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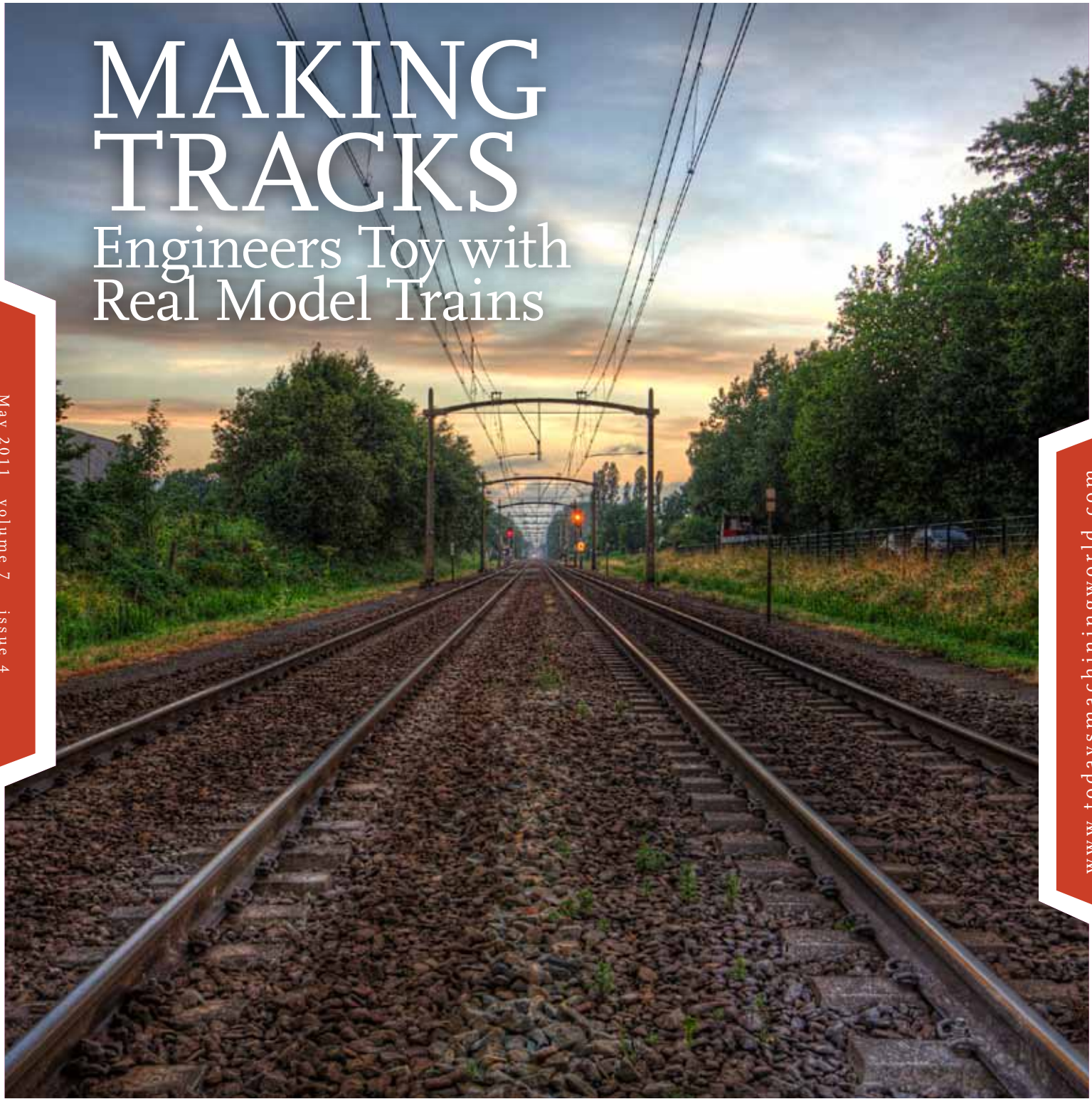

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May 2011 volume 7 issue 4

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4235 W. 166th Street
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(708) 535-2237

Quitter
Lloyd Graff
lloydgrafftmw@yahoo.com
(708) 535-2237

Managing Editor
Emily Aniakou
emily@todaysmachiningworld.com

Features Editor/Web Site
Noah Graff
noah@todaysmachiningworld.com

Creative Director
Todd Toborg / todd t designs, inc.
tmwmagart@gmail.com

Circulation Director
Sue Ravenscraft / RS Media Services
smravenscraft@comcast.net

National Sales Manager
Dan Hummell
dan@todaysmachiningworld.com
Tel: 630-715-4318

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BPA WORLDWIDE

Ending the Print Magazine

After almost 11 years of doing *Today's Machining World*, I have decided to make the next issue (June) of *TMW* the last paper and ink magazine. The decision was a longtime coming, but ultimately it sort of made itself.

The economics of print have been becoming increasingly unfavorable. Look at today's emaciated *Time Magazine*, you used to get in the mail. Printing 17,000 copies of *TMW* costs about 50 cents per copy and mailing is another $6000 per issue. Add in maintaining circulation data and salaries, plus the cost of an art director and sales person and you get a $40,000 per issue nut. Advertising revenue consistently fell short of covering it.

But that is only part of the picture. I did *TMW* for much more than money. For me it has been the culmination of a career in the manufacturing and machine tool world. I love the writing and the topics, and *TMW* gave me the opportunity to be a force in the industry.

As I was celebrating our tenth anniversary during IMTS and putting together our recent Anniversary Issue, I had the chance to make the case why I should persevere with the money-losing print publication.

The stronger my public argument, the less convinced I became in my own mind that continuing was the right call. For more than a decade I had split my time between the Graff-Pinkert machinery business and *TMW*. Over the last six months I noticed I was devoting more and more time and energy to Graff-Pinkert and less to *TMW*. Business is turning around in machinery, and the next three years look like they could be the best in a decade if we really get after it.

About six weeks ago Noah and I were staying late at the office and I brought up the idea of shutting down the print. He told me that he had arrived at the same conclusion. He told me that he felt somewhat trapped because he felt, rightly, that he was indispensable to the magazine but was too loyal to leave, though he saw no personal future in the magazine business. This made the decision an easy one. We badly need Noah's energy, talent and willingness to travel all over the world in Graff-Pinkert as Jim and I move further into our sixties.

Then Noah asked the clinching question, which he usually does, "Dad, do you want to operate a magazine, or do you really just want to write great stuff?" He pointed out that with the *TMW* Web site, the email blasts and Swarfblog, I could do my thing and possibly reach an audience even bigger than with the magazine, and maybe even make money doing it. The iPad and iPhone have changed the publication business forever, like it or not.

This is the bottom line. I'm continuing the Swarfblog and the Afterthought column online. Noah and others will also blog. The *TMW* Web site and email blasts will continue with Emily Aniakou, *TMW*'s Managing Editor, shepherding it. I will be devoting the time and energy to Graff-Pinkert that it deserves and Noah will become a machinery dealer.

Am I sad about *TMW*, the magazine, ending? Yes. But it has been a terrific run and I'm truly proud of it.

And I'm genuinely excited about simplifying my life. Now I can just be a machinery dealer who blogs to the world.

Lloyd Graff
Editor/Owner

contributors

Lloyd Graff started *Screw Machine World*, predecessor of *Today's Machining World*, in 2000. It was a magazine about the people in the machining milieu. It treated big ideas as they related to a metalworking environment. It took a contrarian view to the business to business magazine norm by being literate, sometimes confrontational, entertaining, and unpredictable. Lloyd put his stamp all over the magazine, making it a very personal and revealing chronicle of the industry and his personal and professional life. His personal favorites of all the pieces he has writen for *TMW* are two "interviews" with National Acme Screw Machines, one with an 9/16" RA6 in 2001, and a sequel with an 1 5/8" RB8 eight years later.

Alan R. Earls has always admired Da Vinci and the ideal of the multi-talented Renaissance Man. So, he is unashamedly interested in art, history, culture AND gizmos—especially cars. If you don't find him writing, you can look for him at his workbench or under the hood of a vehicle. He has been self-employed as a writer, editor, and researcher from his home near Boston since the early 1990s.

Noah Graff has been working at *Today's Machining World* since 2005. He is the features editor and "Web Guy" of the magazine. He recently finished 4th in his first Latin dance contest (4 points out of 3rd Place). He's psyched to return to Italy this summer, his home away from home, after five years away, for business, food, romance, and salsa dancing. Latest favorite quote: "Go, make something. We need it!" *Seth Godin*

Robert Strauss is a former reporter for *Sports Illustrated* and the *Philadelphia Daily News*, and a news producer at KYW-TV in Philadelphia. Now he is a freelance writer based in Haddonfield, N.J., where he revels in his two daughters' basketball prowess and their eye rolling at his bad puns. He went to his first rock concert too long ago to see the Cream, and will admit to liking Taylor Swift and Lady Gaga when the teenagers put them on the car radio. He has written for *TMW* on the manufacture of, among other things, mousetraps and marching band instruments. His work appears most often in the *New York Times*, the *Washington Post*, the *Los Angeles Times* and *Today's Machining World*.

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It's Just Not That Simple

I enjoyed reading the primer from the April 2011 issue "How it Works" piece on tool coating, but overall, the comments from various manufacturers are certainly over-simplified as far as the wear types observed on cutting tools. The most glaring omission is the truth behind the CVD or PVD question.

With the exception of easier to machine cast irons, PVD is the correct choice for coated tools. It's not unlike the choice between using a carburetor or fuel injection on a gasoline engine. The carburetor is old technology—best in its day, but inferior at this point in time.

It may be true that in some limited applications, CVD coated inserts will run at higher cutting speeds, but the small potential for faster cutting is more than offset by the inconsistencies observed in tool performance from edge to edge and insert to insert.

Major tooling companies continue to push a plethora of CVD grades into the market. The main driver of this approach is that the cost of coating inserts by the CVD process is many times less than the cost to coat by PVD. Yet cutting tool companies routinely introduce all types of new CVD coating varieties and layers into the market at higher and higher prices. This approach is a winning strategy for tool manufacturers as they make higher profits and can keep their customers confused and captive with an incomprehensible variety of tool choices. Unfortunately, CVD inserts are almost always a losing strategy for machine shops.

The significant majority of shops would be wise to confine their tool and insert selections to about three different PVD coating options and eliminate CVD entirely. With this approach, machinists will better understand tool applications and performance, and focus on correctly applying the tools for each operation. This approach always results in higher overall production rates. If anyone doubts the advantages of this—just take a look at the inventory of solid carbide endmills in most shops. You will find one, two, or perhaps three options (uncoated, TiN coated, and AlTiN/TiAlN coated). Ever wonder why just three options can quite successfully cut all the various operations and materials that need to be milled with a 1/8" to 3/4" diameter milling tool?

Be cautious, and don't study this too hard. The next thing you will start to wonder is why the price of a typical insert is in the mid-teens per insert, when a solid carbide endmill that has twice as much carbide by weight, and obviously is much more labor intensive to manufacture, costs about half what a normal insert costs. A real puzzler that one.

Dave

Feeling Bad for Today's Youth

In response to the feature from the March issue, "How the American Visa System Keeps Skilled Workers Out," since the introduction of the U.S. Department of Education, this country has witnessed the greatest "dumbing of America" in our history. What happened to our vocational high schools, our company sponsored apprentice programs and Junior Achievement? They all seemed to work very well in my youth. I graduated from a vocational (machine shop) high school and completed a Ford Motor Company apprenticeship program. I feel sorry for the kids coming up today.

Gary Goins

Way to Keep Going

In response to your "Swarf" on Caltech's sports teams continuing their efforts after 26 years of losing, I applaud them. Of course everybody wants to win, but I'm sure most of the players are in it for the fun of it. It's not like they're at Caltech on basketball scholarships and need to prove something. If they were a Division I team—then sure, castigate them on their record. But they're not. This example also doesn't compare at all with professional teams that don't perform well. The players on professional teams are there for one reason—to play ball. Playing basketball for CalTech students is certainly not their primary reason for being there.

