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November 2008 volume 4 issue 11

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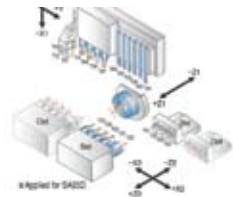
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Today's Machining World USPS 024-909 is published monthly, 12 times a year by Screw Machine World, Inc., 4235 w 166th Street, Oak Forest, Ill. 60452.  
POSTMASTER: Address Changes should be sent to: Today's Machining World, PO Box 847, Lowell MA 01853 or email to cs-smw@computerfulfillment.com.  
Periodical postage paid at Oak Forest, IL and additional mailing offices.  
CPC Publication Agreement Number 40048288 Canadian Return Address: World Distribution Service, Station A PO Box 54, Windsor, ON N9A 6J5  
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A Screw Machine World Inc. Publication  
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Oak Forest, IL 60452  
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## SUBSCRIPTION/CHANGE OF ADDRESS:

Basic subscription rate: US\$40 for domestic/US\$55 for international.

## Send address changes and/or subscription inquiries to:

Today's Machining World, P.O. Box 847, Lowell, MA 01853 or email  
cs-smw@computerfulfillment.com

CPC Publication Agreement Number 40048288

## Canadian Return Address:

World Distribution Services, Station A, P.O. Box 54, Windsor, ON N9A 6J5  
email: cpcreturns@wdsmail.com

# editor's note

## Labor of love

When you go through the physical and emotional trauma I've just experienced it forces you to examine the way you've lived your life and run your business.

With *Today's Machining World* I have pushed myself to write 3,500 words per month of original, provocative and fresh material. Until the last couple of months this was easy — it just flowed. My ideas seemed endless, the words were easy to access and it was fun.

Since I've been sick and my energy has come in spurts and receded in waves, my writing has become more labored. Sure, I can write about my heart attack and recovery, but I think that gets old quickly. It's even starting to bore me.

My challenge is to start talking to people in the field, like Ken Rector of U.S. Bank Corp., on the lending situation in the machining world. This excites me and I know you are interested in his comments.

So bear with my occasional indulgence in my personal struggles. I am committed to aiming this magazine at you, on the front lines of cutting metal. In the coming months we will have more stories about the people who make stuff and make money doing it. I'm reducing the number of big, global stories on politics or General Motors, but they will still be an important part of the mix.

I come out of the health woes ever more determined to make *TMW* great. Doing this magazine well is one of the true loves of my life.

Lloyd Graff  
Editor/Owner



## US Postal Service Statement of Ownership Management and Circulation

TITLE: *Today's Machining World*  
PUBLICATION # 024-909  
FREQUENCY OF ISSUE/Monthly  
NO. OF ISSUES PUB. AN./12  
MAILING ADDRESS  
*Today's Machining World*, 4235 West 166th Street, Oak Forest, IL 60452  
PUBLISHER: Lloyd Graff, 4235 West 166th Street, Oak Forest, IL 60452  
EDITOR: Lloyd Graff, 4235 West 166th Street, Oak Forest, IL 60452  
MANAGING EDITOR: Emily Halgrimson, 4235 West 166th Street, Oak Forest, IL 60452  
OWNER: Screw Machine World Inc., 4235 West 166th Street, Oak Forest, IL 60452  
BONDHOLDERS, MORTGAGES OR OTHER SECURITIES HOLDERS

## DATE OF FILING

October 3, 2008

## ANNUAL

## SUBSCRIP. PRICE

\$40.00

NONE

## EXTENT AND NATURE

OF CIRCULATION	AVERAGE FOR 12 MONTHS	AVERAGE FOR SEPT. 2008
Total Number of Copies	18,908	20,250
Individual Paid/Requested Mail Subscriptions	10,090	10,166
Paid and/or Requested Circulation Sales through Dealers, Carriers, Street Vendors, and Counter Sales	0	0
Requested Copies Distributed by Other Mail Classes through USPS	0	0
Total Paid and/or Requested Circulation	10,090	10,166
Free Distribution by Mail (Samples, Complimentary And Other Free)	7,836	7,726
Free Distribution Outside the Mail (Carrier or Other Means)	931	2,308
Total Free Distribution	8,767	10,034
Total Distribution	18,857	20,200
Copies Not Distributed (Office Use, Left over, Spoiled)	51	50
Total	18,908	20,250
Percent Paid and/or Requested	53.50%	50.32%

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Publisher

editor's note





**Barbara Donohue** received her mechanical engineering degree from MIT. She worked in design, heat transfer and manufacturing for several years before changing careers to become a journalist. Now she writes about technology and business from her home office in Acton, Massachusetts. When not writing, she sings in a choir, volunteers as a literacy tutor, and is a weekend “foster mom” to a yellow Lab puppy named Tikva that is training to become a wheelchair assistance dog.



**Jerry Levine** has been retired since 1998. When not reviewing books for *TMW*, he enjoys his grandchildren, playing golf and tennis, and leading adult education classes at Northwestern University. Mr. Levine had a 35 year career at Amoco Corporation, initially designing and starting up chemical plants around Europe and Asia, then in world-wide crude oil supply during the wild 1970's — through the '73 Arab Embargo, the '79 Iranian Revolution and the government price controls. He spent the last half of his career in Washington representing Amoco and the oil industry in energy and environmental issues. Jerry holds chemical engineering degrees from Purdue and Michigan and is a member of Tau Beta Pi engineering honor society.



**Lloyd Graff** has had a love of writing since getting his first letter to the editor published by the *Chicago Daily News* when he was 12. In high school he wrote short pieces for *Reader's Digest*. He became Sports Editor of the *University of Michigan Daily*, and weighed a career in Journalism before joining the family used machine tool business in 1969. His passion for writing never died as he wrote a “magalog” called the *Graff-Pinkert Times* in the 1990s. In 1999 he decided to build on his knowledge of the machining world and his writing experience by starting *Screw Machine World*, which became *Today's Machining World* in 2005. He considers the development of the magazine to be the culmination of his business and creative careers.



**Robert Bocok** *TMW's* new Creative Director, attended Missouri State and has been working in graphic design for 14 years. He started his own graphic design agency, Top Creative Group, in 2001. Rob is a drummer and enjoys different aspects of music — so much, in fact, that he has built his own drum set. He has an extensive knowledge of cars and dreams of someday living in New Zealand. Rob's vast experience in publishing brings an experienced voice to the *TMW* team and his positive energy keeps the workplace fun and productive.

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### Connecting the industry

Yesterday Steve Hartz came down to our offices. You wrote about him in your August issue in the Jessica Dulong piece titled "From Help Wanted to Help Found: Attracting the new wave of skilled workers." As Oxygen Education is working on educating and he's working on finding skilled workers, you can imagine — we had lots to talk about. We will be spending a lot of time together in the future on the "mission." Funny how things come together when you least expect it.

Joe Kitterman  
Oxygen Education, Indianapolis, IN

### Puzzling

Here's a historical problem for Lloyd to work on as he recuperates, and if you want — to use in your *Today's Machining World* puzzle page:

When the famous Indian mathematician Srinivas Ramanujan was ill, he was visited by Professor Hardy. Hardy informed Ramanujan that the license plate number on the taxi he took was uninteresting, whereupon Ramanujan said that to the contrary it was a very interesting number. He stated that the number was the lowest number that was the sum of two cubes in two different ways. What is the number and what are the two cubes in two different ways?

Mathematically Stated:

$$A^3 + B^3 = X$$

$$C^3 + D^3 = X$$

X = the lowest possible number

What are A,B,C,D and X?

Richard Kaplan  
Flossmoor, IL

### Curious

I was curious about your comment about threading (page 14 in the August 2008 issue), because the salon may in fact be for eyebrow arching, using an old technique called "threading" rather than the more common waxing.

Margaret Bassett  
DAWN Equipment, Sycamore, IL

*After further inquiry into the recently opened Ultimate Arch Threading Salon we have found that it is indeed a business*

*for eyebrow "threading" as Margaret suggests above. Eyebrow threading originated in India, is now widespread in the Middle East and is gaining popularity in the West. It involves twisting a piece of thread — usually cotton — into a double strand, picking up a line of hair and then removing it, creating a very clean and precise hairline.*

### Playing with words

First, I want to thank *Today's Machining World* for choosing one of Heidenhain Corporation's recent press releases (about one of our digital readouts) for use in your September issue. As you know, Heidenhain Corporation is in the business of high precision motion control components ([www.heidenhain.com](http://www.heidenhain.com)) which are integral to machines all over the world.

While we appreciate the important placement, I feel I must comment on the word "nothing" being used in the headline ["Heiden Nothing"], as it seems derogatory. Upon further review I believe it was not intended that way, but simply to be a play on words, though I am concerned about the immediate tone it leaves.

Heidenhain is a leading international manufacturer of precision measurement and control equipment, with hundreds of engineers working daily in an R&D department in an effort to bring breakthroughs to the international machine industry. I am hopeful that the word "nothing" will not be added in future editorial copy when discussing Heidenhain.

Best regards,  
Kathleen Stoneski  
Heidenhain PR Manager

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

Send your comments to:

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Or email us at:

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# Money is Available

Ken Rector runs the Machine Tool Finance division of U.S. Bank Equipment Finance. He has been lending in machinery for decades and really knows the difference between a turret punch and a machining center.

I caught up with him after he had checked out the iron at the Fab-Tech Show in Las Vegas in mid-October. His insider's take on the manufacturing sector is that business is holding up nicely, despite the tsunami of bad news coming from Wall Street, the political campaigns and the neighborhood barbershop.

Rector says the default rate on their active accounts is running steady with last year. He says there continues to be plenty of capital to lend and a consistent flow of solid borrowers for machinery. He sees construction and automotive being down, but far from dead, and medical, aerospace, defense, energy and export as areas of continued strength. Home building continues to stagnate, but overall business in his world is consistent and positive.

He told me that Fab-Tech was well attended and the sellers were pleased with the numbers and the buying interest. People were cognizant of falling stock prices and dwindling 401-K accounts, but as long as they have plenty of work, they remain confident and willing to invest in equipment.



You can read *TMW* online before it's even printed!

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Do you love Swarf?

Did you know that *TMW* readers from all over are reading and responding to additional Swarf entries on *TMW's* new Swarf blog?

Check it out at [www.swarfblog.com](http://www.swarfblog.com)



# swarf

Friday, August 29th,

just two months ago, I came about as close to dying as one can get. I had a heart attack just as my wife Risa and I finished the 50-mile drive to St. Francis hospital in Evanston, Ill. to see my doctor and old friend Chris Costas. I had been feeling increasingly crummy for the previous two months, and for at least three years I had been in a state of denial about symptoms which may have been caused by angina. I had no time for angina in my life, and if I did have it I figured I would just deal with it through exercise or breathing or something else I'd pull out of my behind.

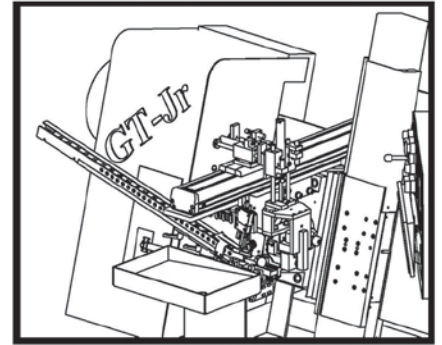
On a vacation from hell in New Buffalo, Michigan, during the second and third weeks of August, I felt terrible. I couldn't walk five minutes without feeling "rib cage" pain. I bought every arthritis cure in the local drugstore to make me feel better. Unfortunately they did not help much to cure angina. Risa, probably also in denial, thought I was having anxiety attacks and proposed that I see a shrink. The one bright spot of the two weeks was getting to spend good time with my children and grandchildren. The fresh peaches and blueberries in Western Michigan also helped make things a bit more bearable.

