

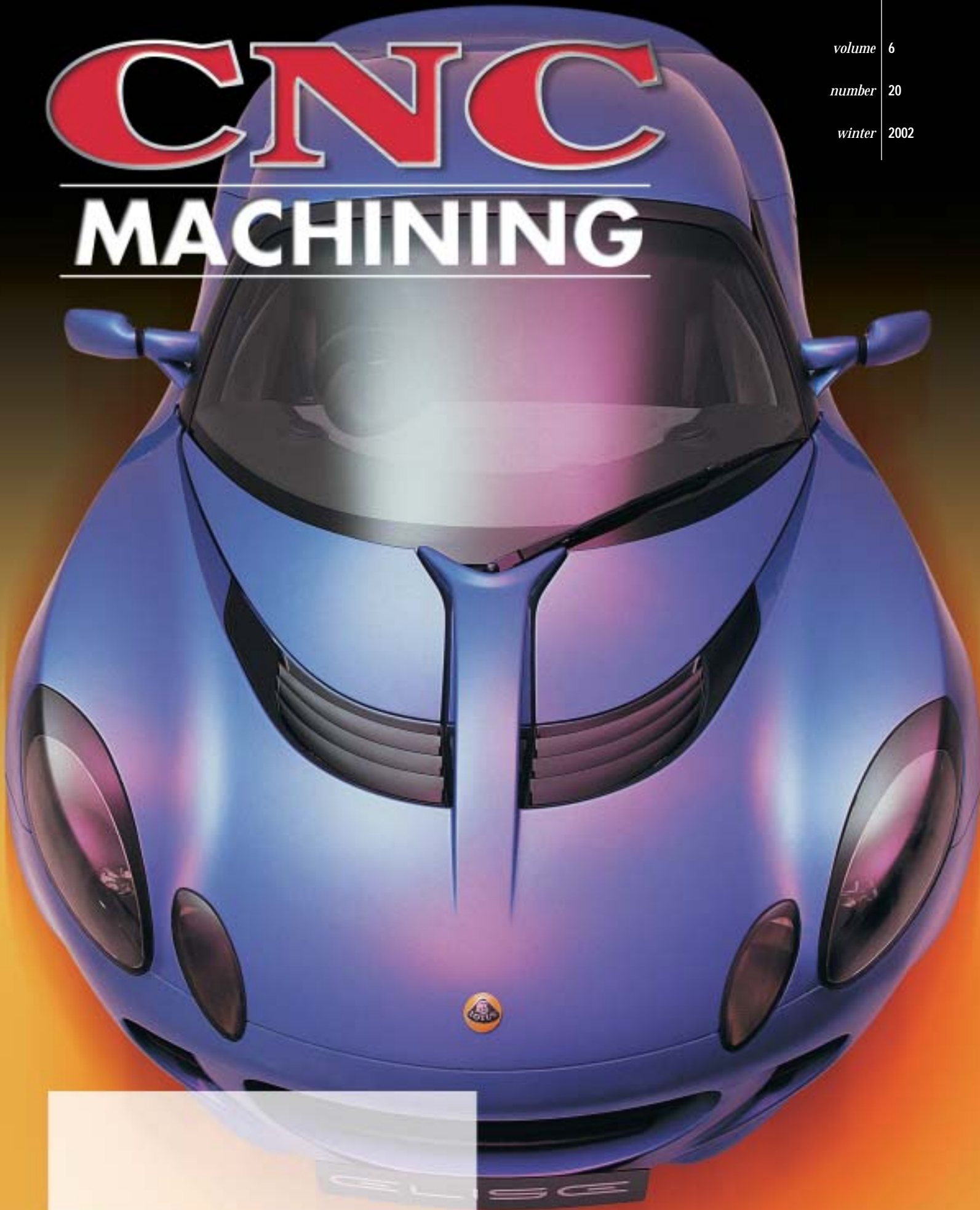
# CNC

# MACHINING

volume 6

number 20

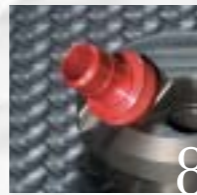
winter 2002



# CNC MACHINING

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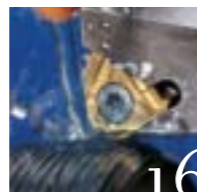
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**W**OW! Another year has gone by. It's amazing how that works. You just make it through one, and another is there to take its place. Sometimes that's a good thing. Each new year brings with it a chance to wipe the slate clean and start afresh . . . to set new goals, and re-evaluate the old . . . to seek out and explore new worlds . . . to boldly go where no man has gone before – sorry, got a bit carried away there.

But really, that's what success is all about: seeking out new worlds and boldly going where no man, no woman, no company, has gone before. Be it creating new products, finding new markets, developing new technologies, discovering new processes or purchasing new equipment, doing something new – *anything* new – is necessary to keep up in today's ever-changing world.

True, it can be risky; but, nothing ventured, nothing gained, as they say. After all, what's the worst that can happen? The "something new" doesn't work, and you have to go back to the old way of doing things. But you already know how to do that. On the other hand, what's the best that can happen? If the "something new" works, you just might tap into a gold mine of success.

For this issue of *CNC Machining* – which is our twentieth, by the way – we visited some companies that have chosen to try something new or do something differently – and they've been quite successful.

Our cover story is out of the U.K., where a company called Titan Motorsports has taken a successful business manufacturing performance parts for the automotive aftermarket and parlayed it into a position as a first-tier supplier for Lotus Motorcars.

Along similar lines here in the States, we visited a former Haas employee who gave up the security of full-time employment to start his own job shop. In just a few years, he has gone from taking contract jobs just to get by, to machining aftermarket performance products for another company, to manufacturing and selling his own line of automotive performance parts.

Also in this issue is a story out of Vietnam, where a small facility near Hanoi is manufacturing components for artificial legs. Underwritten by the Prosthetics Outreach Foundation of Seattle, this facility is the result of one man's new challenge to provide prosthetic care to amputees in developing countries.

You'll also find a piece on selecting the right coolant for your application; the Race Report, with news of the latest team to enter the NASCAR Busch series; and details about the winners of our Rotary Application Contest.

As always, there's much more, but as you read this issue, keep this in mind: It's another year; try something new. You might be surprised by the results.

In the meantime, sit back, relax and enjoy!

### ON THE COVER



The Lotus Elise features steering rack assemblies made by Titan Motorsport.

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### THE MASTHEAD

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# Haas Achieves ISO 9001 Certification

Ten years ago, back in 1991, we at Haas recognized that, in order to ramp up production to meet the current demand, and continue to improve our quality, we would need a process to manage our company.