Kim

Something on your mind? We'd love to hear it.

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By Lloyd Graff

Wisconsin's Uncivil War

The battle of Madison, Wisconsin and Columbus, Ohio is the first major fight of America's new Civil War between the Governors and the Unionists.

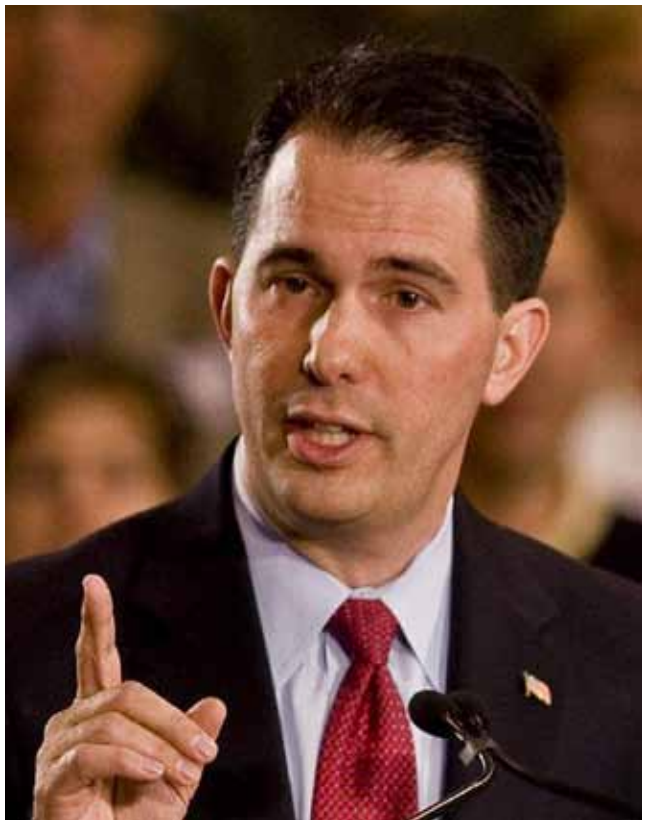
Wisconsin's Scott Walker pushed through a law curtailing collective bargaining for state employees. John Kasich of Ohio forced similar legislation through in Ohio. Now the unions are mounting a counterattack through demonstrations and a full court press in the press.

It is unclear who will win this war. The first sneak attack portrayed the Unionists as spongers who have perverted the political system by co-opting politicians with gluttonous campaign contributions and then exacting tribute from them through opulent pay contracts and pensions that will ultimately bankrupt the States.

The Unionists were surprised by the advance of the Governors, but now are mobilizing their legions under the banner of "saving the middle class."

The public is just starting to listen. The next election may be the decider of the current war because the early battles will be indecisive. The Courts will dither while the troops skirmish with signs and occasional fists.

To me the big question is how "Middle America" comes to view the fight. The middle class has undeniably taken a beating over the last decade,



but whether the voters will see the Unionists, particularly the government worker Unionists, as one cause of the decline is the big question. We tend to like our local teachers and mailmen, even Congresspersons, despite the fact that we loathe them as a group.

We are witnessing more than a food fight in Madison and Columbus. This is not the start of class warfare in America. This is the war for the middle class voter that will decide at least the 2012 election.

The tragedy in Japan is horrific from a human standpoint, but as a parochial businessman in the machining realm I'm also interested in how it affects my operation.

It appears that most Japanese machine tool builders suffered minimal damage because they are located far from the epicenter of the earthquake.

Citizen, Mori and Tsugami say they did not incur significant damage. Mazak has a facility in Sendai that was damaged, but it is not a big production plant. One builder that did incur damage is Citizen-owned Miyano, which has a plant closer to the site of the quake. Though nobody was killed or hurt, delays can be expected in shipments of parts and machines according to Miyano's Web site.

Our machine tool dealership Graff-Pinkert & Co. is making a contribution to the Red Cross for Japanese relief. We received heartfelt emails after the tragedy from two dealers in Japan we have done business with in the past and machine tool builder Mitsui Seiki.

The following are excerpts from the notes sent by Makoto Torazawa of San-Ei Trading in Nagoya, Y. Sato of STI Products in Nagoya, and Mitsui Seiki's Scott Walker and Koichi "Ken" Iwakura.

From Mr. Terazawa
Thank you for your wonderful support for the disaster which occurred in Japan last Friday.

The northern pacific coast area of Japan is in a critical situation. Also, the leak of radioactivity from a nuclear power station is another big problem. Fortunately, our place in Nagoya had very little damage and all of our family, colleagues and friends had no problem since we are quite far from the epicenter.

For the time being, Japan is facing very difficult situation. However, we believe we will see the light with the help of friends all over the world.

From Mr. Sato
Nagoya is far away from the focus of this earthquake. My team and family are okay.

Personally this earthquake scared me very much with the devastating tsunami. According to yesterday's newspaper, 2000 corpses were found and we may have a nuclear disaster. It is a tragedy.

But we Japanese are trying to rebuild Japan soon with help from all over the world, including you.

From Scott Walker and Koichi "Ken" Iwakura
Thank you for your heartfelt inquiries about us after the major earthquake and tsunami events in Japan. We are very fortunate. Our employees and their families are all accounted for and safe. Our factory only experienced very minor damage that has been inspected and addressed already. There are challenges, of course, particularly with the country-wide energy conservation strategies; however we are working around those temporary tactics effectively. We are continuing to support our customers, and our deliveries remain on schedule. We value our business relationship with you, and on behalf of the entire Mitsui Seiki staff, we have been touched deeply by your concern, encouraging words, and gestures of support.

I talked to Jack Schweitert of V-S Grinding recently about how the Mexican drug wars affect his operation in Ciudad Juarez, Mexico. V-S has been operating in Mexico for many years, primarily making shafts. He is headed down to El Paso, Texas, soon for one of his quarterly visits.

I questioned him on El Paso's advertising campaign proclaiming it the safest city in America in 2010. According to stats on violent crime and murder, El Paso, a city of 800,000 people, 3/4 Hispanic, has the lowest murder rate of major cities in the U.S.

But in Ciudad Juarez, just over the Rio Grande River, the drug wars go on unabated, with more than 2500 killings last year.

Jack says his plant manager, Carlos Castillo, who has worked for V-S Precision USA for many years, takes daily precautions. He lives in El Paso and make sure to vary his commuting pattern to the factory. Meals are served to all employees in the company cafeteria, which is the norm in border Mexico. One casualty of the drug war in Mexico is small businesses like restaurants. With people afraid to move freely on the streets, many commercial businesses have closed.

Jack says that Juarez is still a viable manufacturing location. The company made money there last year. He still enjoys going to Texas and finds El Paso a lively place with a multitude of good restaurants and a cosmopolitan community, partly because Fort Bliss welcomes pilots from all over the world for flight training there.

What a difference a river makes.

swarf

Housing prices supposedly dropped in February 3.1 percent, prompting the doomers to predict the dreaded double dip recession. Yahoo! and the New York Times trumpeted the news like it was Armageddon. But I see it as good news for the economy and for America.

The losses that are being taken now on housing mean that sellers are starting to accept the drop in values, which actually took place two years ago. The market is begging for the inventory of unsold homes to re-price to the level that will unlock the wallets of real buyers, be they speculators, renters, or buyer-occupants.

I believe many people would sell their homes if they could land in a better or comparable housing situation. Instead they languish with underwater mortgages, hoping for a miracle in the market that will lift their value vis-á-vis other homes they might covet.

The drop in selling prices is a signal that lenders and occupants are getting realistic about the housing market. When housing prices drop to their fair return rental value—the price people will accept to lease their house to make a reasonable return on investment—houses will sell.

For many years Americans have paid way too much for housing in relation to their incomes compared to the rest of the world. In China people pay more for tutoring their children outside of school than they do on average for housing. The same is true in Korea.

The housing industry has convinced Americans that their home is the best investment they can make. Historically homes have been awful investments, falling in value as often as rising.

The drop in February home selling prices means we are finally coming to grips with an inflated asset class which was overdue for a sustained fall.

One of my most important spiritual holidays was recently celebrated. Not Passover, not Easter, but one just as big on my calendar, Opening Day of the baseball season.

If you define religious experience as a spiritual connection, no day is bigger for me than the signal of hope and rebirth that is Opening Day.

Passover and Easter are beautiful family celebrations of freedom and rebirth, but the fresh slate of a new season, with the stories passing between generations of fans, excites me more than a kid getting a new train set. I remember when I used to talk about the Chicago Cubs with my grandfather, whose baseball lore carried back to Mordecai "Three Finger" Brown, the aptly named Cubs slugger "Smiling" Stan Hack, and "Jolly Cholly" Grimm. His love of the game flowed to my Mother who would walk to the games on weekends as a kid and used to take me to Wrigley on "Ladies Day." Now I get to talk Cubs to my son, Noah, and educate my granddaughters who already identify as Cub fans, even though they've lived their whole lives in the Bay Area.

Could there be any more significant identification with the spirituality of baseball than the choice of songs my family sang to me 45 minutes before I was wheeled into the operating room for heart bypass surgery? The last song I heard was a ringing rendition of "Take Me Out to the Ballgame" and the only thing I remember from the operating room was the Cubs-Houston game on the radio.

If that isn't a religious experience, I don't know what is.

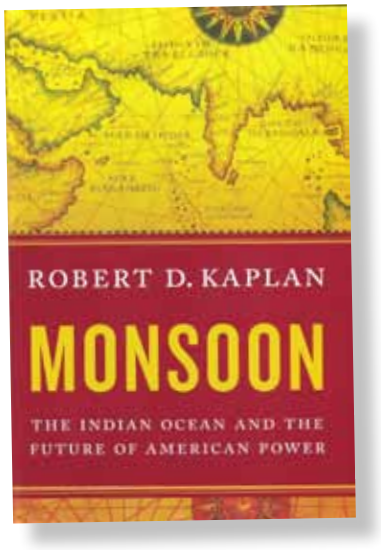
By Jerry Levine

MONSOON

Monsoon by Robert Kaplan is a superb book about India, another Third World country (not China) that is flying into the 21st century. Kaplan believes that during this century the world's balance of power will move from the North Atlantic into the Indian Ocean. India, China and the United States will come into direct competition over raw materials, markets, and political and military influence.

For the past several years a global chess game has been quietly unfolding across the Indian Ocean—stretching from Africa and the Persian Gulf through the Arabian Sea and the Bay of Bengal, and out into the South China Sea. China, India and the United States have been the main players, but Iran, Saudi Arabia, Pakistan and Indonesia have also been active.

The main driver has been China's attempt to line up raw materials, mainly oil, but also minerals from Africa and the Middle East, and then ensure their safe passage to China. About 85 percent of China-bound oil must pass three major pinch points, the Strait of Hormuz at the exit of the Persian Gulf, Andaman and Nicobar Islands in the Bay of Bengal, and the Strait of Malacca, which enters the South China Sea. These strategic locations are controlled respectively by Iran, India and Indonesia—three countries who have not had long-term cordial relations with China. Recently, China has had territorial conflicts with its South China Sea neighbors, Vietnam, the Philippines, Taiwan, Japan and Korea, ostensibly over fishing rights around various small islands. China's real objective, however, is to guarantee unobstructed shipping lanes for oil and other goods.



In the Indian Ocean, China is investing billions along their supply line to build a "string of pearls" series of ports in Pakistan, Sri Lanka, Bangladesh and Myanmar. The ports are designed to handle both commercial and military traffic. China is also looking at overland pipeline routes to its interior from Central Asia and Myanmar, as well as a pipeline from Iran to their new port in Gwadar, Pakistan. India is countering by building additional military ports on both its west and east coasts.