When we finally came home I felt too sick to go to the office. I thought I had the flu or pneumonia, so on Thursday, August 28, I called Chris for an appointment. He said to come in Friday, and thank God we did. We listened to a Clive Cussler audio book during the hour and 15-minute ride to Evanston. I felt increasingly clammy but didn't tell Risa. She dropped me off and we walked through St. Francis Hospital to my doctor's office. Chris was talking to another patient, and I politely waited for him. After a few minutes he came out of his office to greet Risa and I. He took one look at me and called the Emergency Room, stuck me in a wheelchair and said to Risa, "I think Lloyd is in congestive heart failure."

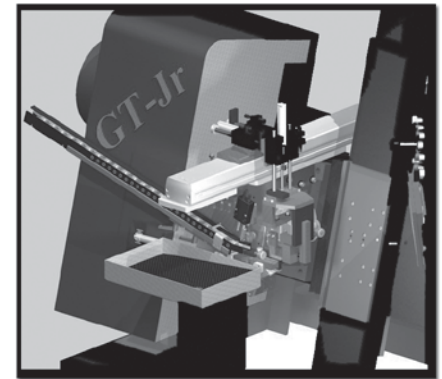


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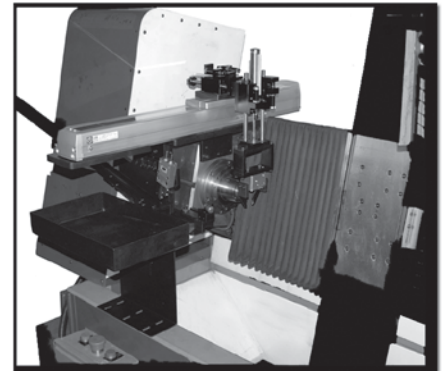


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# swarf

When I got to the E.R. I was having a lot of trouble breathing, and I remember the head nurse asking if she could cut my underwear. Chris has since told me that some rich fools with \$100 Prada boxer shorts actually object, but I was certainly in no mood to argue. They put an oxygen mask over my nose and mouth, and I remember virtually nothing else that happened that Friday.

What I now know is that they wheeled me into the cardiac catheterization lab, diagnosed the blockages, and a gutsy, skilled interventional cardiologist named Dr. Mohammed Akbar put a stent in my left anterior descending artery (LAD), which was 100 percent blocked. He also put in a tiny balloon pump which enabled me to live until the heart surgeons could do a quadruple bypass and a mitral valve repair.

Unfortunately, my heart was too messed up to do the open heart surgery on Friday. The plan was to get me stabilized and stronger over the Labor Day weekend and hopefully do the bypass on Tuesday.

I remember very little from those five days before the operation. They gave me drugs to knock me out which also happened to be amnesiacs, but I defied the doctor's intentions and stayed fairly lucid so I'm told. My sons Noah and Ari arrived quickly on Friday to be with Risa, and my daughter Sarah and sister Susan made it to the hospital that evening from San Jose California and Washington D.C., respectively.

Wonderful friends and family poured into St. Francis Hospital to support Risa and I during that awful night and through the next week. The clan set up shop in the waiting rooms which they nicknamed "The Ritz" and the "Hospitality Suite." Risa and Sarah stayed with me all night even though the nurses said they

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should leave because I'd be sleeping. It turned out I didn't sleep that much, and I felt their loving hands all night.

The docs warned Risa about expected crises, but they always stayed hopeful around me. Finally on Tuesday, September 2, they deemed me healthy enough for a long open heart surgery. Before they wheeled me to the operating room family and friends regaled me with my favorite songs that I had sung to them so many times. The ICU nurses were very tolerant of the 45 minute serenade of Chicago Cubs songs, show tunes, Sam Cooke and "Good Night Irene."

I survived five hours of bypass and valve surgery and returned to the ICU. I was semi-paralyzed from

the anesthesia, but I was lucid enough to hear the Cubs lose 9-7 to Houston on the radio.

I again shunned morphine so I was able to feel what I believed to be a "life force" that traveled from Risa and Sarah as they held my hand that long night when I was supposed to be asleep.

I heard my nurse talk about pneumonia, which spooked me. Nurses may think that patients do not hear in the ICU, but I heard too much. Yet I stayed hopeful and endured a breathing tube for 12 days.

I felt sensory deprived and longed for the perfect peach or orange, but the best I could get was a Listerine square placed on my tongue that I could barely taste.

During my 12 days in the ICU I communicated with my visitors using handwritten notes and hand gestures. I stayed hopeful because Risa and everybody who visited were upbeat — Risa had made sure of it. I survived on love and hope and great caring medicine, and I'm incredibly grateful to be able to write about this now.

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## Scrap steel prices are often

a telling commentary on the world economy. In June prices began a precipitous drop from the stratosphere to the basement. We saw a 67 percent drop in three months.

The Olympic spirit in China manifested itself in a hiatus from importing steel bundles from America. Combine this buying holiday with an automotive and housing disaster and the spreading fear in the marketplace fanned by the politics of a presidential election, you get a scrap price meltdown.

This scrap price roller coaster may be a net plus for high volume shops because it reduces cash requirements for material. Unfortunately, the steel producing firms play the lag game to pick up a temporary price spread. You see the same thing in gasoline prices, which follow the upsurge in crude prices by the minute, but lazily fall when oil prices are sinking like a stone. The spread between wholesale gasoline and pump prices is around a dollar in stable periods. For Chicago, admittedly a high price market, spreads are \$1.50 or more.

It will be interesting to see how the scrap bust will affect a mini mill firm like Nucor, which runs almost exclusively on scrap. The stock fell from 80 to 30 in scarcely a heartbeat as the hot money fled industrial firms like the plague. From the anecdotal news I am hearing there has not been a huge nosedive in machining business recently. Automotive and housing have been soft for two years, so what else is new.

China has not fallen off the map. Their internal needs for steel are huge. The fear is that they will flood the world market with cheap, subsidized steel. I am skeptical, but it may be time to start dickering on steel if you are buying tonnage.

## I'm going to speculate

that we will have an Obama administration as I write this piece in mid-October. I know the knee jerk business reaction is that this will be bad for everybody but Organized Labor, but having observed Obama and read his stuff, I see him as a pragmatic politician in the Clinton mold. He will throw bones to his Labor supporters, but I think he will lean on his friend, Warren Buffett, for good counsel.

I do not think Buffett will take a formal position in a Democratic administration. He will refuse to move out of Omaha and shuns meetings — two things that will keep him out of Treasury. He would have a huge conflict of interest problem unless he divested himself of his Berkshire Hathaway holdings. I've watched Buffett a lot in recent years and I think he is vying for economic icon status, nearing sainthood. Buffett's personal PR campaign is brilliant. He comes across as everybody's billionaire uncle. He does it with such amazing common sense and good humor, you almost have to love that good old teddy bear, Warren.

I do believe Buffett is a patriot. By saving Goldman Sachs and aiding GE he did a service to the country and cut himself two fabulous deals. The guy is a genius.

So let's hope Barack calls Warren on election night to ask him to be his unofficial economic advisor, and that he flies out to Omaha to seal the deal at Warren's favorite steak house while drinking Cherry Cokes together. If he does this the world will be a richer and safer place.



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By JERRY LEVINE

## Living with Heart Disease

As many readers are aware, *TMW* Editor and Owner Lloyd Graff suffered a heart attack recently and is now recovering. His brush with death has sensitized some of us to our own mortality and has raised awareness about the importance of our health and the health of those close to us.

In the midst of dealing with Lloyd's heart attack I found *Living with Heart Disease — Everything You Need to Know to Safeguard your Health* by Larry Katzenstein, at the bookstore. I found it a great resource as it clearly and thoroughly covers the technical aspects of the heart and heart disease. Sections include how to assess your risk, prevention, and treatment and recovery. It also contains an interesting discussion about state of the art advances in treatment.

Your heart is a small but potent muscle about the size of a balled fist. It has two main functions — to send oxygen-rich blood throughout the body and to send blood to itself. The coronary arteries wrap around the heart and send oxygenated blood straight to the heart muscle to keep it working properly. Clogged coronary arteries are the primary cause of heart disease. Other types of heart disease may involve problems with the heart's rhythm and pumping, valves, arteries and the muscle itself.

If the inner lining of a coronary artery is damaged, cholesterol, other fats and calcium can form deposits in the artery wall and create plaque build-up. Heart attacks occur when this plaque and blood clots break loose and block the artery.

One early warning sign of heart disease is angina. It is often described as chest pain, but is not always in the chest nor is it always painful. The pain may be in the back, neck, jaw or arms. One sign that pain is angina is that it will always occur in the same place, often becoming more frequent and severe. People often choose to ignore their pain, dismissing

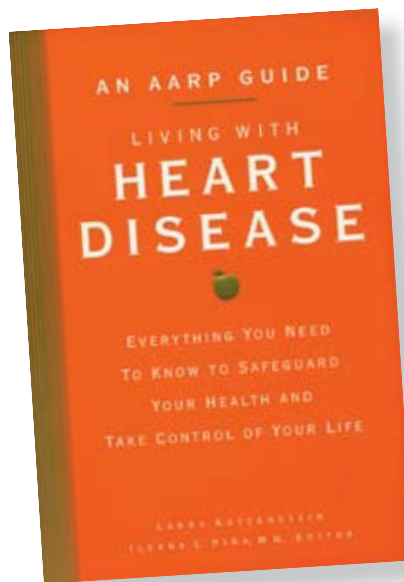
it as a pulled muscle or something else.

In the event of a heart attack, early intervention to minimize damage is crucial. One suggestion is to take a regular strength aspirin at the first symptom. Aspirin is a natural blood thinner and can help blood flow through severely clogged arteries. Never drive to the hospital. Call 911, leave your door unlocked, loosen tight fitting clothing and wait for the ambulance.

Heart disease develops over a period of years. Some risk factors — like aging — one cannot control, but there are several that are manageable. First and foremost is smoking — never smoke. High blood pressure and high cholesterol are also manageable and can be controlled with medication, diet and lifestyle changes. People with diabetes also have an increased risk of heart disease, especially women, and should consult a doctor.

Stress and negative emotions are also linked to heart disease, as are excess weight and lack of physical activity. Regular exercise is the best response to all three of these issues. The book devotes several chapters to discussing simple ways to create a healthier lifestyle.

For those who have recently suffered a heart attack or have undergone a procedure like balloon angioplasty or bypass surgery there is considerable information on recovering — both physically and emotionally. The same issues that minimize the risk of a first heart attack minimize the threat of a future one. It comes down to three basic principles: don't smoke, lose weight and exercise, exercise, exercise. It's the simple cure-all for your heart, your mind and all else that ails you.



Comments? You can email Jerry at [jerroldlevine@yahoo.com](mailto:jerroldlevine@yahoo.com)





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Mazak Corporation recently created the Kentucky-built Vertical Center Nexus 700D-II which features rapid traverse and cutting rates of 1,181 ipm (30 mm/m). The VCN 700D-II has Active Vibration Control, which reduces vibration for high-accuracy motions in all axes while reducing machining time. Since this function lessens tool vibration, high-quality machined surface finishes are achieved and excessive tool nose wear is eliminated. The VCN 700D-II was designed for reliability along with ease of maintenance and operation. It has 10 percent fewer parts than the previous model. Table access is a short 13-inch (330 mm) reach from the front cover, and the front door is 70.8 inches (1,800 mm) wide for ease of setup and loading. The overhead cover retracts for convenient loading of heavier parts by use of a crane. All lubrication inlets, air valves and



other maintenance items are located on a single panel for operator convenience. The VCN 700D-II features the sixth generation Mazatrol CNC, the MATRIX.