At the time, a number of companies and/or consultants were offering to help us set up a TQM (total quality management) system. After reviewing the programs they were offering, I found them so similar to programs I had worked with at previous companies – they were one-size-fits-all type of programs – that I was very concerned they would hinder our ability to grow as rapidly as the market was demanding, and wouldn't allow us the freedom to change as quickly as necessary. At the time, the company was doubling in size every year.

We embarked on a process to improve quality throughout our organization, with a focus on improving both products and processes. We were looking for consistency, not restrictions. It seemed to me that most prescribed TQM programs set up barriers to change – not intentionally, but that was the net effect on the average employee. So, we developed our own system. Our mantra was: "If it ain't broke, make it better."

As the years flew by, we continued to grow. New employees were instilled with our philosophy from their first day of employment. Personnel who came from organizations where "We can't, because . . ." was standard speak began saying "We can, we must." As a new



organization, we had the opportunity to start out with an attitude of making things better every day. When asked how we were able to grow and improve our products so rapidly, Gene Haas once replied: "We don't have anyone here who says no, or tells us we can't."

We stayed away from the standard industry buzzwords: Quality Initiative, Continuous Improvement, etc., and lived and breathed "Let's make it better." This grew into "Let's make it bigger, better, faster, cheaper." Our "system" grew with us, and became so much a part of the "culture" that it was not something we talked about as a program, it was just the way we were – and still are.

At the beginning of 2001, we decided to apply for ISO 9001 certification. We put together an ISO steering committee headed by George

Zicker, our QA Manager, and composed of volunteers from every department. This group began cautiously preparing us for the inevitable registration audit. I say cautiously, because the committee was warned not to change the system if it required changing the culture. They could tweak the system to make it a little more formal and understandable to outsiders, but they could not change our culture. To help us learn what was expected to achieve ISO 9001 certification, we *did* hire an outside consultant, Mr. Phil Brooks. He won the job because he did not want to change us, just to direct our people to meet ISO expectations.

Last November we did it! We were certified as an ISO 9001:2000 company on our first attempt. The audit went better – and faster – than the auditors expected. They made a list of "observations," but there were no show stoppers. The auditors had more good things to say about Haas and our people than they had observations.

Haas would like to thank Phil, and all the volunteer members of the steering committee – George Zicker, Joe McKenna, Pam Ramsey, Angel Guerra, Jason Bruce, Byron Jacomo, Tom Church, Megan Lee, Michael Smith, Sharon Garcia, Dave Pieper, Jeff Connelly, Mark Brown, Nick Rocksvold, Maurilio Felix, Jeff Dadigan, James Gillespie, James Hensley and Barbara Clark – for all their efforts in leading us through the ISO process, while still keeping up their full workload.

We've proved once again what can be accomplished with our "can do" spirit. 📷

**ISO 9001 registration assures that quality systems have been implemented – in accordance with standards set forth by the International Organization for Standardization – in all product development, production, shipping and support operations. ISO 9001:2000 is the most current version of this standard for quality management, quality assurance and continuous improvement; it has been adopted by much of the global business community.**

## Think Smaller . . . and Expect More for Less. One day. Five machines. Forty locations.

Last November, Haas Factory Outlets across North America synchronized their watches and opened their showrooms to host a "Mini Machines and More" demo day. This one-day event gave customers around the U.S. a chance to see the new Haas "Mini Series" machines in action. The stars of the show – the Mini Mill, Super Mini Mill, SL-10 lathe, Mini Lathe and Toolroom Mill – all offer full CNC capabilities, with a small footprint and a very affordable price.

By all accounts, the event was a tremendous success. Not only could customers study the machines in operation, but each HFO had applications



personnel on hand to answer questions and provide solutions to their manufacturing needs. "We were really surprised with the number of people who came in, and the questions they asked about the Mini line of machines," said one HFO staffer. "It was a great way to show what these machines can do."

For many, the demo day was the first opportunity to see the new Toolroom Mill in operation. Base priced less than \$20,000 (U.S.), the Toolroom Mill combines the simplicity of a manual mill with the power and flexibility of the easy-to-use Haas CNC system. 📷

## Yes, It Rains in Southern California

"What do you mean it's going to rain tomorrow!?" A month of planning had to be changed in a day to accommodate the weather forecast as Haas Automation prepared for an open house last fall. The rain came as scheduled on Tuesday, October 30, and so did the visitors – more than 400 in all.



At the open house, themed "A Tribute to American Motorsports," visitors got to tour the newly expanded manufacturing facility, watch machine demos and see exotic cars on display. The full line of Haas machines in the Demo Room was operated by the Applications department. Visitors took guided tours

on the observation deck, from which they could view the machine shop and the assembly area. Staff members also guided floor tours of all three buildings by golf cart, allowing guests to get an up-close look at Haas operations. The newest expansion has brought the plant to more than 820,000 square feet – a good thing for the open house, since much of the event was originally scheduled to be held outdoors. Haas staff made room in the new machine storage area for exhibits.

After the tours, visitors were treated to a Santa Maria style barbeque and a chance to talk with one of the 13 vendors on hand, including Esprit/DP Technology, Renishaw, Parlec, Valenite, and Marposs. Also on display were a wide variety of motorsports vehicles, from racing teams such as Hendrick Motorsports, PacWest Racing, AAR All American Racers and Lirones Motorsports. The Battle Bots – as seen on TV! – gave demonstrations, and guests experienced virtual racing from Desktop Simulators. 📷

## Haas Helps Human-Powered Submarine

Haas Automation is always looking for ways to help customers improve speed and performance. And for years, Haas has sponsored racing teams attempting to set new records. Now Haas is going underwater to help engineering students set a world record with a human-powered submarine. The company is sponsoring a team from the University of California at San Diego by machining the mold for the fiberglass hull.

It all started when Cameron Murphy called up his uncle, Sheldon Khougaz, manufacturing engineering manager, and asked, "Do you have a big machine?" He had definitely called the right place. Sheldon guided the effort as the Applications department used a SolidWorks model of the submarine hull to program a VR-11. It then took a week on the five-axis machine to mill out the

Please see SUBMARINE page 39

Another year of racing is behind us – and what a year it was for Haas-sponsored teams. The final moments of 2001 found racing teams striving to be the best, with many reaching their goals by capturing titles, winning races and earning end-of-the-year awards. The 2001 race season included many firsts, as veteran and rookie drivers won their first races, while others returned to the summit of racing's elite, including NASCAR championships in Winston Cup and Craftsman Truck Series.