In the meantime, the U.S. 7th Fleet is still exercising its dominance in those same sea lanes. The 7th Fleet is still far larger than the combined navies of India and China, but both countries have significantly increased their military spending in the past few years in an attempt to project more power in their own back yards.

The rise of India's and China's economies and the countries' demand for oil has been an accelerant for the Arab world's economies. For the Arabs, China could be an alternative strategic partner to the West. The way the U.S. manages the "Arab Spring" revolutions will define its relationship with the Arab world, which may then affect the inroads China achieves in that region.

Likewise, Africa is also becoming a beneficiary of India's and China's economic growth. China today gets 35 percent of its oil from Africa and India gets 20 percent of its oil from Africa. Chinese goods are flowing in the opposite direction. Access to arable land is another area of competition between the two countries. While both India and China are self-sufficient in food production, the two compete for additional land in various African countries to plant exotic crops like palm oil for biofuels.

It is possible that India's and China's mutual dependence on the same sea lanes could one day lead to an alliance that could turn hostile to the Unites States. But currently, the three countries have been united in humanitarian efforts, such as providing aid to the victims of the 2004-5 Indian Ocean tsunami. Pirate attacks, an ever-increasing problem in both the Arabian and the South China Seas, will also provide opportunities for cooperation among the three powers.

Robert Kaplan entitled the book "Monsoon" because monsoons are destructive yet also essential for growth and prosperity. The Indian Ocean countries are growing rapidly and represent a shift in the global balance of power. American foreign policy needs to allow room for this growth and then participate in the region's increased prosperity.

Comments? You can email Jerry Levine at jerroldlevine@yahoo.com.

◀ EXAIR

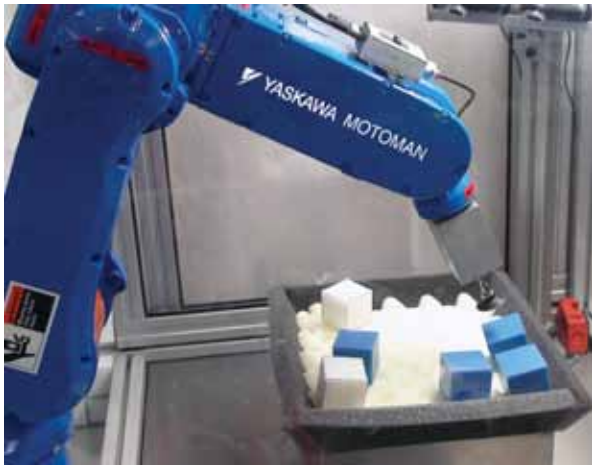
EXAIR's new atomizing spray nozzles are internal mix nozzles that atomize fluids in a range of spray patterns for a variety of uses. They combine liquid and compressed air to create a mist of atomized liquid that can be easily adjusted to meet the needs of your application. With EXAIR's atomizing nozzles, you can coat, cool, treat and paint a variety of products using compressed air and liquids with a viscosity of up to 300 centipoise. Used with water, atomizing nozzles are an efficient way to evenly cool hot items in your automated process. The stainless steel construction of these atomizing nozzles adds to their durability and corrosion resistance. EXAIR atomizing nozzles are available in a variety of sizes and shapes to meet your needs. All models are adjustable and come with a five-year Built to Last Warranty. Price starts at $159.

For more information, please contact EXAIR at 800-903-9247 or visit www.exair.com.

▶ Hurco

Brooks Associates will demonstrate the power of Hurco technology at EASTEC Booth 1304 with the VMX30U 5-axis machining center, TMX10MY high performance multi-tasking turning center with sub-spindle, and 3-axis VM20 equipped with a rotary table. The VMX30U has an efficient trunnion table design and advanced 5-axis technology that simplifies the complexities of producing parts and molds with swept surfaces and contours. For customers who don't have simultaneous 5-axis work right now, the Hurco 5-axis machines include the 5-sided solution that will make each part more profitable.

For more information, please contact Hurco Companies, Inc. at 800-634-2416 or visit www.hurco.com.



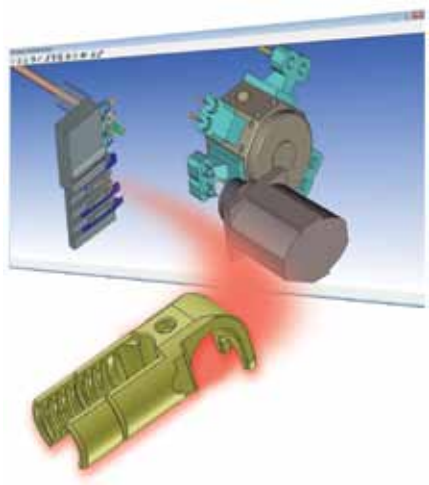
◀ Motoman

MotoSight™ 3D Spatial Vision, an innovative 3D vision system, delivers cost-effective, flexible and scalable real-time 3D vision guidance for Motoman® robots. It is ideally suited to enhance part picking, box moving and automated kitting. "MotoSight 3D Spatial Vision is a great step forward in 3D vision guidance for industrial robots," said Roger Christian, Vice President Marketing and International Groups at Motoman Robotics. "Powered by Universal Robotics' Spatial Vision™ Robotics software, we are now able to offer 3D vision guidance at 2D prices that can be customized to a user's needs. We are excited to partner with Universal Robotics to bring this solution to market."

For more information, please contact Yaskawa America at 937-847-6200 or visit www.motoman.com.

fresh stuff

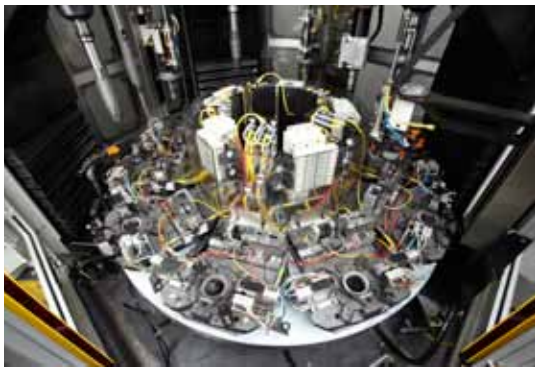
▶ PartMaker



PartMaker Inc., a division of Delcam Plc, will demonstrate its latest version of PartMaker Software for programming CNC Mills, Lathes, WireEDM, Turn-Mill Centers and Swiss-type lathes at Eastec 2011 in West Springfield, Mass., from May 17 – 19, 2011 in booth 5326. PartMaker Version 2011 features the PowerSHAPE Companion for PartMaker, an optional module to allow you to design 3D models, repair poor quality 3D data and modify 3D geometry to improve "Design for Manufacturability" (DFM). This new optional module features the powerful "Solid Doctor" utility, allowing you to read and repair models from all sources and tackle the common problems that can be found when translating low-precision and incomplete 3D data by detecting and repairing faults in engineering models and generating a valid, high-precision solid model ready for programming in PartMaker.

For more information, please contact PartMaker Inc. at 215-643-5077 or visit www.partmaker.com.

◀ Sunnen



Sunnen's new patented multi-feed honing technology, which will be demonstrated at Eastec, gives users a revolutionary choice of tool-feed modes to achieve the shortest cycle times, lowest part cost, and longest abrasive life. Multi-feed combines Sunnen's new controlled-force tool-feed with its controlled-rate feed system. The two different tool-feed modes allow the user to select the better option to suit the workpiece geometry, material and tool type/size. Multi-feed technology is available as an option on new machines in Sunnen's SV-1000 and SV-500 Series, as well as a retrofit for existing machines in these series. Controlled-force honing, a new feature in multi-feed, works like cruise control to ensure the optimum cutting load on the honing abrasive throughout a cycle, irrespective of the incoming part's hardness, geometry or size variation.

For more information, please contact Sunnen Products Company at 800-325-3670 or visit www.sunnen.com.

▶ ZPS America

With ultra short cycle times, outstanding throughput and the highest standards of surface cleaning, Pero's R1 sets a new benchmark in component cleaning performance. The R1 is suitable for any type of machined or formed metal components that can fit into a standard 530 x 365 x 250 mm basket (other sizes are available as special order). The R1's innovative and cost-effective vacuum solvent degreasing technology is ideal for machined components; punched, drawn and extruded parts; precision ground products and close-tolerance electro-mechanical items. Aerospace components, engine and automotive parts, heat exchangers and special purpose units are ideal candidates as well.

For more information, please contact ZPS America LLC at 317-452-4030 or visit www.zpsamerica.com

With Alan Earls

Today's Machining World's feature "Origins" tells the stories of how successful technologies, companies and people got their start. This month we look at Leonardo Da Vinci's sketches of proto-machine tools, including lathes and screw machines, which he conceived hundreds of years before they were ever built.

The Da Vinci "Code" Included Machine Tools, Too

These days, thanks to books, movies, a Discovery Channel reality show, and innumerable global museum exhibits, that penultimate renaissance man, Leonardo Da Vinci, is among the most popular of the tribe known as dead white males. Dan Brown made him a central figure in his novel, *The Da Vinci Code*, where his art (and sexual proclivities) are analyzed ceaselessly by scholars and pundits. For every gear-head, engineer, scientist and nerd, there is always the attraction of his mechanical inventions, most famously including military tanks, helicopters and multiple barrel artillery.

It turns out, though, that among Leonardo's inventions there is a whole collection of proto-machine tools. For instance, around the year 1500, the artist-turned-engineer sketched a lathe with a three-bearing head stock as well as a screw cutting machine. The latter consisted of a flat table with a "cutter block" sliding across at right angles to the material being threaded. The crank, which rotates the stock, also "feeds" the cutting block through a series of gears, at a rate designed to produce a specific thread pitch. Da Vinci's drawing includes illustrations of alternative gears, which would allow for different screw pitches to be cut on the same machine.

He conceived the lathe as treadle powered, and appears to have envisioned it as another way to cut screw threads. A different drawing by Leonardo shows a lathe also powered by a treadle, however, in this case the crank is supported by two bearings to enhance rigidity, and beyond the crank, a flywheel has been added to the design to produce steadier, uni-directional rotation. The tailstock on this lathe is fixed, but a threaded centerpiece permits handling of work pieces of various lengths.

Leonardo also made a very detailed drawing for a pipe-boring mill. The design was considered so complete that a scale model was crafted from it and put on display at the London Science Museum. According to *A Short History of Machine Tools* by L.T.C. Rolt, "The most remarkable feature of this machine is that the screw clamps which hold the workpiece in position for boring are interconnected by pinions with a ring gear, so as to be self-centering," anticipating the design of the self-centering chuck.

As if those achievements weren't enough, Leonardo also sketched a wide array of grinders, including one designed to grind curved mirrors and an "internal" grinder.

Not bad for a contemporary of Christopher Columbus.

However, like Leonardo's helicopters, military vehicles and host of other fascinating conceptions, there is no evidence that he or his contemporaries ever attempted to actually build the machine tools he sketched. It was, it seems, "the thought" that counted. The world went on its way for a few more centuries before others, independently, came to conclusions that were similar to the ultimate Renaissance man.

Valek Sykes, a special effects expert *and* mechanical designer, as well as a "star" of the Discovery Channel show *Doing Da Vinci*, says Da Vinci's influence on the contemporary world is still huge. For his part, Sykes says he has visited just about every museum in Europe that has Da Vinci exhibits. And, as part of his work with the Discovery Channel, he used Autodesk Inventor software to produce renderings of several Da Vinci designs, including a large crossbow.