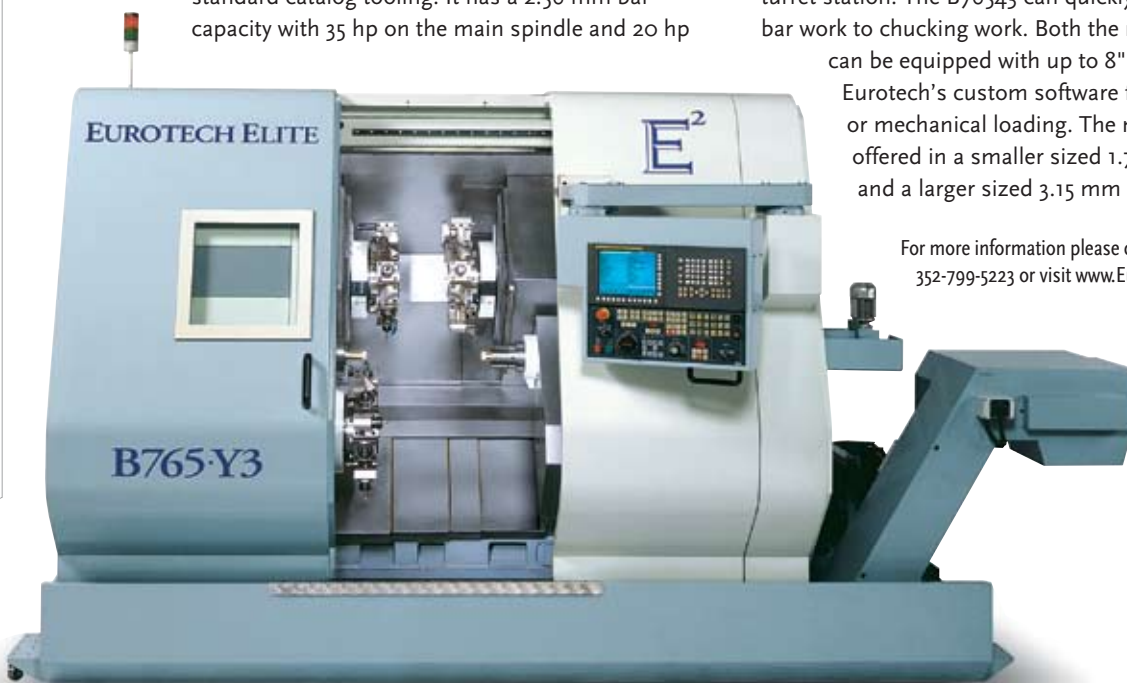
For more information, please contact Mazak Corporation at 859-342-1700 or visit [www.mazakusa.com](http://www.mazakusa.com).

## ▼ All Sizes

Eurotech introduces the new B76543 with over 4" of 4-travel on each turret combined with Eurotech's standard catalog tooling. It has a 2.56 mm bar capacity with 35 hp on the main spindle and 20 hp

on the sub-spindle. C-axis on both spindles and 4 axes on each turret are standard with standard live tools at every turret station. The B76543 can quickly be changed from bar work to chucking work. Both the main and subspindle can be equipped with up to 8" chucks, ideal with Eurotech's custom software features for robotic or mechanical loading. The new series is also offered in a smaller sized 1.77 mm bar capacity and a larger sized 3.15 mm bar capacity.

For more information please contact Eurotech at 352-799-5223 or visit [www.EurotechElite.com](http://www.EurotechElite.com).





# fresh stuff

## Never Idle ►

MAG introduces the new TWINFLEX flexible, two-station CNC machining center which delivers short chip-to-chip and low idle times achieved by alternating machining between stations. The TWINFLEX has two swivel bridges with independent drives. During the loading and unloading process both machining units work together on the workpiece of one swivel bridge. At the same time the loading and unloading space is screened off from the neighboring workspace by a protective guard.

For more information please contact MAG Industrial Automation Systems at 859-534-4600 or visit [www.mag-ias.com](http://www.mag-ias.com).



## ◀ Fast and strong

GBI Cincinnati introduces the new matec-30 HV/K 5-axis machining centers which include versatile high-speed linear guide ways in all axes. A high-torque 30 kW AC spindle motor with direct drive permits full horsepower at low spindle speeds. The standard 40-taper spindle delivers 12,000 rpm (42,000 rpm optional) with through-the-spindle coolant at 20 bar (70 bar optional) which helps keep the spindle cool. To assure the rigidity required for heavy-duty cutting, the machine base is manufactured from high-quality mehanite cast iron. A 630 mm diameter CNC torque rotary table permits machining on 5 sides, with a speed range of 1,800 rpm. The swing circle of the CNC torque rotary table has a diameter of 1,000 mm. The CNC torque swivel head has a range of  $\pm 105$  degrees for horizontal and vertical machining.

For more information, please contact GBI Cincinnati at 513-841-8684 or visit [www.gbicincinnati.com](http://www.gbicincinnati.com).



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The new FANUC DDR/B from Methods Machine Tools is a rotary 4th-axis designed specifically to complement the speed and versatility of the FANUC RoboDrill vertical machining center. By eliminating the positioning delays of traditional rotary tables, it dramatically reduces part cycle times. A true milling 4th axis, the DDR/B can unclamp, rotate 180 degrees and reclamp in less than 0.3 seconds. Capable of 200 rpm, it has a part-loading capacity



of 220 pounds and 369 foot-pounds of torque, enough to handle the most difficult applications. It has a direct-drive motor with no gears to wear out or break. If bumped, it can be easily tuned to original specifications.

For more information, please contact Methods Machine Tools, Inc. at 978-443-5388 or visit [www.methodsmachine.com](http://www.methodsmachine.com).



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With improved dust resistance, NSK Precision America's new HA Series linear guides are ideal for machining centers, high-precision lathes and grinding machines. The use of ultra-long ball slides achieves high motion accuracy in both narrow and wide ranges. These slides minimize posture changes in the bearing that would normally result from ball passage vibration or rail waviness. Additionally, the unique design of the HA Series ball



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## ◀ Seeing straight

The L.S. Starrett Company introduces the new Galileo AV350 Video Measurement System. The AV350 is an intermediate travel, multi-sensor, metrology instrument offering a large, square 14" x 14" (350 mm x 350 mm) X/Y work area and extra Z-clearance at 8" (200 mm). The large Z-clearance, combined with extra rigidity provides the necessary space for multi-sensor attachments, including vision, contact probe and laser scanning. The Galileo AV350 is ideal for use in QC labs, research, engineering and manufacturing environments.

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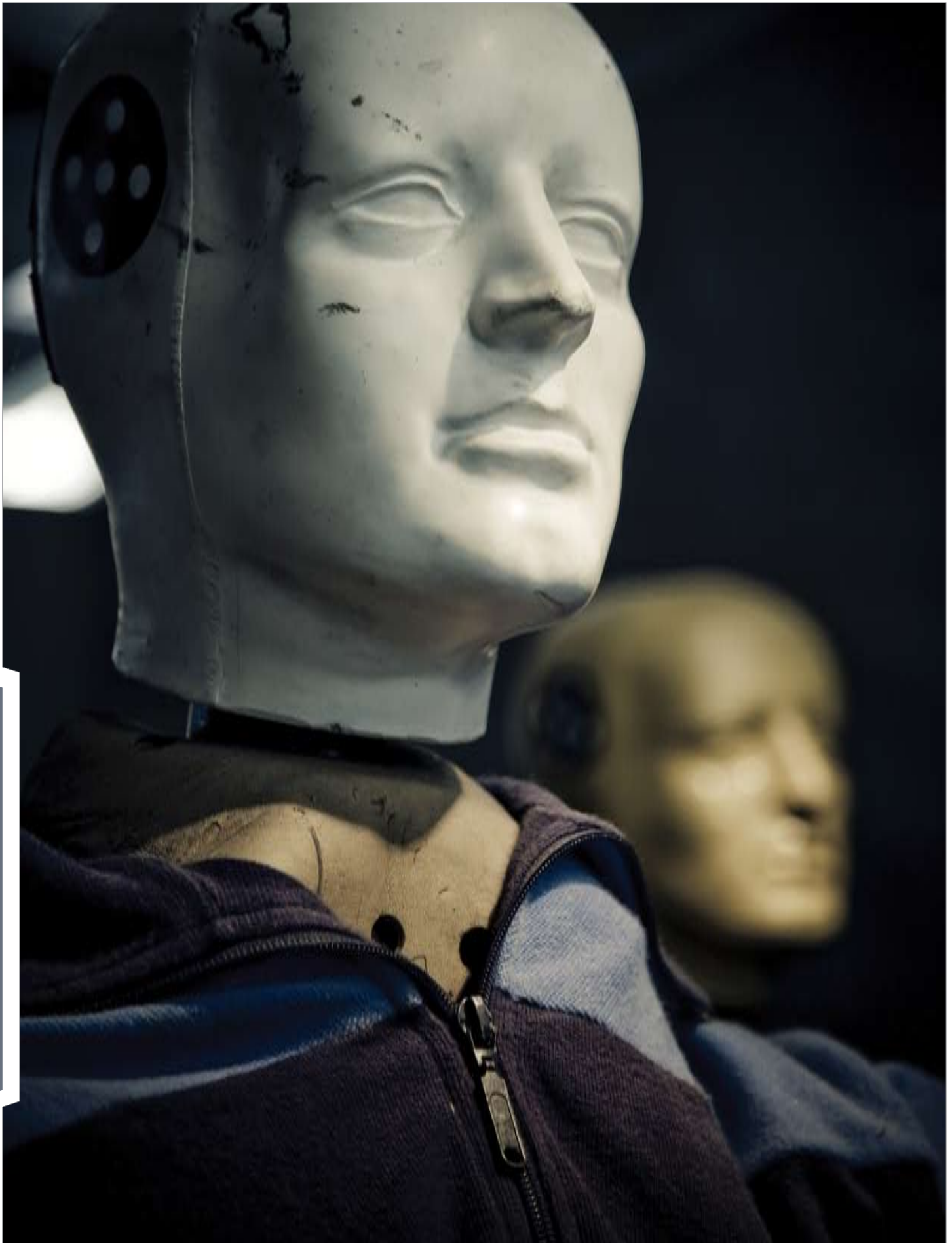
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By D. Douglas Graham

# “Crash, Course”

There’s nothing “dumb” about crash dummies. These highly-sophisticated, anthropomorphic test devices come equipped with a battery of intelligent instrumentation for measuring the bodily effects of every conceivable impact scenario. A crash dummy is a work of art designed and constructed as a marriage of cutting edge computer and machining technology, and the skill of the master artisan.

Today’s typical crash dummy, (let’s call him “Reggie,”) is a human knockoff close in so many respects to the real thing that one is tempted to describe him as “alive.” Reggie’s virtual skin and bones are a blend of materials carefully selected to respond like actual skin and bones to a range of accident scenarios. He also comes equipped with his own vital organs and nervous system in the form of *load cells*; highly complex gauges designed to measure all the damage scenarios of a collision. *Accelerometers*, for example, track the velocity and

speed of the objects to which they are attached, while *potentiometers* monitor deflection to determine the extent to which a body part will deform upon impact.

Reggie is far more than a mechanized manikin. His sophistication commands a price. Auto makers, safety equipment manufacturers, government, aerospace, the military and many others pay to bring him on board, plus a significant sum beyond their initial investment to keep their not-so-dumb, dummy in good, working order.