Gordon built an insurmountable lead late in the season and held off second-place points finisher Tony Stewart. Gordon joins elite company as one of only three drivers with four championships, behind Dale Earnhardt and Richard Petty, each with seven titles.

"I'm just blown away," said Gordon, who finished sixth at the Napa 500 in Atlanta. "This is our fourth time doing this, and it seems like the first time all over again. Each one gets sweeter than the last."

Fellow Hendrick

racing team members, Jerry Nadeau and Terry Labonte, concluded the year with strong finishes. Nadeau finished fourth at the Napa 500 after running out of gas on the final lap while in the lead. "I expected to win," Nadeau said. "We had a fast car and good pit stops. It's too bad, we just ran out of fuel. I'm not sure why. We should've gotten better fuel mileage than that." Nadeau finished 10th at the UAW-GM Quality 500 at Loews Motor Speedway, and then improved with a fifth place at the PopSecret Microwave Popcorn 400 at North Carolina Speedway. Labonte

placed 13th at the EA Sports 500 in October, and 11th at the Pennzoil Freedom 400 on the track at Homestead-Miami Speedway in November. Nadeau and Labonte closed out the 2001 season in 17th and 23rd positions, respectively.

Driver Ricky Craven and PPI Motorsports team owner Cal Wells each earned their first NASCAR Winston Cup victory at Martinsville Speedway, Virginia, in October. Craven led early in the race, but fell all the way to 15th position before coming back. Craven took the lead for the final time on lap 473, but had to hold off a charging Dale Jarrett.

"Here we are. We won at Martinsville, one of the toughest tracks on the entire circuit. I want to thank Dale Jarrett for being such an awesome gentleman. I found comfort knowing he was in my mirror. I knew he would not rough me up," said Craven from Victory Lane. Craven finished 21st in the final Winston Cup point standings with 3,379 points.

NASCAR photos courtesy Hendrick Motorsports



### NASCAR Craftsman Truck Series

Hendrick Motorsports driver Jack Sprague (24) collected his third Truck Series championship in November, capping off a season that included four victories and 15 top-5 finishes. Sprague became the only driver in the seven-year history of the series to win the championship three times. The 2001 championship goes along with titles Sprague won in 1997 and 1999.

"We had an awesome truck, and once we figured out the mechanical gremlins that were bothering us the first half of the season, we had a great second half. A lot of great things have happened to me over the past seven years, and I've got a lot of records in this series," said Sprague, who holds the career earnings record and the mark of competing in all 170 series races. Teammate Ricky Hendrick finished in sixth place in the final point standings. Sprague and Hendrick will be racing in the NASCAR Busch series in 2002.

PacWest Racing's Scott Dixon, right, finished a successful first year in CART by finishing 8th in the points and winning Rookie of the Year.

A joyous Jack Sprague, below, talks with the press after clinching his third championship in the Craftsman Truck Series. Sprague moves to the NASCAR Busch Series for 2002.



### CART

Pac West Racing's Scott Dixon (18) finished a successful first year, with the Jim Trueman Rookie of the Year Award and an eighth place finish in the CART FedEx Championship Series points standings. "One of my goals heading into the season was to win Rookie of the Year, and the accomplishment is a testament to all the hard work we've put in since the end of 2000," said Dixon. Despite a crash in the final race of the year, Dixon topped everyone in laps completed (2,521 out of 2,610 laps) for an outstanding 96.6%.

"This year has been a big learning experience for me, and I couldn't have done it without the help of a great teammate in Mauricio Gugelmin, and an excellent crew both at the track and back in the shop," said Dixon. Six top-5 finishes, 11 top-10 finishes and a victory at Nazareth propelled Dixon to the Rookie of the Year Award. "I've accomplished this goal. Now I'll set my sights even higher for 2002 and the Vanderbilt Cup," said Dixon. The CART 2002 season begins in Monterrey, Mexico, in March, before coming to the streets of Long Beach in April.

Please see RACE REPORT page 38

While everyone else is downsizing, we keep rolling out new productions.

# Coming Attraction.

Our New Mini FMS  
2-station, 4-pallet  
Vertical Machining Center



**HAAS DESIGNED**  
Performance Features for the Way You Work.  
Configure It With Special Options

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HAAS AUTOMATION, INC., PRESENTS THE ALL-NEW VF-3 MINI FMS, FEATURING DUAL PALLET CHANGERS, 40"x20"x25" (xyz) TRAVELS, FOUR PALLETS AND A 40-TOOL SIDE-MOUNT TOOL CHANGER. THIS CONFIGURATION CAN NET 4 TIMES THE OUTPUT BY ALLOWING MULTIPLE JOBS TO BE RUN AT THE SAME TIME.

THE PALLET SYSTEM ALLOWS QUICK SETUPS FOR REPEATED SHORT RUNS, AND NON-MACHINING TASKS LIKE FIXTURE SETUPS AND PART CHANGEOVERS CAN BE PERFORMED OFF-LINE WHILE PARTS ON ANOTHER PALLET ARE BEING MACHINED.

Machine shown with CE guarding • Prices and specifications subject to change without notice • All prices in U.S. dollars

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genuine USA

# What Goes Around Comes Around Rotary Contest Winners Collect Cash

One of the fastest and most economical ways to boost production on a machining center is to add a rotary table. Depending on the specific application, a rotary table can make complex geometries possible, reduce the number of setups for multi-sided parts, shorten cycle times and cut the number of tool changes.

Haas Automation recently held a Rotary Application Contest to discover some of the unique, real-world applications that customers have found for Haas rotary tables and indexers. After close examination of the applications, two were selected for recognition and awarded cash prizes. The first-place winner was awarded \$1,000 and the runner-up received \$500.