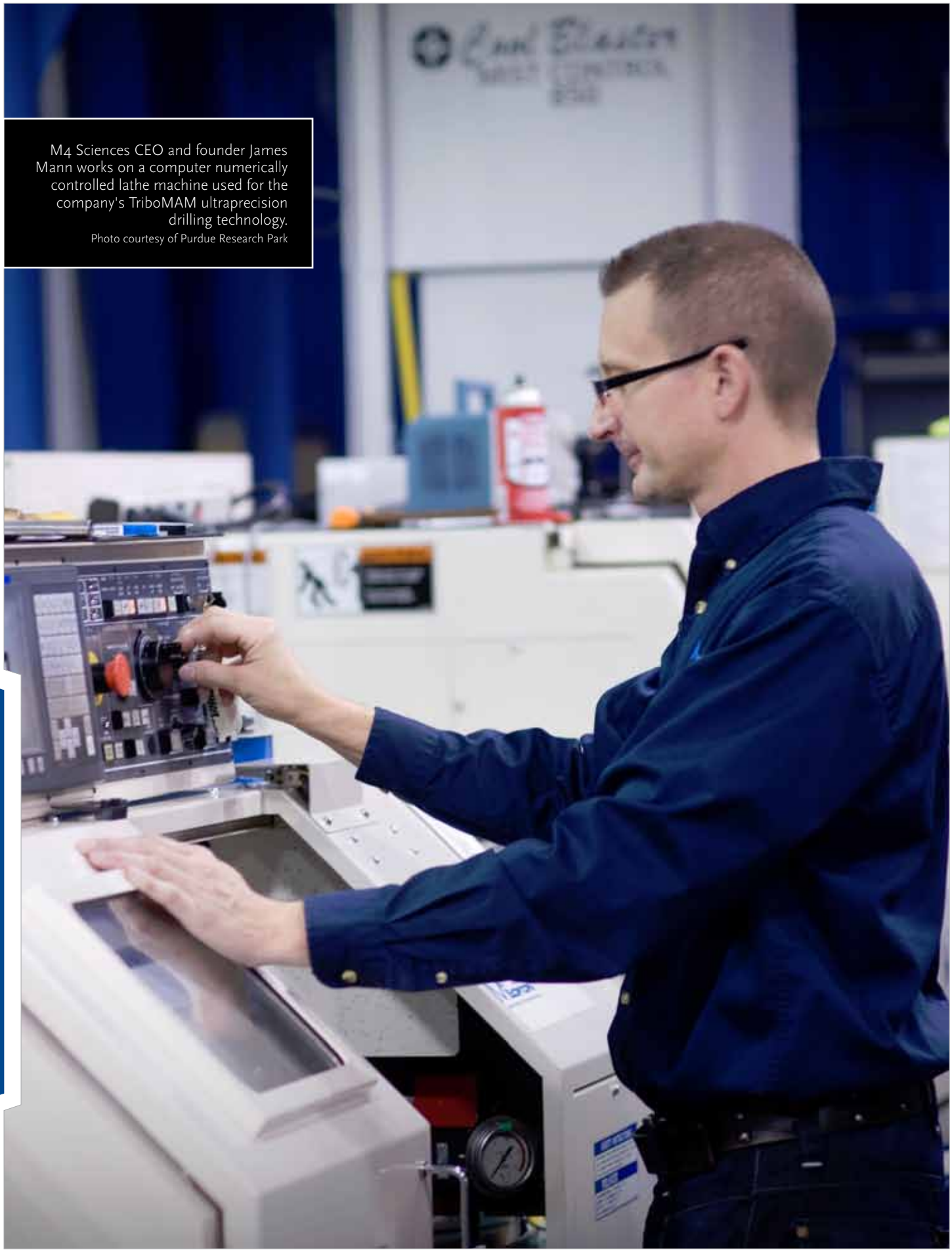
Sykes' company, Tech Works FX Studios, Inc., boasts, "If you can think it, we can build it," and the Da Vinci show helped give form to several of the inventor's ideas. "Because it was a TV show, they wanted all the cool stuff, so we built about 10 machines, mostly war machines," says Sykes.

"One of the interesting things we found is that, probably because there was no such thing as patents back then, Da Vinci sometimes put in a few things that were deliberately wrong, so it would be hard for an uninformed person to make his designs work," he explains.

Samuel P. Clemence, the Meredith Professor of Civil and Environmental Engineering at Syracuse University is also hooked on Da Vinci and actually co-teaches a course about him. "I have struggled to get inside his head, but it is difficult because we have so little to go on," says Clemence.

According to Clemence, Da Vinci's interest in things mechanical may have been sparked by a trip to Florence where he was able to view the cranes and other machines being used to construct the Basilica di Santa Maria del Fiore (better known as the Duomo), with its dome engineered by Filippo Brunelleschi. Unfortunately, after his lifetime of creativity, many of Da Vinci's drawings and notes were scattered and permanently lost. "If he had had steam or electricity, there's no telling what he could have done," says Clemence.

Clemence says the class he co-teaches with an art history professor brings together engineering and art students. They get to consider such "what ifs" as well as the broader implications of genius and the rarely explored intersections between art, science and engineering. "We limit the class to 10 engineering students and 10 fine arts students and by the end of the course they are doing projects together," he adds.



M4 Sciences CEO and founder James Mann works on a computer numerically controlled lathe machine used for the company's TriboMAM ultraprecision drilling technology.
Photo courtesy of Purdue Research Park

By Barbara Donohue

University Research on MACHINING

Metal cutting is alive and well in academia, with research producing both radical new technologies and clever tweaks for traditional machining.

While your shop is busy making chips, professors and graduate students around the country are researching and experimenting with ways to make your jobs easier, faster, and more cost effective, and even make impossible parts possible to machine.

It's a liquid—it's a gas! Cooling with supercritical carbon dioxide

Cutting fluids are expensive to buy, expensive to maintain, and then expensive to dispose of after their useful life is over. They can also cause skin sensitization, and you have to treat them to prevent anything from growing in them. Minimum quantity lubrication (MQL) offers a way around using large quantities of fluid, but MQL's spray of lubricant doesn't appreciably cool the tool.

A new approach, developed at University of Michigan, uses carbon dioxide, but not in its familiar gaseous form. "When you take carbon dioxide and compress it and superheat it, it displays properties of both liquid and gas," said Gordon Krauss, research investigator/adjunct lecturer at University of Michigan, Ann Arbor, Mich. This is known as the supercritical state, and it occurs for many materials at the right temperature and pressure. For carbon dioxide that means 31 degrees C (88 F) and 1100 psi, Krauss said.

To create this process you would need to buy a pump system—that's the critical aspect of the technology, Krauss said. It would require you to buy food-grade carbon dioxide and mix in a small amount of the appropriate lubricant. Then use a nozzle to spray the coolant at the machining area. The carbon dioxide cools as it expands, providing a cooling effect for the tool. At the same time, a small amount of the lubricant is applied.

The project's goal originally was to develop a cooling technology that was more environmentally friendly than conventional coolant, even if it meant a lower performance, Krauss said. He "set a grad student to work on it, hoping for it to be half as good," he said, "and it turned out to be better."

The food-grade carbon dioxide used in the system is a by-product of ammonia production, Krauss said. It's the same stuff that puts the bubbles in soft drinks. Carbon dioxide has a bad reputation as a greenhouse gas, contributing to warming the earth. However, taking into account the whole life cycle—coolant manufacture, usage, and disposal—the small amount of carbon dioxide this technology uses has a small environmental effect compared to that of conventional cutting fluids, according to a study published in the journal, *Environmental Science & Technology*.

In addition to environmental improvements, though, "you have benefits like tool life—it can make tools last twice as long," Krauss said, "or [you can achieve] twice the machining rate."

This technology is being commercialized by Fusion Coolant Systems, Ann Arbor, Mich.

Coming attractions in cutting fluids

Krauss also talked about forming a new working group for those "who care about metalworking fluids." Every interested party has different needs and a different point of view, he pointed out, and this group will seek to cover everyone's interest. The end user wants cheaper. The toolmaker doesn't care too much as long as there is no negative reaction with the tool, and machine manufacturers and cutting fluid producers have their own agendas. "Something should happen, and we're going to do it," Krauss said. "By having the university involved in the actual research, we can get this information and share the benefits."

how it works

Smaller chips mean no more pecking cycle

A technology developed by professors W. Dale Compton and S. Chandrasekar at Purdue University School of Industrial Engineering, West Lafayette, Ind., enables faster drilling, without peck cycles. Modulation assisted machining (MAM) oscillates a drill in a controlled motion, up to 1000 times per second. This produces an intermittent drilling action that cuts consistently small chips, which easily flush from the hole. It also enhances lubrication.

M4 Sciences, West Lafayette, Ind., is commercializing this technology in its precision TriboMAM drilling system and custom modulation-assisted machining devices.

Strategies for chipbreaking

Chips are also on the research agenda at University of North Carolina Charlotte (UNCC), Charlotte, N.C. You can use a lot of different strategies to deal with them, said UNCC professor Scott Smith. High-pressure coolant and tool geometry come to mind. His department is working on using the axes of the machine to change the tool path and control movement of the tool entering and leaving the cut, thereby controlling the geometry of the chips. You can break all chips in all materials, Smith said, by modulating the tool path. This same strategy can aid in machining difficult materials like nickel alloys.

Deformation on purpose: making complex shapes happen

UNCC has a long history of making really thin parts by machining—parts that used to be made in sheet metal, Smith said. With lots of applications in aerospace, big reductions in cost and weight were possible. In sheet metal, the cost was not in the material but in the hand work: folding, riveting, sealing layers to put a rivet through. The focus on machining thin parts has been going on for more than a decade, he said.

Now the thin-parts work goes farther, into a process called deformation machining. "After machining something thin," Smith said, "we use a tool that looks like a ball end mill without the flutes" to deform the part in various directions to get the desired part geometry. For example, pushing out the bottom of the cells in a honeycomb bulkhead makes it stronger. "We can make 5-axis parts on a 3-axis machine: pins pushed open like a flower and things that look like impellers."

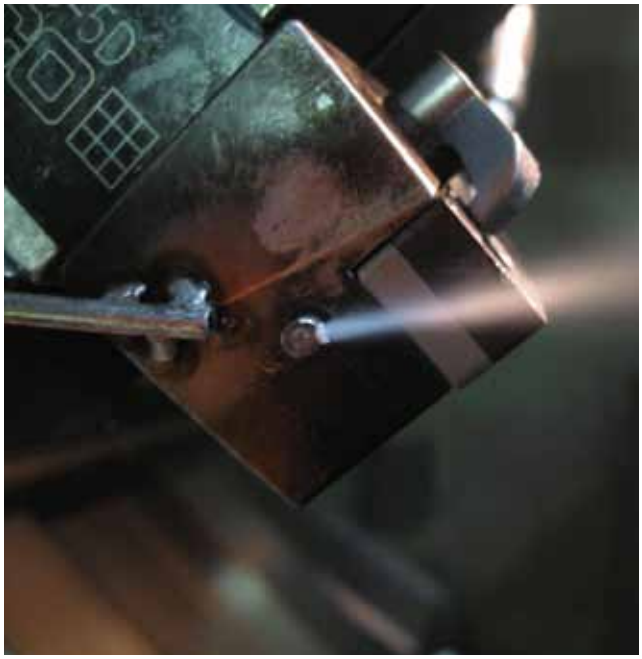
Micro and meso on the move

"Since the early 1990s, we've been asking 'How are we going to make this oncoming slew of micro parts?'" said J. Rhett Mayor, professor at Georgia Institute of Technology, Atlanta, Ga. Research includes looking at fast, accurate machining, hard-to-cut materials, and micro-scale mechanical machining processes.

Left: The M4 Sciences TriboMAM system provides ultraprecision drilling for more efficient production of orthopedic bone screws, electronic equipment and automotive engines. Photo shows TriboMAM control (background), tool, and chips.

Photo courtesy of Purdue Research Park

university research



Left: Supercritical carbon dioxide CHiP Lube (composite high pressure lubrication) installed for a turning operation.
Photo courtesy of Fusion Coolant Systems

Conventional machining goes down to tool sizes of 1 mm or 1/16". Meso (intermediate) machining includes work with tools smaller than 1 mm or cutting features under 1 mm. Micro machining has many definitions, some of which would include the meso range. In practice, however, said Shreyes N. Melkote, PhD, also a professor at Georgia Tech, machining features below 500 microns (about 0.020") qualifies as micro machining.

