, or at least best time to see the president or CEO in person. It's a great time to introduce yourself, strike up a conversation and work it! If you run into the person responsible for your holiday party, remember your manners and thank them. They've probably put in a great deal of time and effort in making the party a success.

And while you're at it, don't forget to mingle! I know it's easy to stay with the familiarity of your compatriots, but it's a great time to meet colleagues from other departments, put faces to names and branch out from your own division. A holiday party is a great time to network and schmooze – use the time to introduce yourself and build or strengthen business relationships. A word of caution – it's probably not the best time to get into "shop talk." Avoid talking about deadlines, agendas or the dreaded office gossip.



how it works

And now for the fun!

If you're doing a theme (and there is a seemingly infinite number to choose from) check out Oriental Trading or Rhode Island Novelty online for fun and inexpensive ways to decorate. From luaus, sports, Hollywood, decades parties, Vegas Night, Westerns, murder mysteries or Mardi Gras, there's a wealth of cheap and fun products to accessorize your event.

Sebrina Carter, marketing manager of HORN USA, Inc., filled me in on last year's holiday party there. They went with a "Black and White" holiday event. They had a black and white movie of the original Rat Pack playing behind the open

bar. They had their DJ play big band music and lots of Frank Sinatra during dinner. They randomly draped top hats and white feather boas around for the guests to have fun with (guys, it's ok to wear these boas!). Their centerpieces were glass mirrors with martini glasses filled with pearl necklaces. They had white tablecloths with a shimmery overlay and black velvet ties around the backs of chairs. The buffet table had white tablecloths and black linens, and they entwined the serving trays with glittery lights.

Sebrina hired a photographer to take photos of couples in front of a lighted "cityscape" setting and ordered silver picture frames as giveaways. She said the event was a hit – right down to the boas. They played a couple of team games and made upper management be the guinea pigs – another ice breaker to consider!

Enjoy a few recipes from *TMW* for your next party – and happy holidays to all!



Jill Sevelow's Latkes (potato pancakes)

- 12 medium potatoes
- 2 onions
- 4 eggs
- 3 c flour
- 2 t salt
- vegetable oil for frying
- sour cream or apple sauce – or both!

Pare and grate potatoes into a mixing bowl and squeeze out liquid. Peel and grate onion into potatoes. Add eggs, flour and salt, then stir to make a smooth batter that will drop heavily from the spoon. Pour a good deal of vegetable oil into a heavy frying pan (enough to cover the pancakes amply). Drop the batter from a spoon to form three inch pancakes in the hot oil. Fry over moderate heat until brown on the underside, then turn over to brown. Lift out and drain excess oil onto paper towel. They should be puffed and crisp.

Serve with sour cream or apple sauce on top, or with ketchup (even though everyone in my family makes fun of this option).

Carol Sobecke's Christmas Bark

- 1 Cup Crushed Candy Canes
- 2 Pounds of White Chocolate
- 2 Teaspoons Peppermint Flavoring

Place candy canes in a plastic bag and hammer into 1/4 inch chunks or smaller.

Melt the white chocolate in a double boiler.

Combine candy cane chunks, white chocolate and peppermint flavoring. Pour mixture onto a cookie sheet layered with parchment or waxed paper and place in the refrigerator for approximately two hours or until firm. Remove from cookie sheet and break into pieces (like peanut brittle).

Cathy Heller's Raspberry Bars

- 1 c butter, softened
- 2 c flour
- 1/2 c sugar
- pinch of salt

Mix by hand. Press down into a 10 x 15 pan. Bake at 350 degrees for 10 minutes.

While baking, mix the following:

- 3/4 c flour
- 1/4 c sugar
- 1/4 c brown sugar
- 1/3 c butter
- 1/4 t salt

When the first pastry is done, spread one can of SOLO raspberry pie filling over pastry. Top with the second mixture. Return to oven and bake 25-30 minutes.

Mix 1 c powdered sugar, 2 T milk and 1 t lemon juice together. Drizzle over warm pastry. Cool, and cut into bars.



product focus



Golf Dreams

Dreaming of a golf club that guarantees it will help you hit the ball longer? TaylorMade Golf of Carlsbad, California promises just that with their new r7 draw driver, featuring a 460 cc titanium clubhead and what TaylorMade has dubbed “Draw-Weighted Technology.” They say the club is actually engineered to help players either hit the ball longer by hitting a draw, or hit the ball longer by straightening the slice.