## FIRST-PLACE WINNER

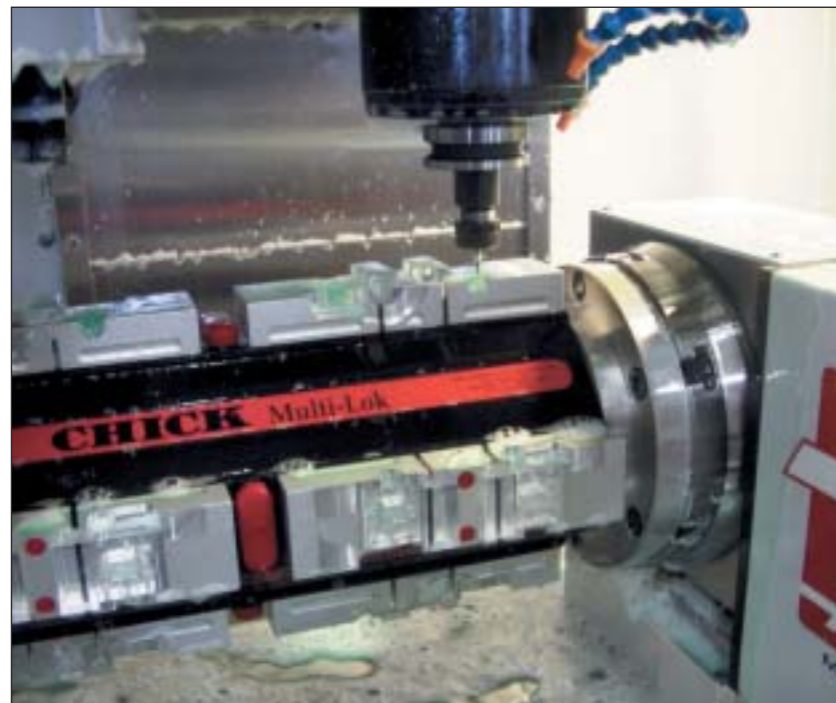
Nicholson Precision Instruments, Inc., of Gaithersburg, Maryland, specializes in machining acrylics and plastics for the biotech industry. NPI, which has been in business for more than 30 years, uses an HRT 210 rotary table on a Haas VF-0E to work on 16 pieces of 1.45" x 1.85" x 0.68" cast acrylic.

"Our problem was that our customer required deliveries of 100 pieces per week," explains Thomas Gabsa, NPI's manager. "The original three operations took up too much operator time. They needed to be set up on three separate machines so the setup would not have to be broken down every week."

The old setup took 15 minutes and 29 tool changes per part. It took more than 4 hours and a total of 464 tool changes to run 16 pieces. By using the rotary table in combination with a double vise tombstone, however, NPI was able to run all 16 parts in one operation.

"The run time is now 130 minutes," says Gabsa. "That's 8.125 minutes per part, and just 20 tool changes for all 16 pieces." This new setup, which has been in use for the past year, is saving NPI nearly 7 minutes per part. And with a 3,000-piece order, "the savings have

already paid for this whole setup, and then some," says Gabsa. In addition to cost savings, the rotary table has also freed up the operator, who can now run another machine during the 130 minutes it takes to mill those 16 pieces.



This tombstone and HRT 210 rotary table setup reduced tool changes from 464 to 20 for a run of 16 parts, while cutting cycle time nearly in half.

## RUNNER-UP

Spelunkers are investigating some of the deepest underwater caves around the world using parts manufactured by Triad EDM, Inc. of Dunnellon, Florida. The central Florida shop manufactures parts for the Halcyon rebreather unit, which recirculates air, increasing dive time and making extended diving safe.

Triad manufactures 26 different parts for the underwater breathing unit, which is then assembled at the nearby Halcyon factory. The top cover presented a unique challenge that was overcome with the use of an HRT 160 rotary table.

"Our obstacle was to cost-effectively drill two holes at 45 degrees that are 120 degrees apart," explains Sam Hytovick, vice president of Triad. So Triad built a 45-degree sub-base block on which to mount the HRT 160. "The 45-degree block allowed us to machine in one setup and save at least 20 minutes per part," says Hytovick.

Starting with a black Delrin plastic bar turned first on an SL-20, the 7" diameter by 4" top cover is then milled on a VF-2. The five-tool program begins with an insertable face mill removing bulk material from surfaces. The second




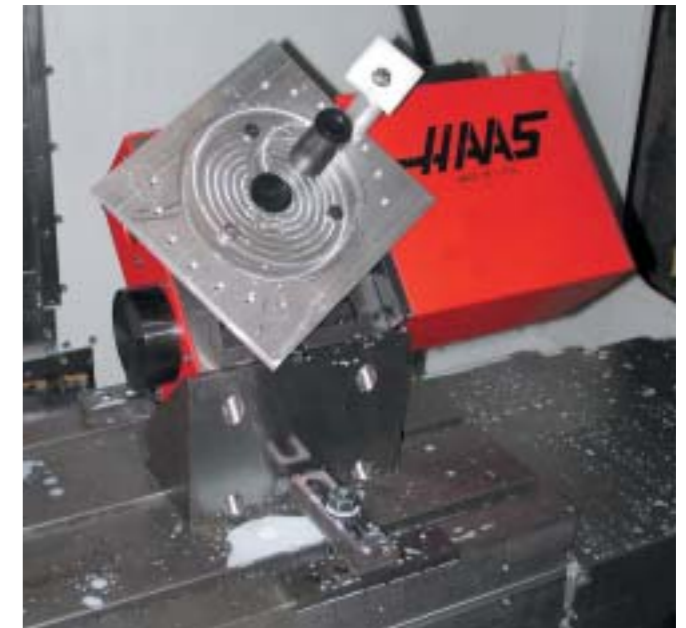
The top cover for an underwater breathing unit, above, is machined in a single setup on a Haas VF-2 using an HRT 160 rotary table mounted on an angle block. The setup is pictured below.

tool drills holes to the inner cavities. The third tool, a 1.00" diameter endmill, removes additional material, removes four sharp corners and circular interpolates a bore diameter for thread milling. The fourth tool chamfers additional sharp edges and circular interpolates a chamfer for an o-ring seal at the top of the thread. Finally, an insertable thread mill completes a helical

interpolation of M36 x 2.00 thread.

The underwater rebreather unit is used in conjunction with a smaller dive tank to extend dive time. The exhaled air is recycled through the unit, allowing dive times of up to six hours.

Look for in-depth stories about Nicholson Precision Instruments and Triad EDM in future issues of *CNC Machining*. 



# A Leg to Stand On

**D**r. Ernest Burgess was, by any measure, a remarkable man. In March 2000, just six months before Dr. Burgess' death at age 89, Senator Robert Kerrey submitted a resolution commending him for "service to the nation and the international community." Senator Kerrey noted, "As a veteran and amputee, I live with the daily reminder of the costs of war. . . . Dr. Burgess pioneered new surgical techniques that allow amputees to move with more comfort and mobility. . . . On a personal note, my passion for running and my ability to ski and play golf and walk these halls could not be a reality without the advances spearheaded by Dr. Burgess."

Ernest Burgess grew up in rural Utah, profoundly influenced by an aunt who was a practicing physician during an era when women were still struggling for the right to vote. He graduated from Columbia Medical School in 1937 and served in the Pacific theater during World War II. It was this first-hand experience with land mine casualties that kindled his life-long interest in improving the lives of amputees. After a post-war stint as Chief of Surgery at a Honolulu hospital, he settled into an orthopedic surgery practice in Seattle.