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"Minus load cells, the price of a dummy averages around \$30,000," explains Mark Brown, Ohio plant sales manager, Denton ATD Inc., a manufacturer of crash dummies, load cells and crash dummy certification labs headquartered in Rochester Hills, Mich. A certified dummy meets biofidelic standards that its components will mimic human muscle, bone and flesh in an impact scenario. Depending on how much instrumentation is added, the price of a "loaded" dummy can go as high as \$100,000. Complexity drives the price up. You can add instrumentation to monitor accident effects on the lower legs, the upper torso, the head, wherever. The more the components, the higher the price. It's kind of like buying stereo equipment."

"We test living volunteers and postmortem humans to obtain the data we need."

### Reggie's Roots

Henry Bliss of New York City became America's first auto fatality when he stepped out of a trolley in 1899 and was promptly walloped by a heedless motorist in a big

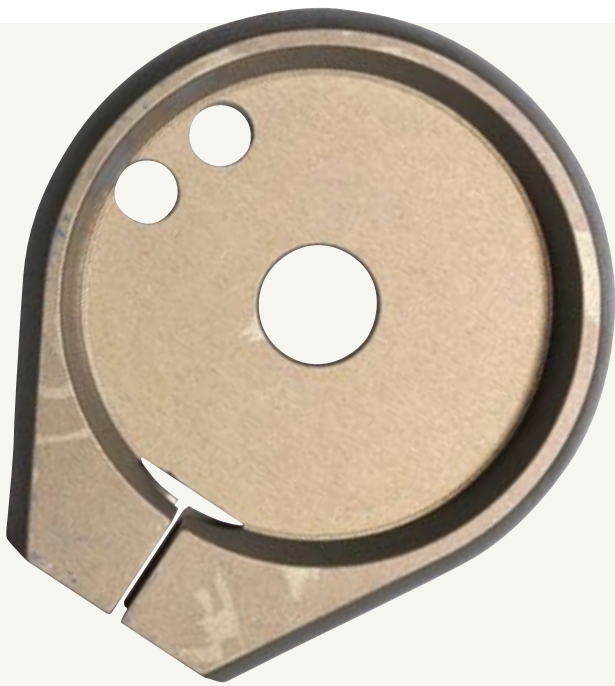
hurry. Motorized mortalities racked up by the millions soon after the close of the 19th century, as cars became faster, more numerous and increasingly dangerous. Death on the road was all too common by Depression times, a situation not improved by the interior design of most of the vehicles of that era, whose features included rigid metal dashboards, non-collapsible steering wheels and many protuberances on which to crack one's head or become impaled in a worst-case collision scenario.

Car bodies themselves were built with lethal inflexibility, passing the full brunt of collision impact along to occupants. Testing to determine the health consequences of auto accidents was legally mandated, and 1930s researchers looked to the nation's morgues for subjects. Cadavers were pushed into empty elevator shafts, packed along with rudimentary instrumentation into soon-to-collide, simulated vehicles, or thumped atop their heads with enormous ball bearings — all for the sake of assessing the physical consequences of hypervelocity impact on the human form.

Tests involving live human volunteers and animal subjects were also widely employed in the days before the debut of Reggie's earliest ancestor, a postwar crash dummy christened by its makers, "Sierra Sam." Nothing breathing ever sailed down an elevator shaft, however, or was made to endure a skull-bashing courtesy of a bowling ball-sized, steel bearing. The aim instead was to ascertain, in a manner as painless as possible, the effects of rapid acceleration/deceleration and auto collision impact, often simulated in the case of the latter by striking a test subject in the chest with a weighty pendulum.

"The mission of today's biomechanic testing facilities is to search for data that can be used in the creation of *biofidelic* crash dummies," says Dr. John Bolte IV, director of the Injury Biomechanics Laboratory, Ohio State University. "When we say *biofidelic*, we mean human-like, and we test living volunteers and postmortem humans to obtain the data we need to achieve that goal."

Volunteers are treated gently, Bolte explains. Even cadavers are spared the indignity of being mashed against mortar at high speed. Typically, a living volunteer would be subject to a range of motion tests (none injurious), a cadaver, to a stiffness response examination wherein its thorax might be pushed from the side to determine the pressure required to displace an inch of flesh. According to Bolte, the goal of such testing is to establish *biofidelity*, the criteria needed to insure a dummy reacts bodily to



**Above:** Hybrid III 50th male knee cap milled from 70-75 aluminum bar stock and hard coat anodized. Dimensions are machined to a .001" to .005" tolerance.



the perils in which it is placed the way a motorist would in identical, real life circumstances.

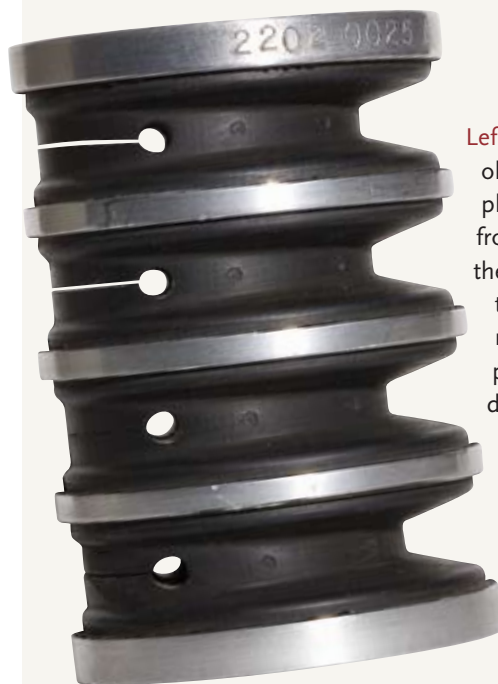
“Crash dummies are a vital component of car-crash testing,” adds Jessica Gall, crash test engineer, MGA Research Corporation, a transportation safety research company in Burlington, Wis., “They’re placed in passenger seats, and introduced to accident situations faced by actual motorists. Such scenarios might include head-on collisions, rollovers, airbag deployments and just about anything else you might have heard about or can imagine. It’s important to point out that not all accidents are auto-related. You might also use a dummy to reconstruct an incident involving a roller coaster in which someone got hurt. A crash dummy can tell you a lot about an accident, as you can equip its various parts with up to 150 sensors. Dummies also replicate the range of human body genres, from large adult male and somewhat smaller female to elderly and child-size.”

**“A femur made from a manganese bronze casting, is a problem part because it eats up cutting tools.”**

### Building Reggie

The machining of Reggie and his siblings is no walk in the park, claims Denton ATD machine shop supervisor, Jeremy Buchanan. Each dummy is comprised of many machined components, including the metal castings the company purchases from its foundry vendors. The castings are transformed by Denton’s machine shop into shapes closely correlating to human body parts, i.e; skulls, pelvises and femurs. Such shapes are highly eccentric, and as such, resistant to machining.

“Most parts call for between two and eight operations,” Buchanan explains. “Most are done on vertical CNC machining centers. The initial work on the pelvis, for example, we machine a surface area for lumbar attachment. Once that surface is complete it’s time to move on to the rest of the fixturing for the ball sockets that link the pelvis to the femur. We use the same top-surface fixturing method to machine a ‘pocket’ at the back of the pelvis to hold an accelerometer mount. We also work a couple of areas on the pelvis wings, or ilium — the pelvis bone’s right and left flank, to receive load cells. That’s about all there is to machining the



**Left:** Hybrid III 10-year-old neck. Aluminum plates are machined from 6061 stock and then molded within the segmented rubber form. This part must pass dynamic testing in flexion and extension corridors before it can be sold.

**Right:** Hybrid III 50th male foot. This is solid vinyl molded around a fabricated steel foot bone that has been heat treated and nickel plated. The thin ensolite foam heel pad provides compression characteristics in that region.



pelvis, but when the operations are combined with those required to create the other parts that go into a crash dummy, you’re talking a lot of machining.”

Many parts are made from solid bar stock, Buchanan continues. One example is the neck adjusting bracket custom-fitted to every dummy. Components of this part include an upper and lower bracket made from 7075 aluminum. The brackets are worked complete on a vertical CNC, then oxidized to protect against corrosion. Other dummy parts are turned on a CNC lathe, like the welded

tubing that will ultimately serve as a leg or arm bone.

Such operations pose challenges all by themselves, but in the case of crash dummies the hurdles stand even higher. Government, insurance and engineering specs frequently call for the use of tungsten alloys, manganese bronze castings, titanium and other unfriendly materials with strength characteristics appropriate for the combat-level duties to which they will test. One example, a femur

made from a manganese bronze casting, is a problem part because of its sand porosity, which eats up cutting tools. Denton gets around the porosity issue by using carbide tooling, which holds up better against manganese casting than a tool made from high-speed steel.

In CNC lathe turning applications, tooling and inserts must be matched with the appropriate chip breaker. Aluminum parts, for example, produce a stringy chip, calling for the use of a higher shear insert chip breaker. The non-metallic materials used by the shop also require special handling. Materials used include plastics such as delrin® and nylon, rubber, urethane and even leather. Each possesses its own machining for which the proper tooling must be used at the right speed and feed rate.

“Tight tolerances are probably the tallest machining hurdle we have to leap,” Buchanan adds. “We get around that problem by doing our work without rushing. We regularly check tool wear, and 100 percent inspect all parts to make certain each is coming out properly and in accordance with specs and expectations stipulated by the federal government, the insurance industry, our customers and everyone else we aim to please.”

Denton ATD is one of only two U.S. crash dummy makers in business today. (The other is First Technology Safety Systems (FTSS) of Plymouth, Michigan.) The company does its own manufacturing, including the shaping and on-site machining of the raw and cold rolled steel, and aluminum bar stock it uses to construct crash dummy skeletons. It does little outsourcing, apart from occasionally doing business with a handful of local vendors.

Denton sells approximately 150 dummies per year and scads of parts to clients all over the world.

“This is a highly unusual business,” Brown admits. “And it’s mainly for that reason that we find ourselves faced with problems most companies never have to worry about. The biggest are on the design and manufacturing side. How do you get rubber and vinyl to perform in the same way flesh does in an accident situation? Be familiar with the materials you work with, know how to process them to get the best results and control every aspect of production. This is why we don’t work with outsourcers. It’s also the reason we have such a high rejection and scrap rate, which in turn raises the price of our product. We’re improving a lot in the scrap area but in this business you have to be better than good. You have to be perfect.”



**Below:** Hybrid III 6-year-old upper femur assembly. The part is comprised of four components made of 624 aluminum bronze. The shaft is press fitted and welded to the machined body with the femur socket ball pinned to the end.



## Reggie On The Job

Risa Scherer is dummy lab engineering, and operations section supervisor at Ford Motor Company in Dearborn, Michigan. An early convert to the dummy concept, Ford has crash-tested using Reggie and his kin since the 1950s and currently keeps a stock of approximately 120 units on hand. All ages are represented; adult dummies, child and infant dummies, even whole families. According to Scherer, the auto maker's anthropomorphic test devices are subjected to a wide range of accident scenarios, among them the irritating rear end impact situation occurring when one is stopped at a traffic light unnoticed by the motorist trailing a few yards behind.



Risa Scherer, supervisor of Ford's Anthropomorphic Test Devices Laboratory, readies a crash test dummy for an upcoming test.