Engineers incorporated draw-weighted technology into the clubhead, wherein all available discretionary weight is positioned in the back of the clubhead and towards the heel. Their “inverted cone technology” features a variable thickness profile milled directly onto the inner side of the clubface, which changes the way the clubface behaves at impact.

For more information, please contact TaylorMade Golf at 800-888-CLUB or visit the company website at www.taylormadegolf.com.

Each month, *Today's Machining World* works to help you understand how the precision parts marketplace works, what's available in the industry, and how you can use available resources, as well as knowledge, to run a more efficient and effective shop.

In this issue, we've changed our focus a little bit. We still want to offer you the very best in innovative products, but December gives you a twist – we've highlighted products for you, or your boss, or your employee, or anyone else you'd like to choose an exciting gift for.

We love the choices out there – from an artist using CAD and metal printing technology to produce exquisite sculptures to a company willing to take you wherever you want to go, our Product Focus is “things you just don't find everywhere else.”

Enjoy – and happy holidays!

Queen of Arts

Bathsheba Grossman's sculptures are a perfect blend of art and science; she's a math whiz and digital sculptor who creates pieces using computer-aided design (CAD) and metal printing technology. Her website, www.bathsheba.com, goes into detail on her choice of programs and tools (Rhinoceros, a Microscribe digitizing arm, Ex One's 3D printing are mentioned) but it's her mathematically-bent artistic brain that contemplates the shapes and creates these masterpieces. Bathsheba says it best in her introductory statement: "My work is about life in three dimensions: working with symmetry and balance, getting from a zero point to infinity, and always finding beauty in geometry." A visionary, indeed.



Got the beat?

Hey, Ringo – this electronic drum pad also serves as a mousepad, and allows you to play eight different percussion sounds, including bass, snare, two rack toms, a floor tom, hi-hat, crash, and ride cymbals using only your fingers. A demonstration mode allows you to accompany six pre-set patterns, and you can record up to 30 of your own rhythms. Separate volume and tempo controls allow you to adjust sound levels.

Priced at \$39.95 (way less than a drum set), we think this may revolutionize the work desk. www.hammacherschlemmer.com.



product focus

It Takes Two

Want to Tango? Marketed as the world's fastest urban transportation, this 2-seater commuter vehicle packs the speed and agility of a motorcycle with the safety of a car. Weighing in at 2,000 pounds (primarily batteries) its race car-style roll cage design, 4-point harness and low center of gravity keep it safe – while fitting into half of a 6-foot lane. With over 1000 ft.-lbs. of torque, the Tango can accelerate from zero to over 130 mph in one gear. It accelerates from zero to 60 mph in about 4 seconds. A dryer outlet will charge into its lithium-ion batteries in under three hours.

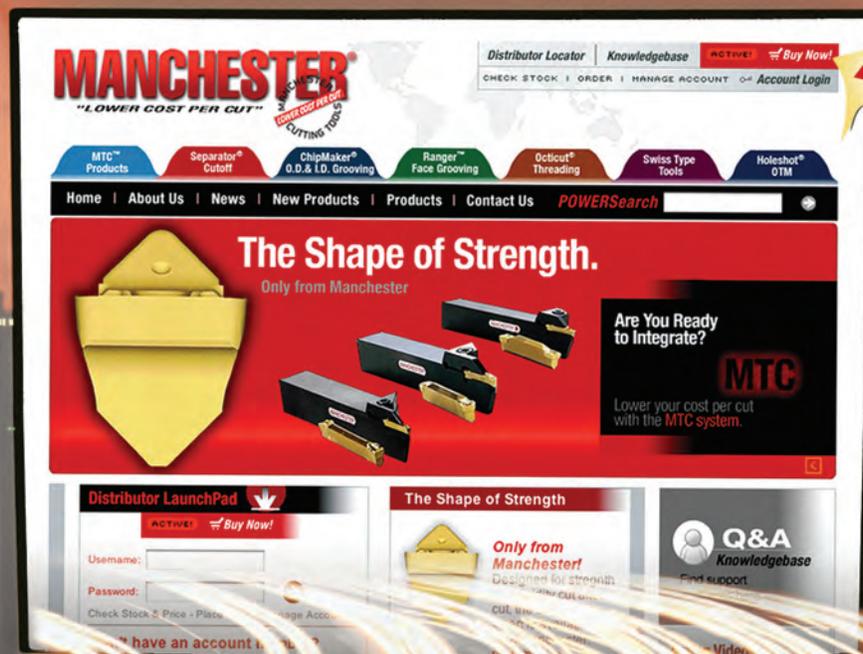
Best of all, it uses no oil and is a true zero-emission vehicle. Their website states: If 50 million of the 92 million single-occupant commuters in the U.S. drove Tangos, there would be approximately a \$50 billion savings in fuel at retail that would be replaced by \$7.3 billion of electricity at retail – a savings of over a billion barrels of oil per year.