"Job shops call me and ask, 'How can we get into the [micro machining] market? How can we participate?'" Mayor said. "It's often as simple as buying better spindles and taking a short course. People with a smaller conventional robust 3-axis machine—maybe Haas or Okuma—will come in and ask, 'Could I make a meso scale component with some micro features?'" For example, some shops may be making biomedical parts that are not that small, but the surface required to allow proper tissue growth may be in the micro realm—you now have to make micro surface features.

On the micro level, many aspects of machining change, becoming more difficult or just different.

Your feeds and speeds are fundamentally different for micro work, Mayor said. At micro scale, shallow and fast gives precision. It seems like pretty aggressive feed per tooth.

Conventional CAD/CAM breaks down at the sub-200 micron tool level, Mayor said. "Some interesting things occur in how you define the geometry of the tool path when the feature is no longer bigger than the tool."

Melkote has worked to develop methods to set tools 100 microns (0.004") in diameter. You can't use paper, which is about 100 microns thick, to set a 100-micron tool. Automatically detecting when the tool contacts the workpiece will aid setting. Tool holding becomes a challenge when just tightening a chuck can break a 100-micron tool.

Work is being done on lubrication and cooling at the micro level, Melkote said. "If you take a normal coolant nozzle and blast it on a 0.004" tool you can break it." New coolant schemes will provide laminar (smooth) flow around the tool.

And macro

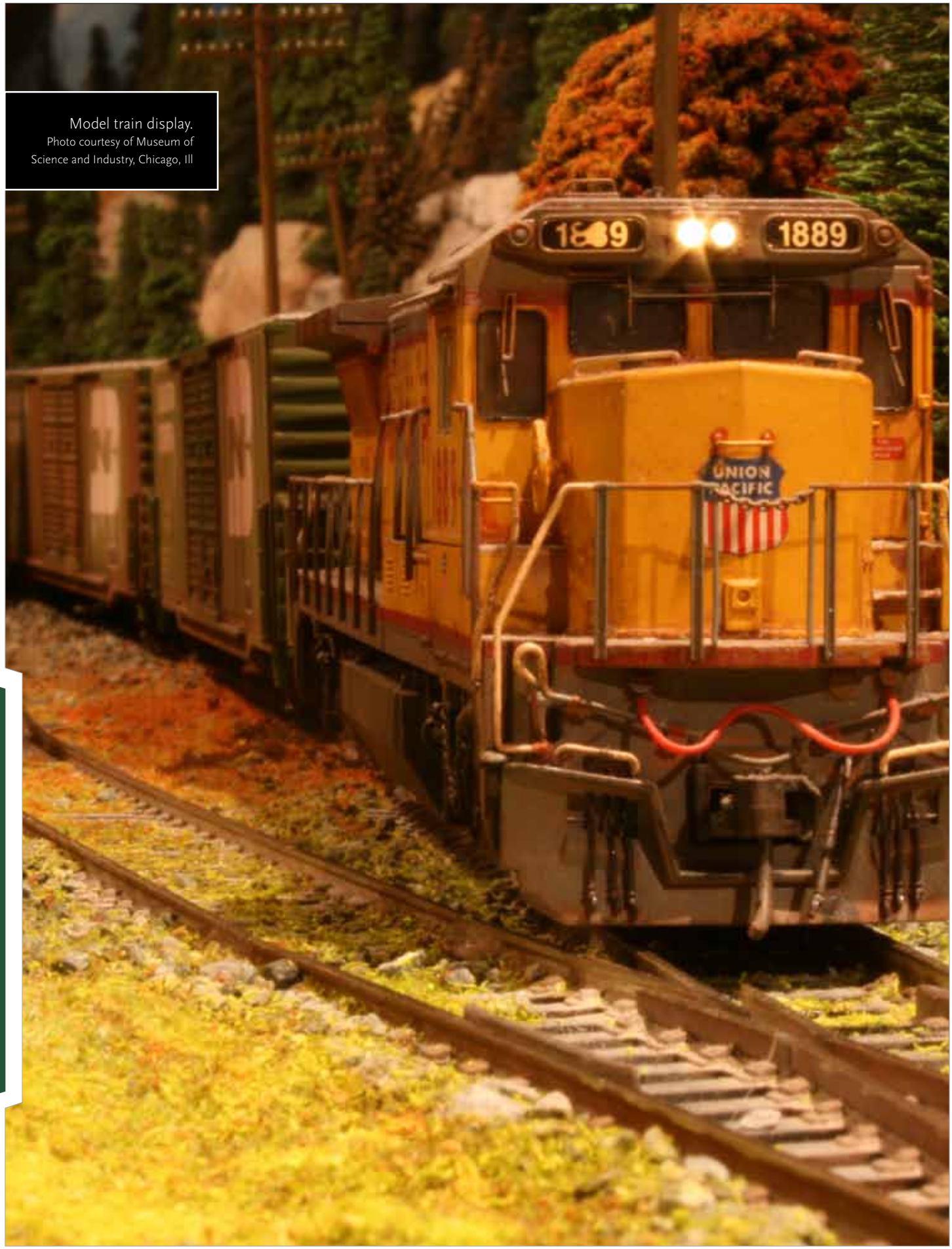
Georgia Tech is developing a new approach for enhancing the productivity of making large parts made of hard materials, Melkote said. For example, bearing rings for wind turbines present particular challenges. They're made from hard materials and run two to three meters in diameter. They take six to 10 hours of grinding or hard turning, using cubic boron nitride (CBN) tools.

On a smaller scale, his department is working with one of the leading bearing manufacturers, allowing them to speed up the machining process and use lower-cost tools, such as aluminum oxide ceramic. In laser-assisted machining of hard materials (perhaps in excess of 60 Rockwell C) a laser is used to treat the surface before machining. To incorporate a high-powered laser right on the spindle is unwieldy, so the process uses the laser outside the machine tool to essentially temper the surface of the workpiece a few millimeters deep. Then the part can be cut at conventional speeds, or even faster, reducing the overall processing time.

Some of the current research may seem like science fiction, but probably carbide tools and CNC machines did, too, when they were being developed. Many of the far-out ideas in university labs today will eventually find their way into your shop to make your work life easier and your profits higher.

For more information:

Abrasive Form, Inc.: www.abrasive-form.com
Fusion Coolant Technologies: www.fusioncoolant.com
Georgia Institute of Technology: www.gatech.edu
M4 Sciences: www.m4sciences.com
Purdue University: www.purdue.edu
University of Michigan: www.umich.edu
University of North Carolina Charlotte: www.uncc.edu
Paper: Comparison of Life Cycle Emissions and Energy Consumption for Environmentally Adapted Metalworking Fluid Systems, Environmental Science & Technology: http://people.virginia.edu/~afc7r/pubs/es800791z.pdf



Model train display.
Photo courtesy of Museum of Science and Industry, Chicago, Ill

Engineers Toy with Real Model Trains

By Robert Strauss

Charlie Smith weaves his Big Joe forklift through his warren of machinery as if he were the Pac-Man of an old video game. The machines are relatively of that era—Van Dorns and Hansvedts and CNCs of various types and sizes.

On the Big Joe is a thousand-pound S-7 tool-steel mold for a GP 38 Model O engine, whose machined parts Charlie makes for Weaver Models, one of probably less than a half-dozen model train manufacturers who still do all their machine work in the United States.

While Weaver itself is a modern business complete with glossy Web pages, international sales team, and a sleek headquarters on the main road in this Central Pennsylvania town—Charlie is from an era long-past, though hopefully never forgotten.

"Charlie never trashes anything and he fixes his own machines. He probably has 30, 35 machines in that shop. I only wish someone were there to take all his knowledge down," said Joe Hayter, the owner of Weaver Models, which will sell one of the GP 38s—scale models of engines found all over the Missouri Pacific and a dozen other freight lines in the 1970s—for $299 from its catalogue.

Hayter won't try to compete in volume with the industry leaders like Lionel, which has gone through several upheavals, bankruptcies and sales since its mid 20th century heyday, or Bachman Industries, a Chinese-owned company with American headquarters in Philadelphia, which claims to be the worldwide model train sales leader—Thomas the Tank Engine and the like.

But with custom sales and homespun items like the GP 38, Weaver is a cog in the continuing interest in model railroading. The trade organization, the National Model Railroading Association, claims there are 500,000 enthusiasts, with the largest segment of them middle-to-upper-middle class Baby Boom men, folks like Weaver's Hayder, who is 64, himself.

"In the late 1940s, and then after, it was something every little boy had, or wanted to have, underneath the Christmas tree. There weren't video games or much of anything that actually moved, so this was it," said Hayder. Things went a little dormant toward the end of the 20th century as computer-oriented games and toys became the norm. But there seems to be a bit of a revival of late.

"Grandfathers are buying sets for their grandchildren, something they can do all together," said Hayder. Weaver, he said, doesn't sell starter sets, but caters mostly to collectors and people who know trains a bit. But he said Lionel and the mass-producers do a good job of keeping initial prices low for rudimentary tracks and trains, and then, like in all hobbies, hooked enthusiasts trade up to Charlie-Smith-made Weavers or trains from Bill Donovan's Real Train Company out in Yucaipa, California.

Real Train makes what are called three-inch or one-and-a-half-inch scale—as in that part of a foot—meaning that Real Trains (the brand) are one quarter to one eighth the size of real trains. That means instead of just looking at them circle a board-supported layout, Real Train types put on their railroad caps and ride them.

Above: Joe Hayter outside Weaver Models.
Left: Collection of various Weaver train models.
Photos courtesy of Weaver Models

"When I was younger, I built the regular model trains," said Donovan, whose Southern California plant is 4000 square feet and full of CNCs, lathes, screw machines and even manual machines. "But then my dad picked it up from me and found people who liked the bigger trains they could actually ride."

Fifteen years ago, Real Trains was born to do more custom and exotic models. It provides amusement parks with rides—usually the larger three-inch models that run on 15-inch gauge tracks, meaning it is 15 inches from the inside of one track to the inside of another. At home, enthusiasts usually go for the smaller models, the one-eighth sized on seven-and-a-half inch gauge—the distance between the inside of the rails.

"Amusement parks need it wider to prevent them from tipping over with lots of customers. You do it in your yard and you are more careful, so you don't need it so wide," said Donovan. He said it would seem like an expensive hobby, since an entry-level industrial diesel engine goes for about $2300. But, he said, because of the need to have a big space to have a decent-sized layout of track, most Real Train folks belong to clubs, some of which have nominal annual fees just to come out and ride. One club, Train Mountain in Chiloquin, Oregon, has more than 25 miles of track and charges just $50 a year for new members.

Real Trains employs 11 full- and part-time machinists and Donovan said he saw business go up, not down, during the recession, so he bought two new machines in the last couple of years—a Doosan 400 M lathe and a Star ECAS 32 screw machine.

"We do a tremendous amount of laser-cutting of metal, so we depend on that laser," said Donovan, "plus we have a couple of small CNCs that we have had for a long time for more precision work."

Modelers of the smaller sort tend to be in clubs, rather than having merely basement layouts, these days. The South Jersey Garden Railroad Society, for instance, rents buildings—often out-of-use department stores—to have mini-conventions every couple of months or so. For a weekend in mid-March, for instance, a vacant former Circuit City store just west of Atlantic City became a convention of sorts for several hundred model trainers—in Hayder's suggested demographic of granddads and grandchildren. There were a half-dozen layouts of various stripes, from a citified trolley line exhibit to a complex 100-yard countryscape, full of valleys and rivers and barns with chewing tobacco advertisements painted on the side.