"We put our dummies through numerous test modes, including the famous one where the vehicle slams directly into a wall," she explains. "We also have a setup where the car careens with the wall at a 30 degree left or right angle, and a simulation in which it crashes into an oncoming semi truck. Our test vehicles are provided with plenty of inviting targets, simulated poles into which they can collide and moving

barriers. While the props employed do not resemble the objects they are intended to simulate, they perform just like the real thing in a crash situation. Our semi truck is a concrete mass with a simulated bumper on it, and the front end of our crash car an aluminum honeycomb which gets swapped-out for a new one after each test."

Crash dummies are serious business at Ford, Scherer adds. The automotive giant regularly collaborates with Denton, FTSS, insurers and the appropriate entities within the Federal government to tweak existing dummy models or come up with new designs better suited to the testing needs the industry.

"We work with both dummy makers and collaborate with them when the need arises," she says. "A good example came up when we were using dummy-testing airbags on a female. We got two different results — one good, one bad — and the results were inconsistent though they were obviously inaccurate. We met with the two manufactures and asked them to design a part that would give us the consistent results we needed to properly test our new airbag. Working with the Society of Automotive Engineers, an organization that works closely with the automotive industry to create anthropomorphic test devices so human-like they will fit into any application with the same result, the dummy makers redesigned a vinyl part that goes over a female's upper torso, simulating a breast. With that piece in place we retested and got the consistency we were looking for. We try to leave no stone unturned. We even come up with a special test every once in a while to pinpoint the reason that say, a driver's right foot keeps slipping off a gas pedal. Is it a fluke or a serious problem? A crash dummy may have the answer, but only if it's made of the right stuff."







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The HS Indexing Chuck machines combine precision chucks with the indexing accuracy and reliability of the Hirth ring, a proven hallmark of Hydromat machine design excellence and accuracy and repeatability.

Available in 12 or 16-station models, the HS machines have the rigidity to handle all component types within their capacity, a 102 mm cube on the HS-12 and a 76 mm cube on the HS-16. The chucks can be rotated and indexed as required to machine 5 sides without having to re-clamp the workpiece. The 12 horizontal station EPIC R/T is capable of the addition of six vertical units, while the 16 station version can handle eight verticals, that's up to 24 tools in the cut at once. Impressive.

Bar fed applications can also utilize the advantages of the EPIC R/T HS Indexing Chuck configuration. Materials up to 45 mm in diameter and 200 mm in length to be machined without problem.

The HS is fully integrated into the Hydromat machine program, so the same modular components used with Hydromat's other popular EPIC R/T rotary transfer models are compatible with the EPIC HS machines.

All of the EPIC machines feature EMC Technology, Embedded Motion Control, an advancement that brings new power to Hydromat's already impressive capabilities.

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Emily Halgrimson Interviews

# Darlene Miller

Darlene M. Miller, owner, president and CEO of Permac Industries in Burnsville, Minn., has turned a small manufacturing company, which she bought when it was virtually bankrupt in 1994, into a prosperous business. Darlene discusses what she has done to create this success, how she finds new customers, breaks into new sectors, keeps costs down and keeps her employees involved.

Darlene Miller, president and CEO of Permac Industries Inc.



**P**ermac Industries started in 1966 as a 7,000 square foot screw machine job shop in Bloomington, Minn. They now manufacture precision parts for customers worldwide in industries including hydraulics, off-road equipment, food and beverage, avionics and medical technology. Darlene purchased Permac in 1994 and throughout the 1990s and 2000 augmented the company's original battery of Brown & Sharpe single spindle screw machine equipment, adding an Acme Gridley six-spindle, CNC lathes with live tooling and sub-spindles, 13 axis twin spindle/multiple turret turning centers and Swiss machines.



Citizen CAV16C Swiss turning center surrounded by representative parts and a Permac Inspector at work.

Under her leadership the company has strongly increased revenues, physical space and capacity. In October of 1998, Permac moved to its current headquarters in Burnsville, Minn., with 17,000 square feet. In 2007, the company doubled capacity and space to 34,000 climate-controlled square feet, while adding seven new pieces of equipment. This provided space for in-house warehousing and customer inventory management, assembly areas, engineering, administrative offices and a leading-edge quality control laboratory. Darlene's initial business plan included a 15 percent revenue growth goal every year, which she has met. Permac recently set the goal of 25 percent revenue growth for 2008. Her success and business acumen have earned accolades for Darlene and Permac, locally and nationally.

**Emily Halgrimson:** I understand Permac has achieved its revenue growth goal of 15 percent for years now and you are upping that to 25 percent. What steps have you been taking to accomplish that?

**Darlene Miller:** We are, although we're only at about 5 percent growth for this year so far. I've brought on a new national sales manager, which has proven to be very beneficial because I did all the outside sales before. We are also expanding into some diversity programs, especially now that we have our ISO 9001-2000 Certification, and [we have] some government contracts. Whether we'll hit our goal is pretty subjective, but if not we believe we will next year, with things in process. A good part of it is that we're able to brainstorm a whole lot better now and really look and research companies we want to go after. That's really helped to market us. We redeveloped our new Web site about three months ago. I also co-founded the Minnesota Valley Medical Manufacturing Network (MEDNET) and that's proven to be a really a wise move. Networking to me is a huge key to the success of our business. We also focused on re-doing customer service this year. I think a lot of it is staying in touch with people and staying out there no matter what, and knowing that anybody can make parts. We have to serve that customer way beyond the norm. We have to make perfect parts, do perfect machining, [have] personal service and [give] no surprises. People want to know what's happening.

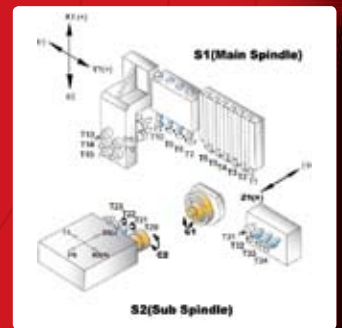


Front entry of Permac facility in Burnsville, Minn.



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**EH:** What are some of the benefits and problems you've had as a result of doubling your square footage to 34,000 square feet last year?

**DM:** The main benefit is the increased capacity. To be able to bring new clients in who have a lot of work and to be able to show our current customers that we do have the available floor space to add equipment and to service their needs is huge. We have begun taking on a huge part of one current customer's assembly, which would have never happened before because we didn't have the space. But they came in, saw it and said "you know, we could close a plant and bring other things in house and run this out to you, if it is competitive." So there is no question that it was good move for us to be able to sell and market. The downside is that there's always the fear, with the economy what it is — you're wondering if this was the right time. But I think I really don't have any doubts that it was. Obviously, the costs are high. Bringing in more power has been a big issue. The biggest issue we have is workforce — finding skilled workers.

**EH:** What have you done to keep overhead costs down?

**DM:** We put a real concerted effort on budget planning, last year especially. We'll be doing it again soon for next year. Part of that focus was to reduce our overtime by over half. We did that, plus some. We used better scheduling methods, shifted schedules and opened up more flexibility in work hours. So by working with people, getting creative, moving times around and looking at scheduling we've been able to cut that a lot. The price of materials has been horrendous, but we partner with a distribution house here and also do a lot of contract work where we can lock in our price on materials.

**EH:** How have you expanded your business year after year?

**DM:** I really have always been a huge networking person. I really believe that you have to get out there and people have to know who you are. You're constantly having to market. I'm on about eight boards, so I meet a lot of people that way. I travel a ton — any opportunity there is with a supplier or customer. We try to stay in the lime-light so people know who we are and that we're strong and doing well. We also target markets and stay in touch with old buyers.

**EH:** How do you find business in new sectors?

**DM:** It can be as simple as doing Internet research, reading business or trade journals and seeing who's new out there and who's growing.

**EH:** How are you going about your expansion into the medical sector?

**DM:** Two things: MEDNET, of course, being on the second year, and Lawson and Burnsville Medical Council. Again, it's networking. When the city works with somebody new coming into town, those of us who have aligned ourselves with the city will sometimes be contacted. We're able to market quicker than someone else in manufacturing who is not as exposed. We're also on the city Web site, and we target companies too — in the business journal you can read a lot about startups. We want startup [companies] to middle size, and those who stay loyal. I also attend the medical shows as part of Burnsville Medical Alliance. I think sometimes you have to think outside the box. It may not happen today, but what about a year from now, six months from now?



**EH:** You've traveled to China and India. What have you found to be the best and worst aspects of doing business there?

**DM:** We had a part time employee in China for three years — the most difficult part was communication. If you're going to succeed you have to have someone who would be there very often. You can't assume you can go there once a year and keep the relationship up. Things fall through the cracks — quality falls through the cracks. And that was even [an issue] with the part-time person, who was Chinese. You really have to spend a lot of time on it. If you're going to make that leap you have to make a commitment to travel, to being there, and to being face-to-face.

**EH:** As a woman it must be more difficult in a way to lead. Have you found that to be the case?

**DM:** Not at all, and you know, if anything, I might say that it's easier. I think as a woman you're more open sometimes, and as an owner you get to hear every story; every birth, death, divorce, money needs — you hear them all. If anything, in sales, when I first started and was making cold calls, I think people would let me in the door because they were wondering, "who is this woman who has a machine shop?"

**EH:** What is the "just say yes" philosophy I read about on your Web site, and how does it help?

**DM:** I always say that "no" is not an answer. Sometimes the guys really laugh at me. They say "we can't" and I respond there is no word "no" or "can't." It might be difficult, but let's really think out of the box. Don't come to me with "we can't do this." Come to me with "we're going to have to change our path a little and this is the answer." Everybody's pretty much gotten to be the same way. They know "no" is not going to work with customers.

**EH:** Are you a workaholic? What do you do in your spare time?

**DM:** Yes (laughing), but I'm also a travelaholic and am very heavily involved with the community. I do a lot of volunteer work. I have a mentoring program, *Hope for Tomorrow*, which is a real passion of mine. I enjoy a lot of friendships and social activities. I boat, travel, read and exercise. So, I feel my life is pretty well balanced.

**EH:** What philosophies have you used to manage your business that you would advise others to implement?

**DM:** Surround yourself with the greatest, strongest most positive managers. My management team is phenomenal.



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It filters everywhere in the company. We're pretty flat, it doesn't matter if you're the receptionist, the shipping guy or a machinist — everybody is in tune with everything we're doing. We have at least monthly meetings, if not more. We do a lot of celebrations. Everybody's aware and I think it's so central to being successful. Make sure that everyone in your company feels a part of the team and knows how they can contribute, how they can change [things]. I can walk out there and ask them what our goals are and they could tell me. Because they're all engaged. They don't leave their brains in the car. Also the management team we have are just doers. I can come up with an idea or suggestion and it just rolls.

**EH:** It sounds like your employees are very happy to be at Permac. What do you do to encourage a happy work environment?

**DM:** We have fun, we really do. Even the auditor who was here for ISO said "you're the first company I've ever audited that when I said 'you're going to pass' instantly jumped on the loud speaker and paged the whole company playing a clip of the song 'I Feel Good'." We played the song and then announced we would be recommended for ISO. He said he had never seen an owner jump up and do that.

To me that's second nature, everybody had worked hard and needed to feel the excitement. We do have fun — we name the machines and have champagne parties when a new machine comes in. We have company parties and people are informed. Allowing them to be engaged and to present their ideas and make sure that when they're presented they're acted upon. Can you do everything? Absolutely not, but communication is what's needed.

**EH:** Do you have any advice for small or medium sized business owners like yourself?

**DM:** I live by my motto that you're never given a dream without the opportunity to make it come true. If you believe in something, you can do it. I also think you need to really surround yourself with people. Join [associations like] PMPA and your Chamber of Commerce. Network in every way possible because you never know who that person is who's going to bring you your next lead. And train all your people to be sales people!