Among other achievements, Dr. Burgess developed new amputation techniques that improved the health of the residual limb. He worked closely with his patients, many of them veterans who wanted to be as active post-amputation as they had been beforehand. "I want to run, I want to climb, I want to do everything I used to do." Ernest Burgess listened.

Once he had met the need for better surgical techniques, Dr. Burgess turned his attention to improving prosthetics. He told the *Mercer Island Reporter* in 1999, "Prosthetics were primitive. [There was] no standardization or research. . . . they were cumbersome and very uncomfortable." In 1964, at the request of the Veterans Administration, he established the Prosthetics Research Study. PRS would become a world-renowned center for postoperative amputee care and the development of

lightweight, high-tech artificial limbs. One result of PRS research is a process known as AFMA: automated fabrication of mobility aids. Computer software called Seattle ShapeMaker®, which allows technicians to sculpt artificial limb sockets for a perfect individual fit, is an essential part of the AFMA process. Another PRS design is the Seattle Foot®, the first manufactured one to work like a real foot, thanks to an internal cantilever spring.

The AFMA process begins with a fairly low-tech step: making a plaster cast of the amputee's stump. Low tech ends there, however. The casting is placed in a three-dimensional digitizer, a device that scans and measures the surface shape and volume of the cast. The digitizer data is then imported into a computer running Seattle ShapeMaker. The prosthetist, who has done a clinical evaluation of the patient before making the plaster cast, modifies the limb socket for a precise individual fit. Next, the modifications are transmitted to a carving machine, which shapes a positive socket mold from a block of plaster. A sheet of 5-mm polypropylene is put into an oven, and a thermoplastic socket is vacuum-formed over the mold.



photo courtesy Mercer Island Reporter

Dr. Burgess in 1999, holding an artificial limb that was hand-made by a Vietnamese woman from plastic, bamboo, cloth string, rubber bands, nails and wire.

The excess plastic is trimmed off the socket, and then modular limb components – a knee joint if the amputation was above the knee, the shank or pylon, the foot – and a cosmetic cover are added, and the limb is ready to be fitted to the amputee. The whole process takes several hours, and the prosthesis will last at least three years. Components such as the foot or knee joint may wear out before then, but those are easily replaced.

In 1989, ready for a new challenge, Dr. Burgess founded the Prosthetics Outreach Foundation (POF), based in

Seattle, to provide prosthetic care to amputees in developing countries. Given his years of work with veterans and his humanitarian need to heal more than just physical wounds, Vietnam seemed the obvious place to begin.

Although it's difficult to get reliable estimates in a country as rural as Vietnam, the most recent data suggest there are more than 100,000 amputees in that country, many of them children and most the victims of motor vehicle accidents or land mines. Rehabilitation services are scarce, and most people can't afford

to pay for them – the average family income in rural areas is between \$200 and \$300 annually. Bartering is, naturally, a vital aspect of economic life, but acquiring an artificial limb requires cash. Even an inexpensive prosthesis costs \$30 to \$50, and growing children need a new one at least every 12 to 18 months.

Conventional prostheses aren't very well suited for a country like Vietnam, with a farm-based economy and a tropical climate. Made from wood and resin, these limbs are stiff and heavy, and while they allow

Story Linda Dorr Photos Prosthetics Outreach Foundation



Thi Trang, three years old in this picture, was two when she lost her right leg in a train accident. She's now 11, and the Prosthetics Outreach Center in Hanoi continues to provide treatment and new prostheses as she grows.



amputees to walk, they don't provide enough mobility for working in the fields. The life span of these devices is only about 18 months, and they usually require a fair amount of maintenance during that time. And in a developing country, fabrication of conventional limbs may take several days, simply because the work is done manually.

The Prosthetics Outreach Center (POC) in Hanoi opened in 1991. In addition to providing clinical services, prostheses are made on-site, using the AFMA system described above. In its first 18 months, the center produced 1,100 limbs – the same time span saw the production of only 150 conventional limbs. POC provides artificial limbs and

rehabilitation services free of charge if families can't afford to pay for them. According to Raymond Pye, Technical Director of POF in Seattle and a frequent visitor to Vietnam, the biggest problem the foundation has is getting the word out to the more remote villages. Disabled children in these villages may rarely leave their homes. Their parents may not even take them to local clinics when a visiting nurse is available,

believing that the cost of care is simply beyond the family's ability to pay.

The Vietnamese staff of POC makes monthly trips to the rural provinces from the Chinese border to Da Nang. A prosthetic fitting can be completed in two visits: at the first, the patient is evaluated and a plaster cast of the residual limb is made. After the prosthesis is manufactured in Hanoi, the POC team returns to fit the limb to the patient; adjustments can be made using portable tools. Up to 60 amputees may be fitted during a 2- to 3-day outreach visit. In response to the needs of Vietnamese patients, POF designed a new foot, made from vulcanized rubber, for farmers who work in muddy rice paddies. It's a very durable item. "Prosthetic feet manufactured in the U.S. or Europe rarely last eighteen

months in tropical climates without replacement of some component," reports Ray. The cost in Vietnam of a foot made in the U.S. ranges from \$250 to \$400 – and "they don't last as long as the vulcanized rubber one made in Vietnam" for \$3.50.

Since 1998, POF has also helped to underwrite a medical manufacturing facility in Ba Vi (a village about 50 km west of Hanoi) that produces, among other things, limb components such as knee joints and adapters. All the products manufactured at Ba Vi are used in rehab devices. One focus of POF's work at Ba Vi is to use local resources as much as possible, in an effort to eventually make the facility self-sustaining. The factory has been in existence since the early 1970s; during the Cold War, it was funded by the East German government.

Having modernized the design of artificial limbs, POF opened the

newly renovated Ba Vi Orthopedic Technology Center in March 1998 and began the work of modernizing the manufacturing processes as well. The Ba Vi machine shop was, of course, a manual shop. "The machines were all hand-me-downs from the Germans," according to mechanical engineer Alan Aulie. Ray Pye adds, "There hadn't been any changes in about 25 years."