Commuter Cars Corporation is taking orders for "kit cars" to be delivered within six months. For more information, please call 509-624-0762 or visit www.commutercars.com.



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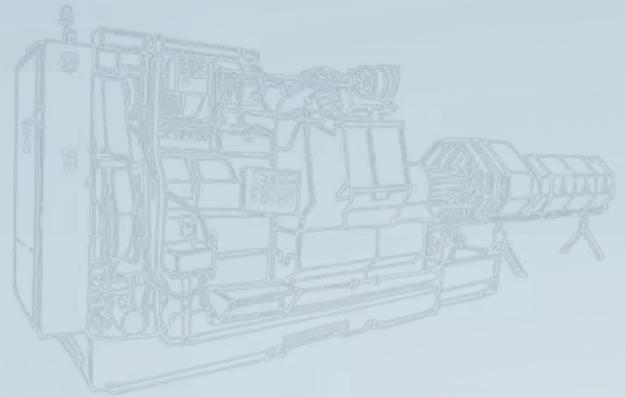
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1" 6-spindle, 1960-1992 (9)
1" 8-spindle, 1979
1-3/8" 6-spindle, 1967
1-3/4" 6-spindle, 1965, 1993 (7)
1-3/4" 6-spindle, factory rebuild
1-3/4" 6-spindle, thdg., 1969
1-3/4" 8-spindle, 1970
2-1/4" 6-spindle, 1973-79 (3)
3-1/4" 6-spindle, 1982
5-5/8" 6-spindle, 1979
6-5/8" 6-spindle, 1979

ACMES

1" RAN6, 1975
1-1/4" RA6, 1975 (3)
1-1/4" RB8, 1975
1-5/8" RB8, 1980, rebuilt 1996. pickoff
1-5/8" RBN8, 1975, rebuilt 2002
2" RB6, 1979-1985
2-5/8" RB6-1977
3-1/2" RB6, thdg
6" RPA8, Gov't Storage

GILDEMEISTER & SCHÜTTE

GM16 AC 1997 w/ lemca loader
SF51 6sp. Schütte, 1981
AF26 8sp. Schütte, 1981 (2)

SWISS-CNC SLIDING HEADSTOCK

Citizen L20, Type VII, 1996-98 (2)
Citizen L25, Type VII, 1998
Star 20mm, 1999

NEW BRITAIN

Model 52, 1-1/4" 6sp., 1979 (3) pickoff
Model 62 2-1/4" 6sp., 1975

INDEX

MS 36E, 1993

DAVENPORT

3/4" thdg., pickoff, 1985 (6) Tamer
3/4" chucker, 1985 (4) Tamer
3/4" thdg., pickoff, 1975