**EH:** Thank you so much, Darlene. It's been a pleasure.

**DM:** Thank you.



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1-3/4" 6-spindle, 1965, 1993 (10)  
1-3/4" 8-spindle, 1970  
2-1/4" 6-spindle, 1962, 1973-79 (3)  
6-5/8" 6-spindle, 1979

## ACMES

1-1/4" RA6, 1973 (2), thdg., pickoff  
1-1/4" RB8, 1981  
1-5/8" RBN8, thdg, 1979, thdg., pickoff  
1-5/8" RB8 thdg., pickup '68-72 (5)  
2" RB6, 1979  
2" RB6 collet chucker, 1980  
2-5/8" RB8, 1973, like NEW  
2-5/8" RB6, 1980, thdg  
3-1/2" RB6, heavy recess, '66

## B & S and INDEX

G200, 1997  
G300, 1997  
B60, 1967  
B42, 1974  
00-R/S 1/2"

## SCHUTTE

SF 51, DNT, 1985 (2)

## CNC SWISS

Star SR-20, 1998  
Index ABC, 60mm, 1996  
Traub TNL - 2001

## NEW BRITAIN

Model 51, 1980  
Model 52, 1980, thdg., pickoff  
Model 62 2-1/4" 6sp., 1975, heavy thdg.

## DAVENPORT

3/4" thdg., pickoff, longbed (4)  
3/4" 1981 (4)  
3/4" thdg., pickup, 1977-66 (8)  
Noise Tamers

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Pro 20, 1999  
HW 25-12, 1994  
HB45-12, 1996  
HB45-16, 1987  
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WITH NOAH GRAFF

## shop doc

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 can also check out the TMW online forum at [www.shopdocforum.com](http://www.shopdocforum.com).*

**Have a technical issue you'd like addressed? Please email [noah@todaysmachiningworld.com](mailto: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 are job shop making a very tight tolerance component in stainless steel. Someone suggested that having part of the job done with investment casting would cut our machining costs and give us a smooth finish. What are the advantages of investment casting versus sand casting, and which method would be better for me? Price, as always, is an issue.

Castaway

Dear Castaway,

First, I'll give you a rundown of how the investment casting process works. It starts with creating a tool (die). Then you shoot hot wax into the tool to make the shape of the part. After that there is a dipping process with an expensive ceramic material, and you melt the wax out and pour in the alloy of choice. Finally, you knock the ceramic off and clean up the casting.

Think about the following when choosing which type of casting to use for your job. Consider which type of metal you are using. You can use almost any alloy with investment casting aside from iron. Sand casting is usually used for working with iron or aluminum, and occasionally steel. Die casting is generally limited to working with aluminum or zinc, and can't be used with steel.

Also important is knowing what type of surface finish and tolerance you want to achieve. Sand casting is going to produce a rougher product with a looser tolerance than investment casting. Investment and die casting can achieve a tolerance within  $\pm .005$  per inch from the die to the end process.

It can also produce a 125 micro-finish or better, while sand casting could yield up to a 250 micro-finish.

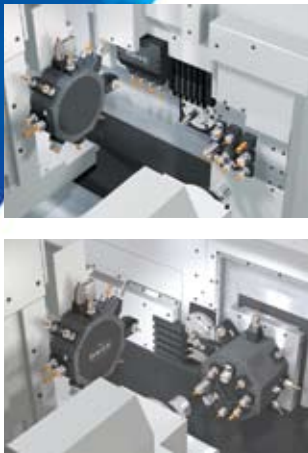
Investment casting is a more expensive process than sand casting, and double the price of die casting. It's very labor intensive, takes more time and has a lot more steps than the sand casting process. However, because investment casting gives you a relatively precise product it could cut down on machining operations afterward, saving you time and reducing scrap. Also, sand casting and die casting require a 1 – 2 degree draft angle, while investment casting is a straight cut, which could further cut your machining costs. You will have to calculate whether the greater precision and finishes achieved from investment casting will reduce your machining operations enough to save you money over sand casting. Sometimes investment casting can make parts so precise that people don't even need to do machining afterward.

One last bonus of investment casting is that after you make the die it basically lasts forever because wax was shot into it, not hot metal.

**Chuck Myers**  
Rimer Enterprises, Inc.

*TMW referred this question to Chuck Myers, president of Rimer Enterprises, Inc. in Waterville, OH, an investment casting firm since 1944.*

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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

BY NOAH GRAFF

next

## In five years will CNG powered cars and trucks be a major player in American transportation?

*Vehicles powered by domestically produced compressed natural gas (CNG) can significantly reduce fuel costs and pollution, yet U.S. drivers operate only 150,000 out of 8.7 million CNG vehicles worldwide.*

With the steady rise in petroleum prices — they never go down much for very long before rising again — we could see 20 percent to 40 percent of our vehicles running on cheap, clean, domestic natural gas by 2013. The percentage could be even higher depending on how much support we get from our government. We are already seeing it in the amount of legislation starting to be proposed in Congress from both sides of the aisle. With streamlined regulations and more incentives we will see the costs of ownership come more into line. Boone Pickens, Chesapeake Energy and NGV America are all making progress in infrastructure production, promotion and publicity of CNG. Demand resulting from economic and environmental factors are going to drive CNG vehicles back into production in the U.S.

**David Clement**

CNG Services of Arizona  
Arizona Authorized FuelMaker Dealer

Maybe! Compressed Natural Gas can fuel U.S. vehicles for decades to come on our own supply with little or no imported natural gas from other countries. Maybe — if the EPA would make a certificate of conformity easier to obtain. I should be able to smog test my own vehicle after a conversion and prove that it is cleaner — I should not have to pay the EPA \$250,000 for a certificate that says the same thing. Maybe — if the government would stop listening to special interests and hindering the production and use of natural gas in vehicles. Maybe — if we as consumers, voters, and stewards of the environment demand these vehicles be built.

So everyone — do something, say something, or just be happy with your \$3.00 per gallon gasoline. I will do the same and continue filling my car for half the cost from the convenience of my home.

**Veerachart Murphy**

CNG Motors (Car Dealership)  
Arizona

### the facts:

The only light-duty, factory-produced, CNG vehicle in production in the U.S. is the Honda Civic GX which starts at a suggested price of \$25,090. Ford, GM, Toyota and Chrysler all stopped their U.S. production of CNG cars by 2005.

By 2050 the number of vehicles in the industrialized world will double. Vehicles in the developing world will increase 12-fold. Together there will be approximately 3.5 billion vehicles in the world according to the Department of Energy.

[www.driveclean.ca.gov](http://www.driveclean.ca.gov)



Photo courtesy of Honda Motor Co. of America.



We do not think that natural gas vehicles will have any significant share of the light vehicle market within the next five years. Right now Honda sells a natural gas version of the Civic and that's it. The Civic GX costs around \$26,000 and they sell less than 2000 of them per year (compared to over 300,000 units of the Civic overall). Compare this to sales of the Civic hybrid which are over 30,000 units per year (although I don't believe there will be a significant number of hybrids on the road either in five years). You can't go to your local gas station to get CNG, and not everyone can get a Phill (a home CNG refueling appliance) installed in their garage. However, there is a market for CNG trucks for fleets because it's easier for truck fleets to set up their own filling stations and recoup the lower running costs over time.

**Mike Omotoso**  
Senior Manager, Global Powertrain  
J.D. Power and Associates

## the facts:

### **Prices of natural gas with equivalent fuel as a gallon of gasoline** (Oct. 17, 2008)

Arizona: \$2.35 per gallon (at station), \$1.45 (filled at home).

Utah: \$0.83

Oklahoma: \$0.93

California: \$1.80 – \$2.50

### **Potential benefits of CNG cars calculated by the U.S. EPA** ([www.afdc.energy.gov](http://www.afdc.energy.gov))

Reduce carbon monoxide emissions 90%-97%

Reduce carbon dioxide emissions 25%

Reduce nitrogen oxide emissions 35%-60%

Potentially reduce non-methane hydrocarbon emissions 50%-75%

Emit fewer toxic and carcinogenic pollutants

Emit little or no particulate matter

Eliminate evaporative emissions

### **Other advantages of CNG cars** ([www.cngmotors.com](http://www.cngmotors.com))

Filling up from home

Using the Carpool lane ALONE

Tax benefits

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Longer intervals between oil changes

A higher octane rating than super unleaded



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Veerachart Murphy with a CNG powered, 2000, Ford Excursion 4x4.

Photo by Mike Adams: Caught In The Act Photography

**Veerachart Murphy** is the owner of CNG Motors, a used car dealership in Phoenix Arizona specializing in cars powered by compressed natural gas (CNG) and other alternative fuels such as propane.

## How did you get into this business?

**VM:** It all started with finding a vehicle for my wife. She drives a Chevy Suburban and we were looking for an answer for the high fuel costs in 2000 (laugh). When we started to hunt down a CNG SUV we had a very difficult time finding one. That was what put the original idea in my head. You can't go down to your local car dealership and say I want a CNG vehicle.

## Who are your customers?

**VM:** I usually break my customers down into one of three categories or a combination of the three. You have environmentalists and you have people looking to save time. Unfortunately, this group of people is what gave the [CNG] market here in Arizona a black eye. A lot of people will do conversions so they can drive in the carpool lane by themselves, with no intention of ever running the alternative fuel. Lastly you have people like me — I originally did it for the cost-saving aspect of it. A dollar a gallon to me is much better than \$3.50 a gallon. I do consider myself a combination of all three categories, but I'll be very honest; my first intent is to save money, my second is to save time in the carpool lane, and lastly I'm going to do my little part to save the environment.

## Are most of the vehicles you sell conversions?

**VM:** Either somebody did a conversion on them, or they came from the factory already converted. Seventy percent of the vehicles I carry have a factory conversion on them. Honda has made factory GXs since 1998 and still does today. Chevy made natural gas vehicles since '92 but stopped in 2005. Ford began in '94 or '95, and they also stopped in 2005. Toyota made some [CNG] Camrys from '99 to '01.

## Why did they stop making them?

**VM:** There was just no demand. In 2005, when they all stopped selling them, gas was still fairly inexpensive — it was just \$2.00 a gallon. There just weren't enough environmentalists out there to make it take off. When gasoline hit \$4 a gallon and you could get natural gas in Utah for 80 cents a gallon, everybody became interested.

## Who is most to blame for the low demand for CNG cars in the U.S.?

**VM:** We are — as consumers for not demanding it, for not pushing our government to do it, for being content with gasoline and oil [prices]. Then there's a huge list after that — government agencies, special interest groups, Big Oil, EPA, other groups that help suppress it, and they're very happy that we as a nation have pretty much been content with gas prices. Every day I take phone calls saying "are you telling me cars can actually run on natural gas? The same natural gas that comes out of my well at my farm? The same natural gas that I use for my gas stove?" People have no idea that cars can run on anything besides diesel and gasoline.

## Fifteen years from now, do you predict a large variety of alternative fuel cars on U.S. roads?

**VM:** I do. The answer is not natural gas — but it is definitely part of the answer and it's going to be a huge part of the answer in the future. Gasoline vehicles will be around until there's no gasoline. But 15 years in the future, of those vehicles not burning gasoline, I would say 50 percent will be natural gas. The other 50 percent will be a combination [of other alternative fuels]. And the reason natural gas will be so prominent is because it's already here. The rest of the world is on it. For almost 20 years we've been using it. We just need to get the word out.



CAPACITY 15 TON

## Machining Large

Milling slots in a hollow cylindrical workpiece on the larger Quickmill gantry-type machining center at Gilchrist Metal Fabricating Company.