Ray knew they needed CNC machines, and at first he thought a knee mill with a relatively inexpensive add-on CNC package might be the way to go. He soon changed his mind. In the course of his research, he asked his friend Alan Aulie, founder and president of Aulie Devices, Inc., for advice. Aulie Devices is an R&D firm that has patented half a dozen varieties of artificial knee and other prosthetic devices, using a Haas VF-0 vertical mill and an HRT 160 rotary table. Aulie worked with Dr. Burgess for several



One of the reasons POF chose Haas is the user-friendliness of the control. The programmer at Ba Vi, who had no experience with computers or CNC machines, taught himself to program the Haas machines within a year.



years before he started his own company, and he has maintained ties with POF – the Ba Vi facility uses an Aulie knee design, modified for Vietnamese use. “I told him they needed a machining center identical to the one used for product design,” says Aulie. “I design right at the machine. I’ve done complex projects that were designed entirely on the Haas control, and then I sent the finished part to a CAD/CAM place to produce the drawings. This is my R&D fast track.” He also knew the Haas control would be easy for the Ba Vi machinists to learn – “there’s a shortcut on the learning curve” – plus “they’re immune to crashes. It’s really hard to break a Haas. You can make a mistake and it won’t hurt the machine.”

The Haas distributors in the U.S. and in Asia have been extremely helpful, according to Ray Pye. The Seattle Haas Factory Outlet, A Division of Selway Machine Tool Company, “spent a fair amount of time” finding POF a couple of Haas machines the foundation could afford. “It was for a really good cause,” said sales engineer Todd Newhouse, “so we went looking for used machines that had low hours and had been taken care of. We found them a VF-0 first,” in November of 1999, and then in early 2000 a good used HL-1 lathe turned up. Once

the machines were shipped to Ba Vi and installed, the Haas distributor in Thailand, Machine Tech Company Ltd. of Bangkok, has provided service. “They have been remarkable,” says Ray. “Incredibly responsive – they’re about an hour and a half away [by air], and they have been really helpful.” The only problems with the machines have been “a couple of little hiccups with the power – the electrical supply in developing countries isn’t very reliable,” Ray observed. The programmer at Ba Vi knew nothing about CNC or computers when the Haas machines arrived. He taught himself to program within a year, using Haas training manuals and some help from the Machine Tech service technician who installed a new control board.

One of the parts cut by the VF-0 at Ba Vi is the prosthetic knee joint. “A knee joint lasts 12 to 18 months,” Ray says. “It’s incredible, the amount of stress we put on our knees. It’s amazing that the ones we’re born with can last 80 years or more! Anyway – we’re working on extending the life span of these things. The bushings wear out; the limiting factor is the material. We’re trying to develop a bushing that will last three years – and keep the cost of the knee component under \$20. That’s the tough part.” The Haas machines are also used to cut modular adapters,

which connect the pylon or leg shaft to the socket and to the foot.

The factory at Ba Vi provides products for government medical clinics as well, including several hospitals that have orthopedic workshops. The HL-1 is also used for wheelchair parts, and by next year the Haas machines will be making parts for orthotic devices – knee and foot braces for patients with disabilities such as cerebral palsy or drop foot. These products are still in the development stage.

Prosthetics Outreach Foundation, says Alan Aulie, is different from most charitable organizations in that “they don’t just go in and fix something and then go home.” POF provides local jobs, and Vietnamese people with disabilities are being assisted by their fellow citizens, not by foreign aid workers. The goal is to eventually make both the clinic in Hanoi and the factory in Ba Vi self-sustaining.

POF is funded primarily through private donations. The cost of fitting a prosthesis in Vietnam, including components, medical evaluation and follow-up, and administrative expenses, is about \$300. 📷

Call 206-726-1636, e-mail [pofsea@aol.com](mailto:pofsea@aol.com) or visit [www.pofsea.org](http://www.pofsea.org)



Ray Pye, above, knew the Ba Vi shop needed CNC machines, but didn’t know much about them at first. POF’s knee designer steered him in the right direction. Below, Mr. Thang, the engineer who programs the Haas machines at Ba Vi, uses a caliper to check the specs on a leg component.

The Vietnamese staff of POC makes monthly trips to the rural provinces from the Chinese border to Da Nang. A prosthetic fitting can be completed in two visits: at the first, the patient is evaluated and a plaster cast of the residual limb is made.



# Are You Using the Right Cutting Fluid?

Finding the right performance characteristics for metalcutting coolants and lubricants is tough enough . . . now add the issues of safety and disposal.

Ninety-seven percent of the energy consumed in metalcutting is converted into heat. This heat can damage both the cutting tool and the workpiece if the right kind of cooling doesn't take place at the cutting edge.

An overheated tool loses its hardness, which shortens tool life, and an overheated workpiece can lose its dimensional integrity. The solution is to continuously cool the cutting tool and workpiece at the cutting zone. So, what's the best way to do it?

That depends on a variety of factors, including:

- the material being machined
- the type of metalcutting operation
- machining speed
- accurate delivery of coolant to the cutting zone
- the type of cutting tool being used

These factors are all pertinent to making an informed selection of cutting fluid. To provide a good starting point, cutting fluid manufacturers have divided workpiece materials into three distinct categories:

- carbon, alloy and tool steels
- stainless steels, titanium and high-temperature alloys
- grey and ductile cast irons, aluminum and non-ferrous materials

For each of these material categories, there are three basic classifications of cutting fluid that can be applied. Depending on the specifics of the application, any one of the three could be used successfully. The three classifications are:

**Semi-Synthetics** – These consist of natural and synthetic emulsifiers, small oil droplets and clear



emulsions. They offer good corrosion protection, lubrication and tolerance to contamination, with better stability and sump life than soluble-oil cutting fluids. Semi-synthetic cutting fluids work with both ferrous and non-ferrous materials, and help maintain a clean work environment.

**Synthetics** – These are oil-free solutions of polymers and other organic and inorganic materials mixed with water. Because there is no oil, they have extremely long life. Synthetic cutting fluids run extremely cleanly, resist foaming and are very compatible with hard water. They also work well at higher speeds, particularly on ferrous materials. The only limitation is that, in some situations, there may be some buildup on certain areas of the machine, and staining is possible on non-ferrous materials.

**Soluble Oils** – These consist of oil with emulsifiers that allow the oil to disperse in water. They provide heavy-duty lubricity in a wide range of applications.

Soluble oils are particularly suited for use in deep-hole or gun-drilling applications on non-ferrous materials.

A fourth classification includes what are called specialty fluids, cleaners and additives. These are basically lubricity enhancers, cleaners, tapping compounds, fingerprint neutralizers, and additives. In some cases, they can help prevent corrosion and provide a solid lubricant between the chip and the cutting tool. A specialty fluid can be applied either to the cutting fluid mix or, in its undiluted form, directly to the

workpiece before or during the machining operation.

## SELECTION

The majority of coolant and lubricant manufacturers provide a similar range of semi-synthetic, synthetic and soluble-oil products. To simplify the selection of the right cutting fluid, it helps to list the specific criteria that best fit your particular manufacturing environment.