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HYDROMATS

HW25-12 1986 (3)
HB45-12 1997
HB45-16 1994
HS-16 2000
HB45-16 chucker, 1997

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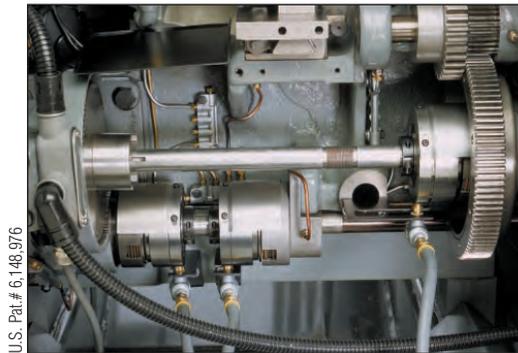
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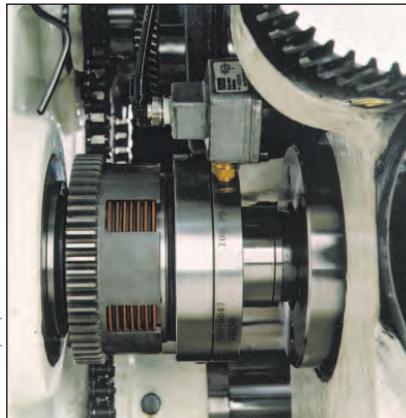
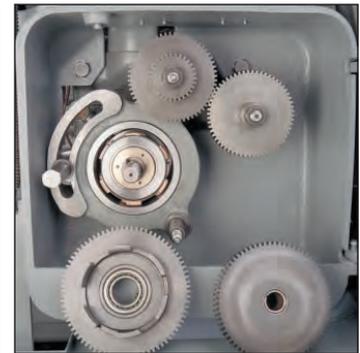
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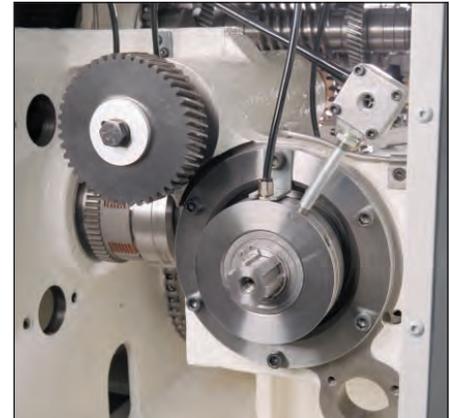
- Increase productivity from 10-20%
- Tools can be positioned closer to the work piece due to repeatable high and low speed clutch engagement
- Better machine utilization - More productivity from existing machines, operators and floor space



For Model B Davenports



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Website Wandering

I'm in charge of information technology at our small firm, and the outside contractor updating our computers told me that one of the laptops they serviced has regularly visited hard-core porn sites. He also said a desk top unit used to track orders in the shop has been surfing hate group addresses. The laptop is assigned to the son of the firm's owner. I like the owner and his son but I'm uncomfortable confronting either of them. Still, I can't see how this is a proper use of company property. I'm also concerned that there might be some hate group wacko working here, but I really haven't seen anyone who fits the bill, at least out in the shop. Now what? Should I tell the owner about his son, the shop computer situation, or mind my own business?

Since you are responsible for information technology, this is your business, and ignoring it constitutes a dereliction of duty. The ethical issue was created because you accidentally discovered something about someone else which is at best distasteful and at worst dangerous. Whenever this happens, how you respond is both a product of what you've discovered and your connection to the situation. If you were wandering through an internet café and saw something offensive on a computer, you'd have no interest in the situation and no obligation to react. If during that same stroll you saw a child predator arranging a meeting for sex with a 10 year-old, the facts of what you discovered would warrant some action even though you had no connection to the situation.

In today's workplace, certain offensive or insensitive material can give rise to discrimination claims because of the hostile environment such material can generate for those subject to it. Here, however, you have no reports that anyone has seen the son use the computer for these purposes at work. His activities may have been totally private, and the images were not downloaded to the hard drive or otherwise displayed. If it is just a matter of using company computer for something not related to work, you'd better be prepared to "out" everyone who ever used it to check the weather or shop online.

The desktop creates a different problem. It is only used in the work environment but you can't identify the offender.

Maybe this was just someone surfing the underbelly of the latest political extremist movement. Still, it can create hostile environment problems, not to mention waste the time of someone the firm is paying to work.

You will certainly embarrass the son by either confronting him or telling his father since you have no idea that this ever involved work or even if they share your opinion of what is inappropriate. You have no one to accuse on the shop side of the problem but it really could lead to trouble if left unaddressed.