## how it works

BY BARBARA DONOHUE

# Machining Large

**T**he machining center's gantry towers over the machinist, and the machinist has to climb on the machine's table to measure a slot cut in the 20 foot-long part. Way up near the ceiling a bright yellow beam announces that the attached hoist has a capacity of 15 tons.

Welcome to the world of big machines and big parts. You may be accustomed to making thousands of parts a day and shipping them out in boxes. What's it like to make the big stuff?

### What's different about machining large parts?

Making chips isn't that much different on large parts. It's still about feeds and speeds. But factors such as part handling, setup and thermal expansion can complicate what happens before and after making those chips.

Setup of a large part can be a painstaking process, bordering on an art form. First of all, you need to use a fork truck, crane or hoist to move the workpiece. You'll seldom work from solid material and will most likely start with a weldment or a casting — so the raw parts probably won't be as square and straight as you would like.

You'll need to align the workpiece to allow for any twist, bow or sag, and support it so it stays rigid under the tools.

"The key is the setup," said Gordon Buchholz, sales director at Quickmill, Inc. in Peterborough, Ont., Canada. "It needs to be good so your tooling can perform. You may spend two hours setting up a workpiece on the machine."

Not only does the part have to be properly aligned on the machine, you have to make sure it is supported sufficiently. Even if you have a plate 10 feet in diameter and eight inches thick that weighs 12 tons, Buchholz said, everything flexes, and the setup has to give the part rigidity while it is being machined.

Then, as you remove material, the part may deform due to residual stresses from welding or casting. Though weldments and castings are normally stress relieved or heat treated before they are machined, large ones are likely to spring and twist as you remove material, said Bob Price, regional sales manager at SNK America, Inc. in Elk Grove, Ill. After taking the rough cut, let the workpiece loose and reset it, he said. Then, take another cut before the finish cut, for three passes: rough, semi and finish.

Another factor small-parts shops are not accustomed to worrying about is thermal expansion. "Temperature can make a huge difference on a 3, 4 or 5-meter part," said Price, you have to let the part reach room temperature before setting up the job and starting to machine.



# how it works

You can calculate the effect of thermal expansion. For example, a change in temperature of 20 F could change the length of a 10-foot (3-meter) steel part by about an eighth of an inch.

Because of these factors and the variety of work, you will seldom make more than a couple of the same large parts. Machine operators and programmers need a high level of skill and experience.

The work is always different, there's more to the setup, and operators have to adjust the machine a lot, said Gary Samms, plant manager at Galaxy Tool Corporation, Winfield, Kan. "They need to know what's happening, why it happens and how to adjust."

Measuring large and irregularly shaped parts can present quite a challenge, too. "A lot of inspection is done on the machine," said Price. There, you can use a probe in the spindle to locate surfaces and features. For off-machine inspection, large coordinate measuring machines (CMMs) are available, and the latest types of laser systems can take care of measuring very large parts to high precision.

## "Big" sets a shop apart from competitors

A wide variety of industries need large machined parts, for example: semiconductor manufacturing, wind power, construction and agricultural equipment, machine tools, aerospace, stamping dies, plastic molds, power generation, food processing, paper manufacturing, oil drilling and chemical processing.

"For small machine shops competing on a \$10 product, it's a price game," Buchholz said. "It's hard to have a value sell on a small piece — you have to do better than the guy down the street, and make it for \$9."

What is the price for large parts? There is a big range, of course, Buchholz said, but Quickmill customers might be looking at making parts in the \$10,000 to \$50,000 range.

Being competitive in the large parts market depends on factors such as machine capacity and proximity to customers. Not every shop has the machines to produce parts that are meters long and weigh tons. And very large parts are so expensive to ship, that a local shop can have a definite competitive edge when quoting parts, Buchholz said. Shipping very large parts to a relatively nearby customer might cost \$3000 to \$5000, he estimated, while shipping the same part 500 or 1000 miles might be \$25,000 to \$30,000. These are parts



The hold-down system allows rotation of this hollow cylindrical workpiece at Gilchrist Metal Fabricating Company.

that need a boom crane to load them on a special trailer and then require oversize permits so they can be transported over the road.

## Gilchrist Metal Fabricating Company: Moving into machining

Gilchrist Metal Fabricating in Hudson, N.H., has made a significant investment in machining equipment for large parts, said Jack Gilchrist, company president. Several machining centers from Mori Seiki and other manufacturers, and a large Toshiba horizontal boring/milling machine make completely machined parts or put the finishing touches on weldments.

"The 'chip equipment' was purchased to support the fab,"



said Gilchrist. "We're a medium-gauge fabrication house. The parts can mostly be loaded with a fork truck. No [parts for] tanks or trucks — or computer chassis, either," he said. The company works mostly with 1/16" to 2" thick stock. We combine fabrication and machining, which is not usually done.

In a separate building, two Quickmill gantry-style machining centers were hard at work on a recent Tuesday morning. One had a 5-by-27-foot bed and was machining slots into a long aluminum pipe. The other had an 8-foot diameter disk

Machinist Dana Hamlin clears chips from the large disk he is machining on a Quickmill gantry-type machining center at Gilchrist Metal Fabricating Company.



mounted on its 8-by-15-foot bed and was drilling, milling and chamfering a lot of holes in it.

Machinist Austin Hamlin was cutting a series of length-wise slots in the pipe on the larger Quickmill. The pipe, perhaps 20 feet long and a foot in diameter, was mounted on a series of rollers and held down with strapping secured by hydraulic jacks. The end nearest the machine console was attached to a pipe rotation device, turned by hand and equipped with an encoder, which fed the change in angle to the control. When a row of slots was finished, the jacks were released and the pipe rotated to the position for the next row. In order to check the dimensions of one of the slots, Hamlin had to climb up on the bed of the machine.

The shop has been working on a series of similar workpieces made from lengths of aluminum or steel pipe, in sizes up to 75 feet long, the heaviest weighing over 10 tons. For a part longer than the machine bed, 25 feet of the piece are machined, then it is moved, probed and properly aligned, and the next 25 feet are machined.

Each of these pipe-based workpieces has dozens of slots cut into it and hundreds of tapped quarter-inch holes. Most of the holes are drilled and tapped on the machining center.

### Unusual material

Machinist, Dana Hamlin, Austin's father, was operating the other Quickmill. The disk he was machining, he said, was a combination of a mild steel base about an inch thick, with a layer of stainless steel bonded to it. The stainless steel was on top as he machined the part, and he was using feeds and speeds appropriate for the stainless steel.

The two materials had been bonded together by a process called explosive bonding, he explained. The company that bonded the part places a sheet of stainless steel on top of a thicker sheet of mild steel, and applies a layer of explosive. Then the assemblage is buried in the ground and the explosive is detonated. The shock wave from the explosion forces the top layer into contact with the base layer at such high pressure that the two materials form an inseparable bond.

The disk will be a "tube sheet" for a boiler or similar application. Tubes will be welded into the dozens of holes he was machining.

Not far from the very large machines was a very small machine. Welder/fabricator Wayne Bryant was using a portable lathe to finish the ends of a segment of aluminum pipe. This is

# how it works



Welder/fabricator Wayne Bryant uses a portable lathe to finish the end of a segment of pipe at Gilchrist Metal Fabricating Company.

much simpler than mounting the part on a conventional lathe, Gilchrist said. The portable lathe clamps inside the pipe and then rotates a cutting tool along the end of the pipe. This was a new tool for the shop and provided a simple, effective, inexpensive way to get the job done.

## Different world

Working big means expensive equipment, handling and set-up challenges, and even shipping subtleties. It also means a shop may be able to distinguish itself from competitors and branch out into whole new markets. The cost of entry into the world of big can be significant, but enterprising shops are finding that the return on that investment can make the effort worthwhile.



## Contributors to this article:

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SNK America, Inc. – [www.snkamerica.com](http://www.snkamerica.com)

## The Machines

The very large milling machines and machining centers use a double-column structure that carries the spindle, and straddles the table. Movement in the X direction is provided either by the table moving, or the spindle structure moving. So there are two types of machines: one where the structure holding the spindle is fixed and the table moves (often called a bridge-type machine), and the other, where a table may be fixed and the spindle structure moves (often called a gantry-type machine.) The structure holding the spindle is called a bridge, and sometimes a gantry. The terms bridge and gantry are sometimes used interchangeably, and many machines are called “bridge/gantry type.”



The Quickmill Eliminator G168-395-24 gantry-type machining center has a table 168" wide and 385" long.

(Photo courtesy of Quickmill Inc.)

## For more information on:

### Large coordinate measuring machines (CMMs)

Brown & Sharpe: [www.brownandsharpe.com](http://www.brownandsharpe.com)

Mitutoyo: [www.mitutoyo.com](http://www.mitutoyo.com)

### Laser tracker measurement systems

Faro USA: [www.faro.com](http://www.faro.com)

Automated Precision, Inc.: [www.apisensor.com](http://www.apisensor.com)

### Explosive bonding

High Energy Metals: [www.highenergymetals.com](http://www.highenergymetals.com)

Dynamic Metals Corp.: [www.dynamicmaterials.com](http://www.dynamicmaterials.com)

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THE FOLLOWING ARE COMPANIES WHO HAVE  
GIVEN INFORMATION ON MULTI-SPINDLE /  
ROTARY TRANSFER MACHINES.

# product focus

Over the last five years, high-precision, high-volume parts production is increasingly being handled by multi-spindle CNC machines which offer the advantages of quick cycle times, the precision of a single spindle turning center and rapid changeover to handle a wide range of parts. Olaf Tessarzyk, managing partner of ZPS America LLC says “in the past, transfer machines were an acceptable way to produce parts in large volumes, but today the need is for much greater processing flexibility and faster changeover. The multi-spindle CNC approach provides this flexibility for volume parts, enabling the user to operate lean and avoid the need to inventory finished parts.”



## ZPS

ZPS America's new MORI-SAY TMZ 642 CNC includes a double Siemens CNC and offers a nearly unlimited number of CNC axes. Standard features of the 642 include six independently driven CNC spindles, six independent compound slides (X and Z), six independent tool carriers with driven tools, three backworking tool carriers (two driven), and standard presettable VDI tooling. Each of its six spindles is linked by a composite shaft to its own motor located away from the spindle drum, which employs a Hirth coupling. This makes it unnecessary to reverse-

index the drum at the end of each 360 degree cycle, connect and disconnect the motors to the spindles with each indexing, cool the drum to dissipate the heat generated by the spindles, or supply power to the spindles through rotating, slip-ring connectors. The mechanical stability of the machine is thus assured without the use of refrigerant or spindle compensation.

For more information, please contact ZPS America LLC at 317-452-4030 or visit [www.zpsamerica.com](http://www.zpsamerica.com).



## Stama

The new STAMA MC 531/TWIN<sup>2</sup> is a four-spindle, CNC vertical machining center for medium sized parts with 4 x 33 kW spindle drives and 4 x 35 Nm spindle torque. 12,000 and 15,000 rpm spindles on 200 mm centers afford users a generous work area of 250 mm x 360 mm x 360 mm in XYZ. The machine features standard 4x14 or 4x30 HSK-A63 tool



changers and allowable 250 mm tool lengths with a 2.6 chip-to-chip time. The sturdy trunnion and base construction of this 9200 kg floor weight machine provide a shop with reliable, high-speed 3-, 4- and 5-axis productivity in four-up mode. Ideal for mid-to-high production runs this configuration results in substantial reductions in setup time and per piece cost.

For more information, please contact STAMA America at 630-233-8101 or visit [www.stama-america.com](http://www.stama-america.com).