With these criteria, most cutting fluid manufacturers can match the most appropriate coolant or lubricant product

to the job. Each product typically has a detailed description of formulation, features and intended applications, and most are available in either 5 gallon (19 liter) pails, 55 gallon (205 liter) drums or 300 gallon (1,135 liter) bulk containers.

## TROUBLESHOOTING

A variety of problems or situations can occur – with respect to cutting fluid performance, biostability characteristics, storage or mixing – that require certain actions to be taken or, in some cases, may require the fluid to be changed completely.

TROUBLESHOOTING GUIDE		
PROBLEM	CAUSE	SOLUTION
FOAMING	<ul style="list-style-type: none"> <li>Concentration too high</li> <li>Machine cleaner in sump</li> <li>Mechanical (crack in hose, sump level too low, crack in pump, pump pressure too high)</li> <li>Soft water</li> <li>High tramp oil content</li> </ul>	<ul style="list-style-type: none"> <li>Adjust concentration</li> <li>Check pH</li> <li>Allow machine to run; cleaner should dissipate</li> <li>Check machinery and repair as required</li> <li>Sample water, treat if necessary</li> <li>Skim off oil</li> <li>Check hydraulic lines for leaks, and repair as required</li> </ul>
RUSTING	<ul style="list-style-type: none"> <li>Concentration too low</li> <li>Poor mixing (soluble oil)</li> <li>High tramp oil content</li> </ul>	<ul style="list-style-type: none"> <li>Adjust concentration</li> <li>Add concentrate to water</li> <li>Skim off oil</li> <li>Check hydraulic lines for leaks, and repair as required</li> </ul>
POOR TOOL LIFE	<ul style="list-style-type: none"> <li>Concentration too low</li> <li>Wrong product being used</li> <li>Large amounts of biocide added to sump or system</li> <li>High tramp oil content</li> </ul>	<ul style="list-style-type: none"> <li>Adjust concentration</li> <li>Contact cutting fluid representative for further instructions</li> <li>Skim off oil</li> <li>Check hydraulic lines for leaks, and repair as required</li> </ul>
ODOR	<ul style="list-style-type: none"> <li>Low concentration</li> <li>Low pH</li> <li>High tramp oil content</li> <li>Contamination</li> </ul>	<ul style="list-style-type: none"> <li>Adjust concentration</li> <li>Check pH, then contact cutting fluid representative for further instructions</li> <li>Skim off oil</li> <li>Check hydraulic lines for leaks, and repair as required</li> <li>Submit cutting fluid sample to a cutting fluid representative</li> </ul>
SKIN IRRITATION	<ul style="list-style-type: none"> <li>High concentration</li> <li>High pH</li> <li>High tramp oil content</li> <li>Dirty shop cloths</li> <li>Allergies</li> <li>Out-of-shop influences</li> </ul>	<ul style="list-style-type: none"> <li>Adjust concentration</li> <li>Check pH, then contact cutting fluid representative for further instructions</li> <li>Skim off oil</li> <li>Check hydraulic lines for leaks, and repair as required</li> <li>Use only clean cloths</li> <li>Have workers checked for allergies – contact physician if necessary</li> </ul>
RESIDUE IN MACHINE	<ul style="list-style-type: none"> <li>High concentration</li> <li>High tramp oil content</li> <li>Incorrect mixing</li> <li>High misting operations</li> </ul>	<ul style="list-style-type: none"> <li>Adjust concentration</li> <li>Skim off oil</li> <li>Check hydraulic lines for leaks, and repair as required</li> <li>Submit cutting fluid sample to a cutting fluid representative</li> <li>Check ventilation system</li> <li>Adjust coolant nozzle(s)</li> </ul>

Story  
Carl  
Kuchler

Photos  
Courtesy  
Valenite



### CARE & HANDLING OF CUTTING FLUIDS

Proper care and handling of cutting fluids involves several important factors, including storage, mixing, bacteria control, tramp oil control, application to the cutting zone and proper disposal.

#### STORAGE

- Store fluid in clean, sealable drums that are clearly marked, protected from frost or sunlight and preferably indoors.
- Have adequate ventilation and fire extinguishers in the storage area.
- Clean up spills with inert, mineral-absorbent materials.
- Keep strong oxidizing agents out of the storage area.
- Do not use sawdust or oily cotton waste for spill control.

### MIXING WATER-SOLUBLE CONCENTRATES

- The oil concentrate must be added to the water (remember: oil = Oil In Last).
- Measure the water into a clean tank.
- Measure the required volume of concentrate and gradually pour it into the water.
- Keep mixing while pouring.
- Slow-speed mechanical agitation is preferred.

Note: It is very important to measure the concentration after mixing. This can be accomplished by using a refractometer or drop kits, or by sending a sample to a test facility. All cutting fluid manufacturers provide a concentration ratio for each fluid that can be checked with a refractometer. Remember, a refractometer reading and a concentration are different. If a fluid is mixed at a 21:1 ratio, you will have a 5% dilution. However, the refractometer reading would not be 5%, because there are normally other additives in the mixture.

### WATER HARDNESS

Water hardness is a measure of the amount of inorganic salts (calcium and magnesium) in the water. Hard water reacts with soaps to produce scum, and with cutting fluids to break down the emulsion. It is recommended that hard water be treated.

Water Hardness Chart		
Water Type	Parts Per Million	Grains (1gr=17ppm)
Soft	0-50	0-3
Moderately Soft	50-100	3-6
Slightly Hard	100-150	6-9
Moderately Hard	150-200	9-12
Hard	200-300	12-18
Very Hard	Over 300	Over 18

### BACTERIA CONTROL

Bacteria feed on the fatty components, corrosion inhibitors and other elements of the emulsion. This causes a chemical change that makes the emulsion more acidic. The low-oxygen emulsions produce foul sulfide

odors. To reduce bacteria growth, use an aerator, keep the sump clean, maintain proper concentration, remove surface tramp oil and add biocides. The most important of these is maintaining proper concentration.

### CONTROL OF TRAMP OIL

Keeping your coolant clean requires regular checks and proper maintenance of your machinery. To avoid spillage, use care when lubricating or filling up hydraulic systems, and consider using an oil wheel and/or belt skimmer to thoroughly remove tramp oil.

### DEBRIS AND DIRT

The basic sieves and traps in machine tools are usually sufficient to filter out grime. Larger swarf will be separated out by gravity. Special systems may be required for cleaning grinding debris, dirt and suspended materials from high-finish applications.

### DELIVERY TO THE CUTTING ZONE

Proper fluid flow is 2.5 to 3 gallons per minute per horsepower. Potential trouble spots include the state of the cutting fluid, flow rate and whether it is being accurately delivered to the cutting zone. Incorrect or invert mixing and rich concentrations will also cause problems. Machining speed and the size and condition of the sump will have an effect as well.