It is not time for accusations. It is a time for information. Tell all your employees what the computer consultants found without telling them where they found it. You won't embarrass or accuse anyone, but the guilty will know who they are, and they will sweat because they won't know how much you know. Explain why the firm cannot afford to have company property used for inappropriate and offensive material, and establish a computer use policy which draws clear lines. Then, remind them that they have no expectation of privacy in the company's computers and should expect no mercy upon violating it, having now been warned.



TMW will explore business ethics monthly. Have an ethics question? email jill@todaysmachiningworld.com.

Today's Machining World's "Shop Doc" column taps into our vast contact base of machining experts to help you find solutions to your problems. We invite our readers to contribute suggestions and comments on the Shop Doc's advice. If you consider yourself a Shop Doc or know a potential Shop Doc, please let us know. You should also check out the TMW online forum at www.todaysmachiningworld.com.

Have a technical issue you'd like addressed? Please email noah@todaysmachiningworld.com. We'll help solve your problem, then publish both the problem and solution in the next issue of the magazine.

Dear Shop Doc,

We recently purchased some ER collet holders and collets for holding drills in lathes and mills. We like the idea of this collet system being capable of holding a range of diameters, but is a 6 to 7 millimeter collet the best way to hold a 1/4 inch shank tool? A 7 millimeter (.276 inch) diameter will be collapsed down to .250 inches which is 66 percent of the designed collapse. That tells me it won't have full contact on the shank of the tool like a collet made to hold a 1/4 inch shank. I'm a bit concerned – can you elaborate?

Signed, Holding On

Dear Holding On,

You have a great point, but times have changed in this area. The ER system typically is shown with a DIN Std 6499 Form B designation. This is a German (European) standard, so you can understand why the original ER systems were only metric sizes and had a .5 millimeter or 1 millimeter range of collapse.

The collet, such as the one you brought up, would be designated 6 to 7 millimeters; thus, the diameter was ground to 7 millimeters, and the design of the collet allowed for it to successfully hold a shank down to a 6 millimeter diameter.

Recently however, with a focus on the inch size tool shanks, collet manufacturers have changed this somewhat. The first attempt by the collet manufacturers was to simply take their existing metric collet and give it an inch designation. You are correct – this was quite deceiving, because the collet was still ground to the metric diameter and not the inch size that was marked on it. The collet still had the same collapse, but it was simply easier to find a collet without doing a metric to customary units of conversion.

Today, more improvements have been made. Many of the collet manufacturers are making what I call "true" inch sized collets. These collets are ground to an inch designation. Now with some brands when you get a 1/4 inch collet, the

diameter is truly .250 inches, giving you the best circumferential contact that you can get.

On another note, most standard precision ER Collets are advertised at .0004 inch runout. This is 2/3 the amount of the .0006 DIN STD tolerance. You will also see ultra precision designs offering an advertised .0002 or less tolerance. You might pay more for that precision, but in smaller diameter tools you should ONLY consider these. The smaller the tool, the better that tool needs to be held or rotated on centerline.

There are even some brands currently that offer the .0002 tolerance in the inch sizes at no extra cost. This is a great deal. Even though the ER Collet design began its life as a metric design, it has evolved to provide a very accurate means of holding inch size tooling.

Second Opinion

Just to verify my prognosis I decided to get a second opinion from a collet specialist. I talked to Cal Macomber at Hardinge Inc. He felt that the differential between .276 inches and .250 inches was much too great to be acceptable. His feeling is that ER collets are inexpensive, and a user is better off buying the proper collet rather than compensating the ER collet that much. He felt that .005 inches was the maximum amount of give for the collet to ensure proper accuracy.

Jim Rowe
Mahar Tool Supply, Warsaw, IN

Getting There An analysis of three GPS systems

A Global Positioning System, usually called a GPS, is a fully-functional satellite navigation system. I conducted a review of three of the latest GPS systems: Garmin's Nüvi 350, Magellan's RoadMate 2200T and the TomTom Go 910. I drove to several specific destinations using the three different systems. I wanted to find which device was the easiest, fastest and most intelligent. Here's my report card.