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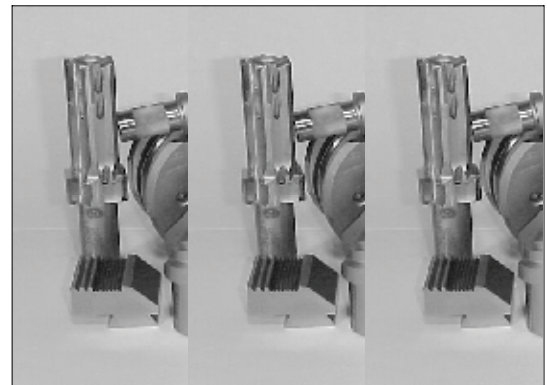
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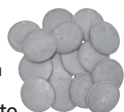


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For more information, please contact Schütte MSA, LLC at 517-782-3600 or visit [www.schutteusa.com](http://www.schutteusa.com).

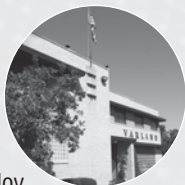


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# product focus



## Index

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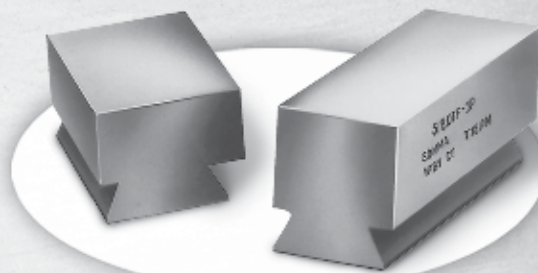
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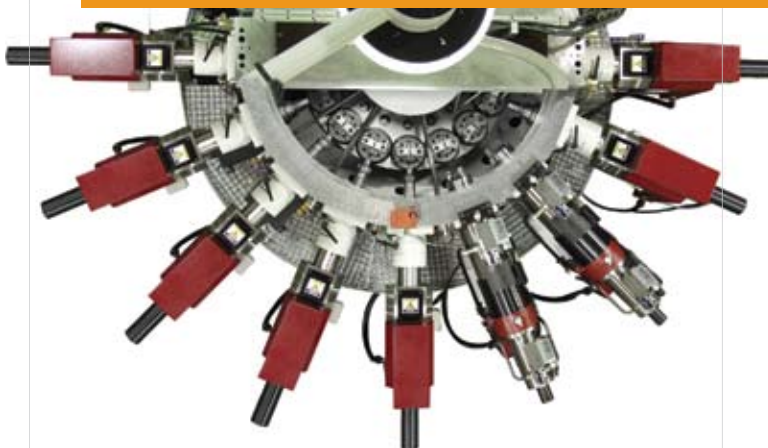
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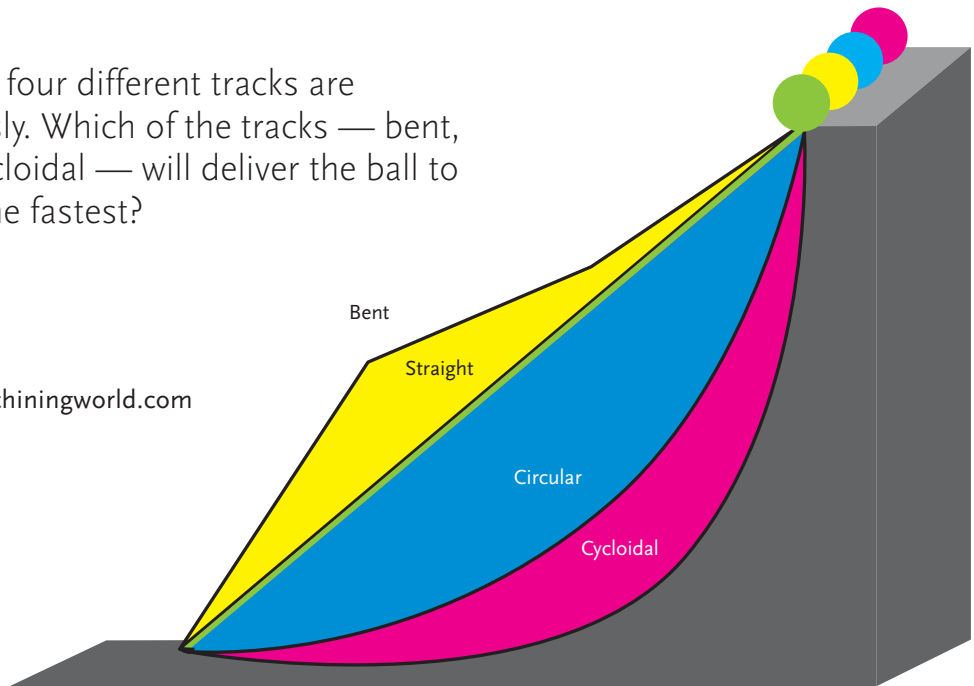
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Y	I	R	E	H	C	N	A	M
N	C	M	A	I	Y	H	R	E
H	A	E	R	N	M	C	I	Y
R	H	Y	N	E	A	M	C	I
I	M	A	C	R	H	E	Y	N
C	E	N	M	Y	I	A	H	R

## Who machined the right answer?

**Dan Sites** of Rickson Truck Wheels in Hunt Valley, MD; **Mark J. Brown** of Wagle Tool Company in Dyersville, IA; **Jeff Young** of Component Tool in Crete, IL

# postings



Noteable and newsworthy  
information and events for  
the month of December

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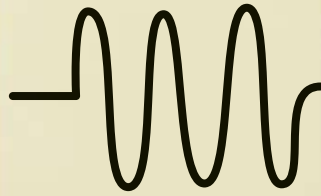
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December  
2nd

Schaumburg  
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Introduction  
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December  
9th - 13th

[www.vibinst.org/vcal.htm](http://www.vibinst.org/vcal.htm)

San Antonio,  
Texas

## International Conference on Machine Learning and Applications

La Jolla, San Diego, CA

[www.icmla-conference.org/icmla08/](http://www.icmla-conference.org/icmla08/)

December  
11th thru  
the 13th

## Performance Racing Industry Show

Orlando, FL



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[www.performance-racing.com](http://www.performance-racing.com)

## Automotive Manufacturing Solutions

AMS

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[www.sme.org](http://www.sme.org)

## Happy Birthday Woody Allen



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December  
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- Continuous output: 1-200 cycles/minute with .2 to 3.0 drops per cycle
- Continuous spray
- For metal cutting, Machining & stamping
- For plastic or wood machining and cutting
- For in-die lubrication
- For chain lubrication



### uni-MAX<sup>®</sup> Serv-O-Spray

- Intermittent: Manual to 200 cycles/minute
- Precise metering of liquids: .2 to 3.0 drop per injection cycle
- Individually controlled meters (1-50)
- Special seals for exotic fluids
- For supplemental and spot lubrication
- For in-die lubrication



### uni-MAX<sup>®</sup> Single Line Systems

- Lower cost alternative to Coolubricator
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## SAW BLADE LUBRICATION — Uni-MAX W/BAT NOZZLE



### Uni-MAX 3 outlet "BAT" Nozzle

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**Outfit or Retrofit your saws** with the latest lubrication technology - designed to increase blade life, reduce fluid consumption, produce dry, easily recycled chips, and maximize sawing productivity.

**Coolube 2210 is a premium quality** vegetable based metalcutting lubricant. It is formulated to work with non-ferrous metals.

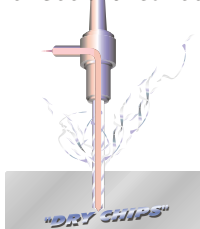
**Coolube 2210EP** is specifically formulated to provide superior performance on all ferrous metals.

**Coolube 2210/2210EP lubricants** are ideally applied with uni-MAX precise fluid applicators. Coolube 2210 is a polar lubricant and is most effective when applied sparingly. If it is applied correctly and the proper amounts are dispensed, Coolube 2210 will yield the lowest net manufacturing cost of any fluid. Cost savings will be realized through longer tool life, increased productivity, lower shop maintenance cost, clean chips, clean parts and clean machines.



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- Improved housekeeping
- No recycling or costly disposal of coolants
- Coolant plus air cools tooling and removes chips
- Lubricants cling to cutting surface reducing heat generation
- Lubricants lubricate the flutes, holes, and chips, improving hole quality

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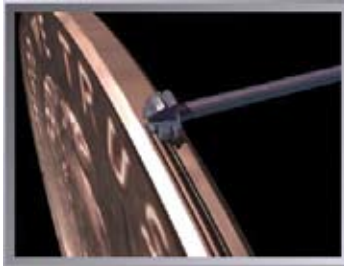
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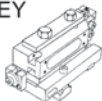
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# afterthought

## My bucket list

After getting within the diameter of a stent of death over the Labor Day weekend I've done a lot of thinking about why I survived and what I want to do with the time allotted to me.

I didn't see the recent Jack Nicholson, Morgan Freeman flick, *The Bucket List*, but I have my own list of things I want to do.

One of the great loves of my life is going to Farmers Markets. I love the smells, the color, the earthy men and women selling their apples, tomatoes and chestnuts. I've loved markets since I was a kid and I treasure them more every year. The Ferry Building in San Francisco, Pikes Market in Seattle, the Shuk in Tel Aviv, Paris markets in the late summer are all places I want to revisit. I saw a documentary on Farmers Markets and one featured was Hilo, Hawaii, where they sell coconuts picked fresh on the day of the market. That would definitely be a cool place to visit.

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But aside from going to green markets I have very little wanderlust. I've traveled extensively throughout the years and my personal odometer is in the seven digits. As Indiana Jones said, "it's not the years, it's the mileage."

My primary bucket list is amazingly local. The things that I truly love are as close as a game of catch. I want to put on a mitt and throw a baseball to my adult children Sarah, Ari and Noah. Sarah has the best arm of the three of them. I made it a point to teach her how to throw "like a boy" when she was 8 or 9 years old and she still has a cannon, even if she's occasionally wild.

Another wish is to shoot the perfect basketball free throw. I used to have a life goal of hitting 65 straight free throws on my 65th birthday. Now my bucket list entry is just shooting them — pure — perfect rotation, arching over the front rim, hearing the swish or the clank — and feeling that pimpled leather ball rolling cleanly off my fingertips. Perfection is the myth of youth.

My bucket list is so mundane yet hopelessly romantic. I want to take tea with my wife, Risa, on weekdays and weekends. I want to steal a long sip from her Frappuccino at Starbucks during an afternoon coffee break. I want to hold hands with her on long walks around the neighborhood we've enjoyed together for 30 years.

My bucket list includes my work. I certainly want to make more big deals, but I really want to write better articles. I want to take the time to do the quality pieces I feel I haven't done yet. I know my best work has yet to be written. The Pulitzer worthy articles are in the bucket.

My bucket list has another entry. I really want to cultivate more friends. One of the great things about almost dying is that I got to experience an "it's a wonderful life" moment. I saw that I had an impact on a lot of lives, and I want to expand on that. I have this sense that I survived for a reason, and I don't think it is to make more money or buy more toys.

My bucket list is all about connecting with people, listening, giving, being a human being.

I imagine my bucket is way more than half full, but who really knows. As I approach 2009 with anticipation and trepidation I am excited because the Cubs *will* win the next World Series and I'll be there rooting for them. My bucket is big and it has room for some big hopes.

Lloyd Graff




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Front Tool	5
Back Tool(Driven)	4(2)
Off-Center(Driven)	2(2)
Cross Tool(Driven)	4(4)
Power	Main 5.5/7.5kW Sub 2.2/5.5kW
Weight	4,050kg
Dimension (LxWxH)	2,720 x 1,304 x 1,775mm



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