> "Anyone can slap a coat of paint on something and get it moving a little bit," said Jack Thornton, one of the Albuquerque enthusiasts. "But these are nuclear scientists from Los Alamos and engineers from the University of New Mexico and machine guys who really know stuff."

In the aisles, not unlike big convention sporting and flower shows, there were vendors with used trains and mock-vintage caps and gear and reference works about long-ago engines and boxcars, as well as scale-sized billboards that might be at the Jersey Shore today—touting radio deejays, casino acts, and restaurants and hotels.

"The hobby is what you make of it with price," said Donovan. "Sure, you can spend $10,000 on something I can make you

Left: The Ryedale Society of Model Engineers Limited gather at Gilling East, UK.
Photo courtesy of The Ryedale Society of Model Engineers Limited

that will be all detail and finely machined. But people can collect Lamborghinis or drive small cars, too. I think that is why it is coming back, because you can start off inexpensively and move up. Plus, trains are the ultimate in nostalgia. Who can resist the sound of a train in the distance, making you think of traveling far away?"

Certainly not the guys of the New Mexico Steam Locomotive & Railroad Historical Society. They are in the midst of trying to rebuild Baldwin Locomotive Number 2926, built originally in 1944 for the Atchison, Topeka & Santa Fe, the railroad line popularized by the song of the same name sung by Judy Garland. The locomotive, built at the Baldwin Eddystone Works in Philadelphia, took passenger trains from Chicago to Los Angeles and was one of the most powerful steam locomotives ever, weighing over a million pounds and generating up to 4500 horsepower.

Number 2926 was retired by the railroad in 1954 and sat in an Albuquerque city park until the late 1990s. Now at a rail siding in Albuquerque, the society members meet Wednesdays and Saturdays to fix it up, and plan to have it running as soon as they are able—maybe by the end of the year—on what is now merely a freight line north from Albuquerque to the Colorado state line.

"Anyone can slap a coat of paint on something and get it moving a little bit," said Jack Thornton, one of the Albuquerque enthusiasts. "But these are nuclear scientists from Los Alamos and engineers from the University of New Mexico and machine guys who really know stuff."

Thornton said they are taking original parts and machining them to fit, or creating tubing for the boilers or engine minutia that has been long gone.

"No one makes this stuff any more, so a lot of it is from scratch," he said. "I was a model train buff when I was a kid, but there is nothing like this. It shows what a hobby can become."

Meanwhile, back in his rambling Northumberland machine shop—a low-lying garage-like structure several hundred yards back from the state road in this burg halfway between Philadelphia and Pittsburgh, which means far away from most everywhere—Charlie Smith looks through his "Car Builders' Cyclopedia: 21st Edition," which was published, oh, only 50 years ago in 1961. Though most of his newer AutoCads are on the computer—a vintage 1996 model with Windows 98—he still has many original blueprints. What Weaver buyers want are not on President Obama's high-speed rail lines, but from the times when those train whistles really were ubiquitous.

"If you give me the pictures, I can create it for you," said Smith, whose wife, Carol, has urged him to quit, but who, at 81, finds a triumph in creating the mold for each new Weaver request. He used to be the manager of several manufacturing businesses, but went off on his own in the 1970s. On the side, he tries inventions—a one-cup coffee dispenser; secure roll-up stoppers for toothpaste and cosmetic tubes—but mostly it is just the chance to machine things—though the train molds are his lifeblood.

Smith has five injection molding machines, including Reeds and Van Dorns of various sizes in his ramshackle shop, and considers them his most important for the model-train work. This particular day, he was running his 150-ton Van Dorn to make the molding for a three-bay hopper car for Weaver. Later on, he will use one of his three vertical mills—two are Bridgeports and one an Enco—on the car.

"I was never into model trains, but these things have so many detailed parts that they are a good challenge. You get to know the trains and why people really love them," he said.

The trains themselves haven't stopped in Northumberland since the local Baby Boomers were babies, but Hayder loves that he, with the help of Smith, can bring an American-machined product to life.

"When I was a kid, every department store had a train section and there were hobby shops in every little town," said Hayder, who employs about a dozen people to paint, assemble and box the models in his 2000-square-foot headquarters. "Now this is starting to grow because the kids who went there have their kids grown and are looking for something easy to slide back into. Those are the people who appreciate that we are doing them by hand. We even put graffiti on some—that is how authentic we can be these days."

Thank you *TMW* readers

for your loyalty the last 10 years.

Sadly, the June issue will be the last

issue of *Today's Machining World*

(If you would like to know more, see the "Editor's Note").

With Noah Graff

shop doc

Today's Machining World's "Shop Doc" column taps into our contact base of machining experts to help you find solutions to your problems. We invite our readers to submit suggestions and comments on the Shop Doc Blog at www.todaysmachiningworld.com.

Dear Shop Doc,

We have always performed single point threading for external threads on our CNC lathes, but lately we have been receiving more requests for rolled threads, especially from automotive and aerospace customers. I machine a wide range of materials, including stainless steels. Thread sizes can vary from around 1/4" up to 1", including metric sizes, up to 3" long. I understand that rolled threads are mechanically stronger than cut threads and I also hear the thread-rolling process is considerably faster. I cannot justify the cost of a stand-alone thread-rolling machine and would prefer to drop parts off my machines complete to remain competitive in the automotive sector. What are the options for thread-rolling on CNC lathes?

To roll or not to roll

Dear To roll or not to roll,

You are correct; thread-rolling improves surface finish, tensile strength and significantly reduces cycle time, with the added bonus of not producing chips (or those bird's nests of stringy swarf familiar to those who perform single point threading). What's more, some of those materials that are sticky and gummy and not fun to machine are often the ones that roll up the best threads you are ever likely to see! It's almost hard to imagine why you wouldn't want to roll all your threads, but of course there are limiting factors to consider; material, component design, quantities, work-holding, machine specification can all influence your decision.

The first obstacle will be the material; in the thread-rolling process, you are effectively cold-working the material, deforming it plastically to the point where it is stressed beyond its yield point, leaving you with an accurate replication of the roll profile on the part. This requires the material to have a minimum five percent elongation and maximum tensile strength of 1700N/mm, which includes most materials you are likely to come across on a day to day basis, including all but the toughest stainless steels, but excluding brittle materials such as cast-iron, hard brasses and hardened materials.

Once you have identified that your material is suited to thread-rolling, you then have to choose how you are going to roll it. Bespoke thread-rolling machines are costly options, best suited to suppliers of specialized fasteners and aerospace components made from high tensile and high-temperature alloys, some of which can be at the extreme limit of rolling and not suited to thread-rolling attachments. The average job shop like yours is looking for a more affordable option that can effectively convert their lathes into thread-rolling machines.

Once you have decided to thread roll, you have three main types of thread rolling heads to choose from. In ascending order of cost, these are Axial, Radial and Tangential, of which the pros and cons of each are detailed below.

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.

Axial Heads

Axial heads are the easiest to fit onto the turrets of CNC lathes, and most are available with a choice of inch or metric round shanks to suit your tool-holding preferences. As their name suggests, these heads feed axially along the part and at the pre-programmed end-point the Z axis feed is dwelled to allow the head to pull open. The virtue of this system is that it allows long threads to be rolled, often on slender parts, without fear of the side-deflections that can afflict single-point threading. This is achieved by the three-rolls in the head, centralizing the part between them as they traverse along, producing accurate, parallel threads with great repeatability and at considerable speed (typically 1" per second based on minimum rolling speeds of 120 feet/minute). Furthermore, a set of standard rolls can be used in both RH or LH heads, and each set is reversible to allow usage from each end.

Consequently, axial rolling heads tend to represent the first step into thread-rolling by the vast majority of new-comers to the process.

Before you rush out and buy one, be aware of the following limitations of the axial system:

* Axial rolls are normally ground with one or two lead threads and as such cannot roll tight to a shoulder or into narrow undercuts. A rule of thumb is to allow 2 – 2.5 x pitch for the thread run-out, but this can sometimes be reduced to 1.75 x pitch in certain circumstances. Also, as they always approach from the front-end of the part, they clearly cannot roll behind the shoulder.

* Most (but not all) axial rolling heads operate best by opening at the end of the rolling pass, allowing them to be retracted in rapid without any change in spindle speed or direction. This, however, requires the head to be re-set (closed) before the next part can be rolled. On manually loaded machines this is performed with ease by the operator but on bar-fed machines a method of re-setting the head by means of mechanical or air-trip needs to be configured.

* For threading above **1,1/8 x 12 UNF (M30 x 1.5)**, the size and weight of axial rolling heads often prohibits their use on all but the largest CNC lathes.

* For rolling left hand threads a left hand head is required, although it will take standard rolls bought for RH threads.

Radial Heads

Radial heads, like axial heads, are supplied with inch or metric shanks, suited for mounting directly into standard tool-holders, but are heavier and more complex than their axial equivalent. Designed for rolling short threads close to the shoulder or into tight undercuts, they are particularly suited for high-volume production of fittings and automotive parts. They work by being positioned over the end of part to be rolled, before being tripped. This in turn allows the sprung loaded rolls to engage on the part, whereupon their cam design squeezes down radially on the part, forming a complete thread in one roll-rotation. Typical rolling cycles are 0.1 – 0.2 seconds.

However, this speed comes at a price:

* A radial head is typically 4 times heavier and 3 times more expensive than its axial equivalent.

* Due to the high rolling forces, only short (typically 1/4" – 3/4" OAL) threads can be rolled and normally only on the very front end of the part or just beyond it.

* Mainly finer pitch UNF threads are suited to radial rolling. RH and LH threads can be rolled with the same head, but the correct version of roll needs to be purchased.

Tangential Heads

Tangential heads are traditionally best suited for high volume batch work on multi-spindles machines, having the ability to roll both in front of the shoulder and behind the shoulder, essential for making fittings and similar parts from hexagon stock. However, they can also be used on CNC lathes for certain high volume applications. These heads work by approaching from the side, rather than from the end, with two synchronized rolls on fixed centers in a caliper feeding in tangentially onto the rotating part. This does exert side forces on the parts being rolled, so slender parts or shafts may need to be supported by centers to prevent deflection or breakage.

With no tripping or re-setting of the head to worry about, these heads are very effective and reliable when in continuous use and can roll very close to the shoulder or into narrow undercuts; like the radial head, both RH and LH threads can be rolled without recourse to another head (but LH rolls would need to be ordered). Also, similar to the radial head, tangential heads can only produce short threads up to the maximum width of roll obtainable for each head type.

By themselves, tangential rolling heads are no more expensive than radial heads, but extra cost is incurred purchasing the bespoke holders that are required to adapt them to each and every machine they could be used on.

So, for high volume production of repeating thread sizes, they can represent an ideal option if being commissioned for use on a single type of machine. However, for the smaller job shop who takes on a wide variety of shorter batch work on a range of machines, tangential rolling is not a viable option and the axial head should be used if suited. You mention some threads as long as 3" long, making them the ideal candidate for an axial head, which reinforces the decision to choose such a head in your case.

Size limitations

Whichever system one elects to use, consideration should always be given to the clearance limits of the machine when the turret indexes. Most modern CNC lathes are compact in design, minimizing the distance of the turret and tools from the slides in order to maximize rigidity. The down-side of this can be a turret envelope that restricts the size and/or weight of rolling head that can be mounted. Of the three systems discussed above, the axial represents the lightest heads, with the radial and tangential (inc holder) being the heavier options. For example, to roll a ange of 5/16 x 24 -7/16 x 20 UNF threads, the following heads would normally be recommended:

RA-1 Axial	Weight 2 lb
Dia of head 2,1/2"	Projects from turret face 2.05"
RT-20 Tangential	Weight 10 lb
Effective Dia of head 5.2"	Projects from turret face 2.3"
RE-10 Radial	Weight 10 lb
Dia of head 4"	Projects from turret face 4,1"

Larger turn/mill lathes with Y axis often provide more workspace in the machine to accommodate larger rolling heads.