Garmin Nüvi 350:

Price: \$749.99

Grade: **B+**

Pluses:

The Garmin's menus are the easiest to read, the most intuitive and the fastest to go through – you don't even have to read the manual. When searching for a destination by name you don't have to scroll through categories beforehand as you do with the other two systems. The map on the Garmin is by far the easiest to read – the streets are marked clearly, the colors are easy on the eye, and you can smoothly scroll around the map to look at new areas by dragging your finger.

Minuses:

On occasion, the Garmin's choice of directions proved to be inferior to those of the other two systems, choosing routes with more turns and traffic, costing me up to 15 minutes time.

Despite that, I still credit the Garmin for saving me on numerous occasions when I was lost or in a hurry. I would take the Garmin Nüvi 350 because of its user-friendliness over the other two systems.



Magellan:

Price: \$499.99

Grade: **B~**

Pluses:

The Magellan's signal seemed to be more powerful than the others, picking up a signal in my office while the other systems could not. The voice narrating the directions on the Magellan and the TomTom were much clearer than Garmin's. The Magellan's navigation choices also earned top marks.

Minuses:

Searching for a destination by name takes longer because icon functions are less obvious and you must sift through submenus and categories. The map, along with the menus in the Magellan 2200T's interface, are unattractive compared to the Garmin Nüvi 350 and the TomTom Go 910. Scrolling the surrounding areas on the map with your finger is not smooth; if you touch the wrong icon, the map disappears and is replaced by a menu.



TomTom Go 910:

Price: \$699.95

Grade: **C+**

Pluses:

It has the most bells and whistles out of the three systems and boasts the biggest screen and sharpest graphics. It delivered me from place to place reliably, but it consistently told me to make "U-turns" when I should make a normal turn.

Minuses:

It's much larger and heavier than both the Garmin Nüvi 350 and the Magellan 2200T. The Garmin and Magellan models are light, flat and can be easily hand-held for a closer look at the screen.

The TomTom maps seem clear, but I still felt more confused than when navigating on the other systems – maybe because there is too much detail. Dragging your finger to scroll around the map was smoother than on the Magellan, but I still had the same problem of tapping the screen the wrong way and suddenly finding a new menu.

The biggest problem with the TomTom Go 910 is that it's over-loaded with icons and confusing menus. I read the manual but still kept getting lost, not just on the road but in the difficult interface.

Have you got a favorite ride? Looking for antique cars, skateboards, motorcycles or anything else that gets you around. E-mail your story and photo to jill@todaysmachiningworld.com.

Special thanks to Garmin, tomTom and Magellan for test models and photos.

Cryptogram

This message has been encrypted with a simple cipher. Can you break the code to discover the three secret words?

I B Q Q Z
I P M J E B Z T
F W F S Z P O F !

Send in your answer—quick! Fax Jill at 708-535-0103, or email at jill@todaysmachiningworld.com



Halloween Mask

The first step you must take to solve the problem is to find the number of combinations of three colors you can make from five colors. Plugging the values into a general formula for the number of combinations gives you:

$$5! (3! \times (5 - 3!)) = (5 \times 4 \times 3 \times 2 \times 1) / (3 \times 2 \times 1 \times (2 \times 1)) = 120 / 12 = 10$$

That result tells us there are ten possible combinations of three colors out of five. But the number of combinations tells us nothing about the order in which the colors are placed on the mask. The different orders in which the three colors can be painted on the mask is 3! (3 x 2 x 1), or six for each color combination. That means there is a total of 60 possible ways the mask could be painted using three colors out of five.

Who knew their Halloween mask possibilities?

John M. Weber Sr. of Weber Systems, Inc. in Menomonee Falls, WI; **Ron May** of Hunter Engineering Company in Bridgeton, MO; **Rick Hybben** of Hyco Machining Inc. in St. Paul, MN; **Jim Bennawit** of Tyco Electronics in Manheim, PA; **Steven Gredell** of Empire Machine Works in Raytown, MO; **Chris Morgan** of K & M Precision Products in Dexter, MI; and **Michael Kaibas III** of Kaibas Machine & Tool in Evant, Texas.

postings



Noteable and newsworthy information and events for the month of January.

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Indianapolis
Conference

Indianapolis, IN

January
26th

Indiana
Convention
Center

www.sme.com

ProMat 2007

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Conference
on productivity
innovations

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distribution, logistics &
IT solutions for the
supply chain.

January 8 - January 11

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www.promatshow.com

Measurement Science Conference

How measurements are made,
managed, and audited for
product quality, maintenance,
safety, and interstate and
international trade.

Long Beach
Convention
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Long Beach, CA

January
22-26

www.msc-conf.com

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January 17-18

www.dovebid.com

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International
Exhibition
Centre,
Bangalore, India

January
18-24

www.intex.in

Edison
Patents
electric light

www.wikipedia.org



January 27, 1880

First Superbowl
Green Bay Packers
defeated
Kansas City Chiefs

Jan. 15, 1967

www.superbowl.com

HAPPY BIRTHDAY
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Hackman

January 30, 1930

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Engineering Tech
(multi spindle, problem solve, repair, train, new launches) Northeast Ohio

Manufacturing Engineer
(Acme, B&S, Hydromat, growing co, non automotive) Sunny Eastern Tennessee

Process / Manufacturing Engineer
(Davenport, OEM manufacturer, multiple plants, growing co., relocation) Southern South Carolina

Engineering Manager
(medical, bone screws, implants, leadership, fantastic benefits, profit sharing) Central Florida

Sr. Manufacturing Engineer
(any brand of swiss lathe, program, process, huge list of benefits) Southwest Ohio

Engineer / Programmer
(swiss cnc lathes, program, set up, new product launch, new equipment, factory training) Southeast Massachusetts

Swiss Lathe Engineer
(medical, great benefits, swiss cnc lathes, projects, program) Southeast Pennsylvania

Screw Machine Engineer
(any brand of multies, OEM, tooling, layouts) Rhode Island

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(orthopedics, implants, program, set up, new jobs) Sunny Central FL - up to \$75K

SWISS LATHE PROGRAMMER
(brand new equipment, new product launches, reports to Eng. Dept) Eastern MA - up to \$70K

STAR CNC MACHINIST
(medical, 20% annual growth, fantastic benefits) Eastern PA - up to \$26/hour

SWISS CNC SET UP
(any brand, all shifts, expanding department) No. IL - up to \$27/hr

ENGINEERING TECH
(any brand of swiss lathe, program, process development) Southwest OH - up to \$69K

CNC SWISS LEADMAN
(program, set up, troubleshoot, relo, state of art shop) Sunny So. CA - up to \$68K

PROGRAMMER
(any brand of swiss, surgical instruments, great retirement, profit share) No. IN - up to \$28/hr

We have over 100 openings throughout the USA for Swiss CNC Machinists / Set Up Operators

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Sales Engineer

(focus on improving current accounts, major suppliers, OEM's, Tier One and Two, high volume machined components) up to \$75K + comm. S.E. MICHIGAN

Sales Engineer

(machine tool industry, Midwest territory, swiss cnc lathes, no relo required) up to \$80K + comm. ANY MIDWEST LOCATION

Sales Rep.

(screw machine contract mfr, growing company, several open territories) OH, IL, MI, SC, NC up to \$75K + comm.

Sales Manager

(high volume, screw machine components, sales, manage reps., call on accounts) up to \$80K + comm. CONNECTICUT

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up to \$25/hr Growing Shop in NE OH

New Britain Set Up
up to \$22/hr -OEM Mfg. in NE IL

Screw Machine Machinist
up to \$24/hr - Acme, Cones, New Britain in WI

Acme Set Up
up to \$25/hr - Major OEM in S.E. PN

Hydromat Set Up
up to \$27/hr - Growing Co. in N. IL

Hydromat Set Up
up to \$25/hr - Great benefits in NE OH

Multi-Spindle Set Up
up to \$25/hr - Acme, New Britain, Index Euro in W. MO

CNC Milling Leadman
up to \$28/hr - Machining Ctrs., Program in E. MA

CNC Lathe Machinist
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General Manager

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Department Manager

(over 30 employees, multi spindle screw machines, full relo and interview costs paid) up to \$100K - Ea. MA

Supervisor

(secondary machining, mills, lathe, drill, broach, deburr) up to \$53K - Southwest OH

CNC Cell Supervisor

(CNC machining centers, cells, programming, leadership) up to \$52K - western NY

Swiss CNC Department Manager

(leadership, any brands of swiss lathes, programming, training) up to \$85K - SW OH

Supervisor Swiss CAM Automatics

(Tornos, Bechler, Escomatic, over 40 employees, electronics components) up to \$89K - So. CA

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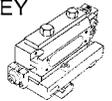
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afterthought

TMW's Report Card

After six years of doing this magazine and writing Swarf and Afterthought, I really want to get a report card on what you like about *Today's Machining World* – and what you don't.