Smaller Swiss style machines, often with gang-type tool blocks, are mainly suited to small axial rolling heads, as parts being machined are often small and slender and as such are unable to support the side loads generated by tangential rolling, nor the high torque resulting from radial rolling.

Component limitations

There are many variables in a component's features that will determine which type of head one should use. For example, thread rolling behind a shoulder, as explained above, can only be done by a tangential head. Acme or trapezoidal threads, which are coarse, deep forms, can only be done with an axial head, as the rolling forces exceed the limits of radial and tangential heads. A thread close to the shoulder can only be done with a radial or tangential head, whose rolls can be made with minimal edge chamfer to get within a pitch of the shoulder face.

Tubular (thin wall) components are best rolled with an axial head which in certain instances can be fitted with an internal support mandrel to prevent the tube collapsing during rolling. A resume` of component features and the systems best suited to each is shown below.

Component features

Thread to be rolled is behind shoulder T
Acme or Trapezoidal thread A
Thread close to shoulder R, T
Short Thread length R, T
Component has thin wall A
Tools Rotates A, R
Tool Stationary A, R, T

A=Axial R=Radial T=Tangential

As you can see, there are many variables which can decide the viability of a rolling application, but these interact in too many ways to give customers a simple tick-box means of deciding which system is best suited to their shop. The best advice is always to talk to suppliers of thread-rolling heads and attachments, who have a wealth of knowledge to offer customers who are faced with your choice: "To roll, or not to roll?"

Bob Perkins
RSVP Tooling Inc., Joliet, Ill.

RSVP is a North American manufacturer outlet for high quality external thread rolling and cutting systems, and knurling and marking systems.

The following companies have provided information on Workholding

product focus

Proper workholding solutions have always been critical, but over the last decade they have been become exponentially more critical. Kevin Shults of Edge Technologies says, "With cutting speeds getting faster and faster, placing more force on workholding equipment, selecting the correct engineered system to do the job becomes tougher than ever. All of your workholding should meet the need for rigidity, repeatability and accuracy. Many times you'll find that a customized solution is the answer for hard-to-cut workpieces and the manufacturing processes that require high levels of accuracy and repeatability."

The following solutions found in today's marketplace may shed some light on a workholding issue you are currently contemplating.

◀ Advanced Machine & Engineering

Advanced Machine & Engineering announces the TRIAG 5axesCLAMP. The machine spindle of 5-axis machines often has difficulty reaching all areas of a complex part using conventional workholding technology. TRIAG's 5axesCLAMP solves that problem. Part of TRIAG's compactCLAMP family of modular workholding products, the breakthrough clamping design of the 5axesCLAMP minimizes interference, so machine spindles can have full access to workpieces, even in high density applications. Access is even better for five axis machines, for which the TRIAG 5axesCLAMP was specifically designed. Both small and large workpieces can be clamped with ease.

For more information, please contact Advanced Machine & Engineering at 800-225-4263 or visit www.ame.com.

▶ Edge Technologies

Edge Technologies recently announced that they are the new sole importer and distributor of Schlenker products for the North American marketplace. Schlenker has a long history manufacturing collets and guide bushings for Swiss sliding-headstock type lathes. In Edge Technologies Schlenker has found a partner with several decades of experience in the precision metal-cutting automation industry. Currently Edge Technologies offers two lines of magazine bar feeders, the Edge house brand and the German made FMB line-up. Besides stocking these feeders in their centrally located St. Louis, Missouri facility, they are also fully stocked with parts, offer specially engineered feeding solutions, and handle all sales and service. Edge Technologies has the privilege of introducing the latest from Schlenker, the S-Slot line of collets and guide bushings. The unique S cut innovation prevents the accumulation of chips and debris in the slots that cause inaccuracies. The S-Slot products are perfect for use in conjunction with high-pressure coolant systems where high precision machining requirements are absolute, and exceptional concentricity is required for part acceptance.

For more information, please contact Edge Technologies at 703-691-7900 or visit www.edge-technologies.com.

▶ Hardinge

Hardinge direct-drive rotary systems, manufactured in Elmira, New York, provide flexible, high-speed, SUPER-PRECISION® rotary parts positioning. These rotary tables have zero backlash, permitting rapid bi-directional movement without the loss of time used to compensate for position over-travel which means more time in the cut. Direct-drive rotary units are ideal for parts that require extremely accurate angular positioning, as well as for high-speed, high-accuracy contouring applications. Hardinge provides SUPER-PRECISION® rotary solutions for the aerospace, automotive, autosport, defense, medical, mold & die, electronics and energy/oil sector industries.

For more information, please contact Hardinge Inc. at 800-843-8801 or visit www.shophardinge.com.

Lenze Americas

Lenze Americas recently announced the launch of a Drive Solution Designer (DSD) for the material handling industry. A software tool for design engineers, the Lenze DSD analyzes the complete drive train of an application to ensure the correct design and dimensioning of a decentralized system. At the core of the Lenze DSD software is a comprehensive examination aimed at deriving real energy savings through the use of highly efficient motors and transmissions, achieving precisely matched speed control through the use of frequency inverters, and enabling the utilization of regenerative energy produced during motor braking.

For more information, please contact Lenze Americas at 508-278-9100 or visit www.lenzeamericas.com.

REGO-FIX®

REGO-FIX® will be showcasing a variety of toolholding solutions at EASTEC 2011 in booth #5459, including its new REGO PLUS line of toolholders for BIG PLUS spindles from May 17–19 at the Eastern States Exposition in West Springfield, Massachusetts. Fully compatible with all BIG PLUS spindles, the REGO PLUS line of toolholders is licensed by BIG Daishowa and includes a full line of ER system toolholders, as well as a full line of powRgrip system toolholders. REGO PLUS offers manufacturers the advantages of better TIR, improved tool stiffness, increased quality of surface finishes and higher machine accuracies.

For more information, please contact REGO-FIX at 800-REGO-FIX or visit www.rego-fix.com.

SCHUNK

SCHUNK presents the new VERO-S quick-change pallet system. All functional components of the new VERO-S module are made of hardened Stainless Steel. Among the many benefits, the pull-in force of the new module is up to 9,000 lbs. With the VERO-S, machine set-up times can be reduced by up to 90 percent. Because of the patented dual clamping stroke and the integrated turbo function, the retention force increases to 9,000 lbs. This is 30 percent higher than SCHUNK's previous model.

For more information, please contact SCHUNK 800-772-4865 or visit www.us.schunk.com.

▲Somma Tools

Somma Tool Company stocks series C3, C4, C6, and C8 Drill Collets along with series STC4 tap collets, all of which were previously offered by Sandvik and Balas. Somma has redesigned the C6 and C8 collets, yet they are completely interchangeable with the old design. The corresponding tool holders and the series C12, C16, and C20 collets are priced upon request. The washers, thrust bearings, and nuts are also available from Somma. Details are found on page 111 of the 2009 Somma catalog and at www.sommatool.com.

For more information, please contact Somma Tool Company at 203-753-2114 or visit www.sommatool.com.

Eric Golde, President and CEO of Equipois using the x-Ar™
Photo courtesy of Equipois

one on one

Interviewed by Noah Graff

Eric Golden, is President and CEO of Equipois® Inc., a company specializing in creating products that increase worker productivity by reducing fatigue on the body. In March 2011, the company released the x-Ar™, an exoskeletal arm that attaches to the arm of the user giving them the ability to hold and maneuver objects as though they are weightless.

Tell me the story of the x-Ar™.

EG: The x-Ar™ is an exoskeletal arm support. It attaches to your arm and supports your arm's weight so you can work with it outstretched without bearing the weight of your arm. It's a decedent of our zeroG® technology, which has been around for a number of years. zeroG® technology holds tools and parts and let's workers move them as if they were weightless. The zeroG® technology has been used by many major manufacturers in aerospace, automotive, machinery, assembly and metalworking.

Who invented zeroG® technology?

EG: It's actually a decedent of the Steadicam™, which allows a camera operator wearing a vest to hold the camera so the camera seems to float. We worked with Steadicam™ inventor Garrett Brown to adapt that technology and evolve it for use in the workplace.

How is the x-Ar™ different from the zeroG®?

EG: The x-Ar™ attaches to the arm itself so you continue to use your hands normally. The exoskeleton is just helping you out, making you have more strength and stamina than you would alone. [It's helpful] if you're working with with very small tools or just for activities that require you to work with your arms outstretched. It could be used for something as simple as operating a computer keypad, if you have to do it in a position where your arms are outstretched. Or it could be used with drills, finishing equipment, welding, soldering—any activity where you can picture somebody needing to have their arms outstretched all day long.

How is the exoskeletal arm support powered?

EG: The x-Ar™ is mechanical. Usually it's attached to a chair or bench. There are no motors, no hydraulics, no pneumatics. It's really just a very clever spring architecture. We precisely control the termination point and angle of the spring as the arm moves so that it applies constant force no matter where it is. That new trick, which uses a centuries' old technology, produces an amazing result—a feeling of weightlessness. [Your arm] still has mass, but it just feels weightless. I have a picture of me holding up a 28-pound tool with one finger. I shot a video of my eight-year-old son moving a 16-pound grinder through the air like it was nothing.

Will there be a version of the x-Ar™ that attaches to a person's body with a harness, making them mobile?

EG: There is a fair amount of demand for a harness version. I would anticipate one later this year. The whole thing, even with the mounting, is only 12 pounds. The parts that move are only five. We made them as light as possible so that you wouldn't feel like you're lugging around a lot of metal.

What is the cost, and will there be a consumer version in the future?

EG: The cost is not finalized, but we expect it's going to be in the $2,000 to $3,000 range. There will be a consumer version; the first will be for folks who have physical challenges. Ultimately, we envision people with brain injuries and serious disabilities being helped by this, but that's a little bit down the road. Right now our pilots are focused on high-risk activities among able-bodied people in the workforce; but it would also be great for rehab or to help people get back to work sooner.

Is the purpose of the x-Ar™ to enable a human to work with the precision of a robot?

EG: That's exactly right. One of our core beliefs is that the most talented universal tool out there is the human hand guided by the human mind. Automation is great for highly repetitive tasks, but if you need real perception and judgment and fine motor control, you just can't beat a human being. Our mission is to empower people and not to replace them. We give people the stamina and strength of a robot, but the fingers and the brain of a human.

Send in your answer—quick!
Fax Emily at 708-850-1334, or email
emily@todaysmachiningworld.com

Green Bird in the Cage

How can you put a green bird in the cage just by looking at the picture?

Puzzle found in the April issue.
SOLUTION TO "Pick up Polygons"

The order is yellow, orange, red, pink, violet, light green, dark green, light blue, dark blue, and lime. The order is also that of an increasing number of sides, from the triangle with three to the dodecagon with twelve.

Who's an orderly person?

Chris Prenatt of Ring Precision Components in Jamestown, N.Y.; **Don Heselton** of Cobham Antenna Systems; **Shawn Kennedy** of Mitutoyo America Corporation in Aurora, Ill.; **Jason S. Habib** of Hi-Tek Manufacturing, Inc. in Mason, Ohio; **Greg Tetrick** of Cass Screw Machine Products in Minneapolis, Minn.; **Richard M. Hanus** of Lockrey Manufacturing; **Sharon Smith** of Fisher Tool & Design.

swarfblog.com

If you're only reading "Swarf" in the magazine you're missing out! Every week, thousands of people log on to our Web site to read and comment on new articles on current and interesting topics. Below are some recent comments from our "Swarfblog" readers at www.todaysmachiningworld.com.

America's Favorite Pickup Line

Noah Graff blogged about a recent report that found Ford's F-Series truck was the No. 1 selling vehicle in 35 of 50 states, and that states which bought primarily imported cars usually voted for Obama in 2008. He asked readers, "Would you feel good about buying an imported car from Japan if you thought it could help the Japanese rebuild their country?"