I will feel honored if you fax your answers back to me at 708-535-0103, and I would be delighted to talk with you as well at 708-535-2200.

THE THING I LIKE MOST ABOUT *Today's Machining World* IS:

- SWARF
- COVER STORIES
- THE WAY IT LOOKS
- COLUMNS
- PRODUCT FOCUS
- FORUM
- PUZZLES
- OTHER _____

I WISH THE MAGAZINE HAD:

- MORE TECHNICAL PIECES
- MORE PRODUCT INFORMATION
- ADVERTORIALS
- MORE USED MACHINERY ADVERTISING
- FEWER PERSONAL OPINIONS BY LLOYD GRAFF
- MORE FACTS, LESS OPINION
- OTHER _____

I READ *Today's Machining World* MAGAZINE:

- FROM COVER TO COVER
- FOR THE ADS
- FROM BACK TO FRONT
- BECAUSE I USUALLY LEARN SOMETHING WHICH HELPS ME IN MY BUSINESS
- IT IS FRESH, ORIGINAL, AUTHENTIC
- HARDLY EVER READ IT BECAUSE _____

I CONSIDER *Today's Machining World*:

- THE BEST MAGAZINE I RECEIVE
- ONE OF THE MANY THAT I READ
- I USUALLY THROW IT AWAY WITHOUT OPENING IT

IF THE MAGAZINE WAS WRITTEN JUST FOR ME IT WOULD:

- HAVE MORE ARTICLES ON THE SCREW MACHINE BUSINESS
- EXPAND THE SHOP DOC
- EVALUATE PRODUCTS THAT I MIGHT BUY
- INCLUDE A CROSSWORD PUZZLE AND SUDOKU
- RUN ARTICLES WRITTEN BY INDUSTRY LEADERS ABOUT THEIR COMPANIES
- USE A BIGGER OR A SMALLER FONT OR FORMAT.
- OTHER: _____

IF TMW HELD A SEMINAR ON THE FUTURE OF THE MACHINING INDUSTRY:

- I WOULD COME
- I WOULD NOT COME
- I WOULD COME IF IT INCLUDED A GOLF OUTING
- I WOULD COME IF _____ WAS THE FEATURED SPEAKER.

I WOULD LIKE TO SUGGEST THE FOLLOWING ARTICLES FOR THE MAGAZINE: _____

IF TODAY'S MACHINING WORLD CHANGED TO A PAID SUBSCRIPTION APPROACH, I WOULD PAY \$20 PER YEAR TO RECEIVE IT: Yes No

IF I COULD TELL LLOYD GRAFF ONE THING IT WOULD BE: _____

I THINK THE MACHINING BUSINESS IS:

- THE BEST BUSINESS TO BE IN
- A LOUSY WAY TO MAKE A LIVING
- ON THE VERGE OF EXTINCTION IN NORTH AMERICA
- A BUSINESS I WISH MY CHILDREN WOULD GO INTO
- HERE'S WHAT I REALLY BELIEVE: _____

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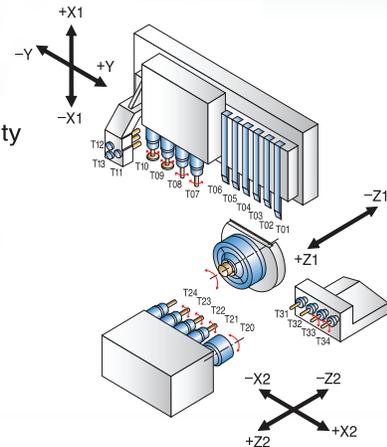
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