Ralph March 22, 2011 at 12:35 p.m.
It's very evident in reading the study that liberal states have no interest in supporting U.S. manufacturing, even when U.S. quality is better than foreign. Just look at all the losers in Washington DC being paid with U.S. tax dollars, driving cars "MADE BY NON-U.S. BASED MANUFACTURERS." I would continue, but it's time to go load a few big bales on the back of my Prius and feed the cows.

Jim March 23, 2011 at 6:18 a.m.
It pains me to say it, but to assume that buying a Japanese car would help with their current catastrophe is naive. They are going to need a lot more assistance to overcome this disaster. They will be lucky if the island will be even habitable considering the condition of their nuclear reactors. The world can only hope that Japan averts a complete meltdown and can begin a long painful rebuild of their nation, instead of an evacuation.

Bill G March 23, 2011 at 9:03 a.m.
I drive a '07 Honda Civic Hybrid and I did not vote for Obama. I drive over 30k per year in my line of work. When I made my choice I was down to the Honda Civic Hybrid and VW Jetta TDi. The '07 TDis were out of stock and would be skipped in '08, so I bought the Civic. My choices were pay the Middle East more money or try and keep some in my pocket. At 39 to 40 mpg, I feel I made the right choice. Just to balance the scales, my wife drives an '08 Town and Country.

A Nuclear Overreaction

Some scientific studies have shown that less than 10 years after the Chernobyl nuclear meltdown, wildlife was flourishing within the plant's evacuated area. Noah asked readers if they felt the environment was more at risk from offshore drilling and burning fossil fuels than running nuclear power plants.

Dan Murphy March 16, 2011 at 12:31 p.m.
If nuclear plants are a bad idea then we should get rid of hydroelectric plants too. More people have been killed by dam failures than nuclear power plant accidents. Coal generation has to go too. Far more people have been killed mining coal than have been killed by nuclear. Plus, burning coal releases more radiation on an average day than a nuclear plant releases. Wind and solar can't meet our needs, ever. Not opinion, just science. There really is no other long-term option.

Power to the People

Noah blogged about a demographics expert who says that China's economy is doomed because of the country's low birth-rate and shortage of women. He asked readers if they thought legalized abortion has affected the U.S. economy.

Art Izquierdo March 8, 2011 at 12:57 p.m.
Abortion has helped America by dealing with unwanted pregnancies in a segment of the population that would not be able to care for the offspring properly and would force public resources to deal with the problem.

Jim March 8, 2011 at 10:37 p.m.
I have to wonder if Barack Obama's mother would have met Art's criteria for being able to "care for her offspring properly," given that she was part of a minority and essentially a struggling single mother. I don't think he would be our president if his mother had taken advice from him or Planned Parenthood. Abortion is not an economic issue because it really doesn't affect the economy (unless it is mandatory as in China). It is strictly a moral issue.

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WICKMAN
5/8" 6-spindle, thdg., pickoff, 1981
1" 6-spindle, 1966-82 (8)
1" 8-spindle, 1980
1-3/8" 6-spindle, 1978 (4)
1-3/4" 6-spindle, 1965, 1984 (3)
1-3/4" 6-spindle 1984
2-1/4" 6-spindle, 1962, 1973-79 (3)
2 5/8" 6-spindle Wickman, 1978

ACME
7/16" RA6, 1975 & 1964
3/4" RA8, 1970
1-1/4" RA6 1978-61 (9) - some w/threading pickoff
1-1/4" RA6, dbl. thrdg. p.o. 1987
1-5/8" RB8 CNC slide
1-5/8" RBN8 CNC slide, 1996
1-1/4" RB8, 1981, thdg., pickoff (2)
1-5/8" RBN8, 1968
1-5/8" RB8 thdg., pickup '68-'72
2" RB6, 1967 & 1980
2" RB8, 1966
3-1/2" RB6, 1970
2 5/8" RB8, 1960 w/CNC slide
2 5/8" RB6, 1980
1 1/4" RB8, locked spindle, '68 (2)

HYDROMATS & ROTARY TRANSFER
HW 25-12 chucker 1998
HW 25-12, 1989
HB45-16, 1997, bar and chuck (2)
Pro-20, 1998
HB 45-12, 1991 (3)
HB 45-12 chucker, 1996
HB 4516, 1993
Epic 16-station, 2007

SCHUTTE & GILDEMEISTER
SF51, 1985-79 (3)

SWISS
Tornos Deco 20 mm, 2000
Ganesh Cyclone 32 w/ LNS express, 2006

NEW BRITAIN
Model 52 1 1/4" 6-spindle, 1979, 1967 (2)

1 5/8" RBN8 1996, (2)
2 axis CNC slides, CNC pickoff % backtap
Cucchi barloader
Like New

CNC Lathes
Mori-Seiki ZL150, 2002
Murata, MW120, 2004
Haas SL-20. 2005
Index 42 mm ABC (2) 1996

ESCOMATICS
D9 (2), 1995
D6SR (2)
D-2, D-4, 1975

MISCELLANEOUS
5 1/4" RAC Nat. Acme spindle bearings
3-1/2 RB6 thdg. attachment
Hydromat units
Siemens varispeed motor off Wickman
Wickman thread chasing 5/8" – 3 1/4"
Every Wickman spare part
Hartford 10-300R flat die threadroller
Sweco 6 cu ft.
Agathon 175 grinders

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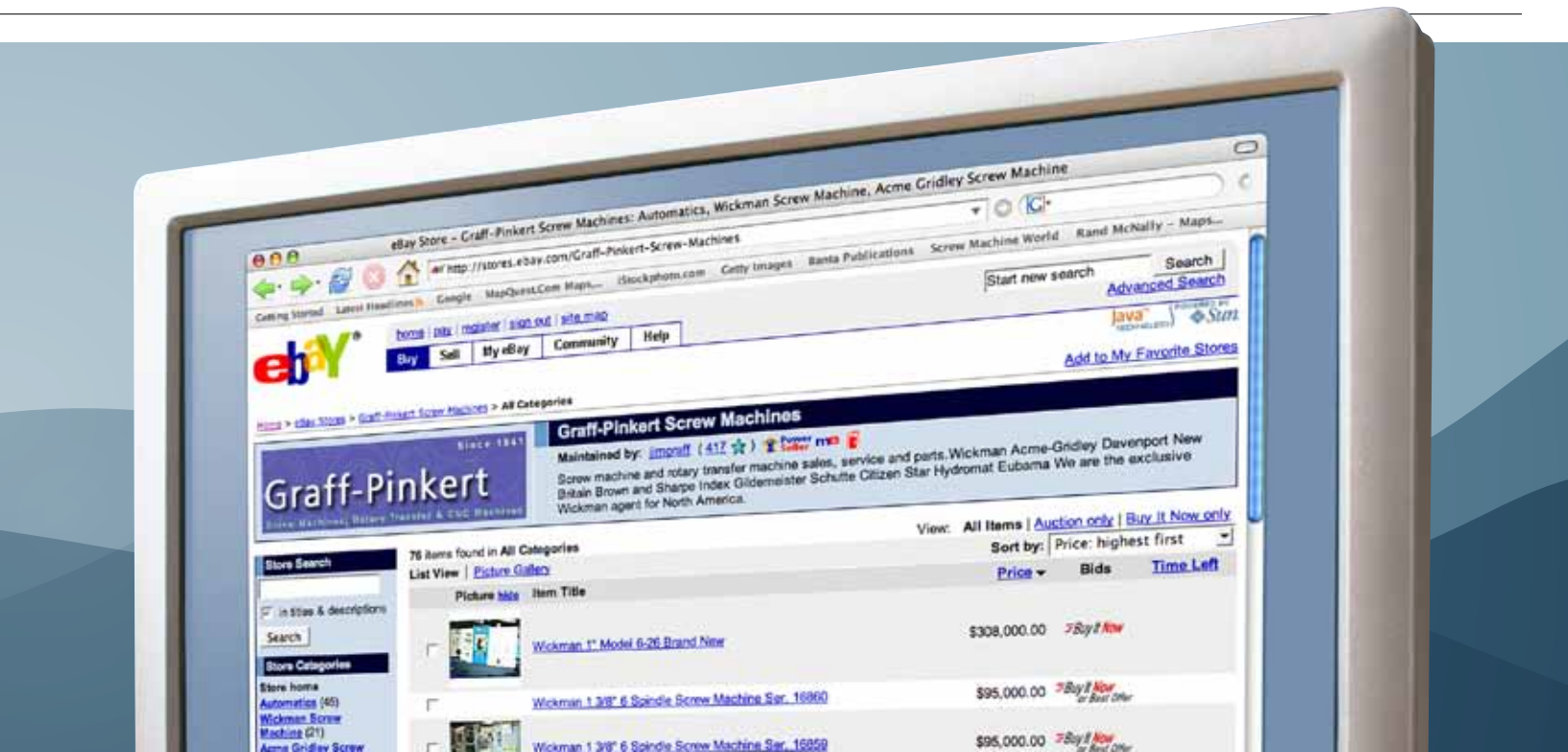

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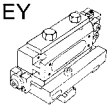

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afterthought

The Illusion of Security

What is your "net worth?"

I remember my father used to calculate his net worth often and would meticulously record the amount his assets exceeded his liabilities on sheets of paper he kept in an accordion file in his desk at home.

When I worked with my Dad we would periodically discuss his net worth. He talked about it with reverence, sometimes in hushed tones, like the figures were inscribed on sacred parchment. And they truly were to him.

Those numbers he wrote down yearly were his personal score card of success, his record of succeeding or failing. They were figures that meant "security" for him. He told me that a rising net worth made him feel more secure, which was a feeling he sought more desperately than any other in his life. But the irony that I came to understand more clearly as we both matured was that he never felt "secure." No matter how much money he had in the bank or in stocks it wasn't enough for him to feel "secure."

> "The term "net worth" always bounces around in my head when I hear it because for me a person's net worth isn't really about his "net worth."

Over the last 40 some years I also observed my father-in-law, Sol Levine, who recently died at age 89.

Sol was a lawyer in Charlotte, North Carolina, who practiced a mishmash of everyday law. He was a problem solver for people. He had an accomplished secretary, Nellie, who tried to keep him on track. She handled the everyday contracts on real estate that kept enough cash coming in to afford a decent lifestyle. Sol really didn't care about having money. He wanted to have enough to live okay, give to charity, and play poker on Tuesday nights. Oddly enough, he never seemed to worry about "security."

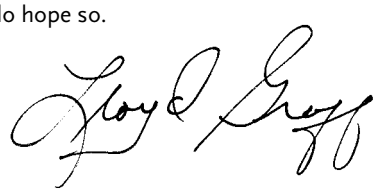
For me it was fascinating to observe these two disparate views of net worth and security. My father had a lot of free cash and Sol had little, yet my Dad always worried about money and Sol never seemed to. How odd.

The term "net worth" always bounces around in my head when I hear it because for me a person's net worth isn't really about his "net worth." My father's net worth to me was his relationships with his family, his compassion, his strength as a person, his honesty and courage and tenacity. Yet he measured himself very much in dollars. Once, near the end of his life, we had a poignant talk and he revealed to me a disappointment he felt about his relationship with my mother, who had died a few years earlier. He said, "I wish I'd given her more jewelry." A Freudian psychiatrist interpreted that remark to me as a sexually symbolic reference, but I don't think so. For my Dad, success, love and money were an intertwined bundle.

Over the years I have arrived at a cynical view of accountants and financial statements because they summarize the strength of a business through arbitrary quantitative analysis. The net worth of a business is so much more than a financial statement. The net worth of a man has little to do with the amount of assets he has versus liabilities.

I often chuckle derisively at the come-on artists who cold call me saying they have "investment ideas for 'high net worth individuals.'" Are they calling me? Are they calling the right person?

I really do hope so.



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