Cutting fluid manufacturers can only suggest how to care for and maintain coolants. What works in one plant may not always work in another. The end-user must realize that manufacturers can only institute certain controls on the chemistry of a coolant. The conditions under which it is used are the most important factors influencing a coolant.

### RECYCLING OF METALWORKING FLUIDS

Many manufacturing operations today are finding it advantageous and



cost-effective to clean and reuse cutting fluids by either mechanical or filtration units. Systems can be set up to mechanically break out tramp oils from the coolant simply by letting them sit still for a period of time. Another process involves the use of a coalescing unit that mechanically extends the surface area of the used coolant to break out tramp oils. Other methods involve the use of various filtration systems.

### DISPOSING OF METALWORKING FLUIDS

Disposal issues related to used and contaminated metalworking fluids are a major concern to all of manufacturing. Most companies have an organized system in place that utilizes either a HAZMAT disposal service or an internal wastewater treatment operation. In each case, there are several important factors to

consider with regard to cutting fluid disposal.

- It is crucial to comply fully with federal, state and local regulations.
- Methods used to treat waste fluids depend on the type of product.
- With water-diluted coolants, the water (90%-95% of volume) can be removed and the remaining solids disposed of.
- Wastewater treatment is divided into three stages. The primary stage involves removing free oil (skimming) and suspended solids (filtration and settling). In the secondary stage, ultra-filtration (cross-flow to remove oil and solids) and chemical treatment (aluminum sulfate is the most common way to

separate fluids) are used. The tertiary stage employs carbon filtration and reverse osmosis for final purification.

### CONCLUSION

Selecting, using and maintaining good cutting fluids is a dynamic of manufacturing that requires constant updating in the latest techniques, product developments, current industrial trends and government regulations. Most fluid manufacturers provide training to keep customers informed. A glossary is provided below to better familiarize users with the language used by cutting fluid manufacturers. 📖

Carl Kuchler is the Technical Representative for Valenite Valcool cutting fluids, specialty fluids, cleaners, additives and fluid maintenance.



# FROM MOTOR RACING SUPERSTORE

... TO FIRST-TIER  
**Automotive  
SUPPLIER**

STORY AND SHOP PHOTOS  
BY MATT BAILEY



**T**O WEEKEND RACERS and professional teams around the world, Titan Motorsport is a motor racing industry superstore. To the world's automotive industry, it is a first-tier supplier of complex automotive systems. The gradual metamorphosis that transformed a motorsport job shop from a one-time builder of Formula Ford cars into a supplier of automotive systems owes much to the company's investment in manufacturing technology, and its high standards of quality and reliability.

Based in St. Neots, Cambridgeshire (UK), Titan's stockroom is wall-to-wall shelves, where flywheels for Minis can be found next to sumps for Caterham 7s, parts for World Rally cars and gearbox housings for the latest Le Mans machines. It seems that whatever you need, in whatever formula, Titan either has it in stock or can make it, PDQ.

"We maintain a stock of all the more common items, because enthusiasts and teams can't afford, and don't want, to wait," says Paul Littledyke, Titan's General Manager. "We've made quick response our specialty, and our reputation and business have grown. We've never advertised and yet we get orders from all four corners of the globe."

The company also holds a comprehensive stock of parts that are no longer made by the original manufacturer. "A car or an engine may have been discontinued by the original manufacturer, but that doesn't mean everyone is going to stop using it," states Littledyke. "We make parts for engines that have been out of production for a long time. If there is enough demand, if enough people are racing a particular engine or car, then we'll make the parts and hold them in stock."



part photos by Scott Rathburn



**H**ELPING TO BUILD THE COMPANY'S REPUTATION for fast turnaround and consistently high quality are the 14 Haas CNC machines – vertical machining centres and lathes – which occupy the Titan machine shop.

“The Haas machines work well for us,” states Managing Director Oz Timms. “The reason why we have 14 of them is that they offer exceptional value for the money, and Haas UK does a great job of supporting them. It's not like dealing with a big corporation. We can always talk to the right people and we get things done straight away. Despite the fact that we have so many machines, we don't have that many issues. If we do, we know that Haas UK will get them sorted.

“Originally, Titan made entire racing cars and racing engines,” says Timms. “As time has gone by, we've expanded our spares product line, and we've developed an in-house design facility, as well. Our capabilities as a supplier have grown considerably, to the point now where not only can we receive and manufacture designs for the top F1, World Rally and Le Mans teams, but we can also design, manufacture and assemble many of the components used on these vehicles.” This capability has not gone unnoticed by the automotive companies themselves, and some of this “systems” work involves high-volume production machining.

“This kind of work can tie up the Haas machines for prolonged periods,” says Littledyke. “It's had a knock-on effect with the quick turnaround jobs and, to meet our order book, we've had to work the Haas machines 24 hours a day.”

Titan tried subcontracting the quick turnaround jobs but, says Littledyke, “it caused more headaches than it cured.” The company risked letting its customers down and harming its hard-earned reputation.



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**T**ITAN MOTORSPORT HAD ARRIVED AT A FORK IN THE ROAD. "We had a simple choice," says Timms. "We could stay the same, continuing as a pure motorsport supplier, or we could recognize this as an opportunity and expand to take advantage of it."

#### TITAN AUTOMOTIVE

"We wanted to be able to say: We can design it, we can prototype it and we can manufacture to production volumes. That's what Titan Automotive is all about," says Timms. "Titan Motorsport handles the fast turnaround one-offs and batch jobs, and Titan Automotive does the production work."

Early in 2001, to move Titan Automotive up a gear, the company invested in another batch of Haas CNC machine tools: A VF-3 vertical machining centre with a Haas HRT 160-2 rotary table, and an HS-1RP horizontal machining centre. The Haas VF-3 has a 1 219 mm (48") long table and a Y travel of 508 mm (20"), making it ideal for long components. The HRT 160-2 is a compact rotary table with twin platters that allow two components to be loaded side by side.

"These latest machines," explains Littledyke, "were introduced to machine a particular job: steering rack assemblies for the Lotus Elise sports cars. We asked Haas UK to propose a solution for the steering racks on a turnkey basis."

Using Gantt charts and project management software, Haas UK began comprehensive project planning that included the scheduling of engineering resources and identifying and detailing the project costs. The HS-1RP was chosen as the basis for the project for a number of reasons, according to Haas UK Technical Director, Pat Fenn. "The HS-1RP lends itself well to this type of component. A vertical machining centre wouldn't have allowed sufficient room underneath the spindle. We

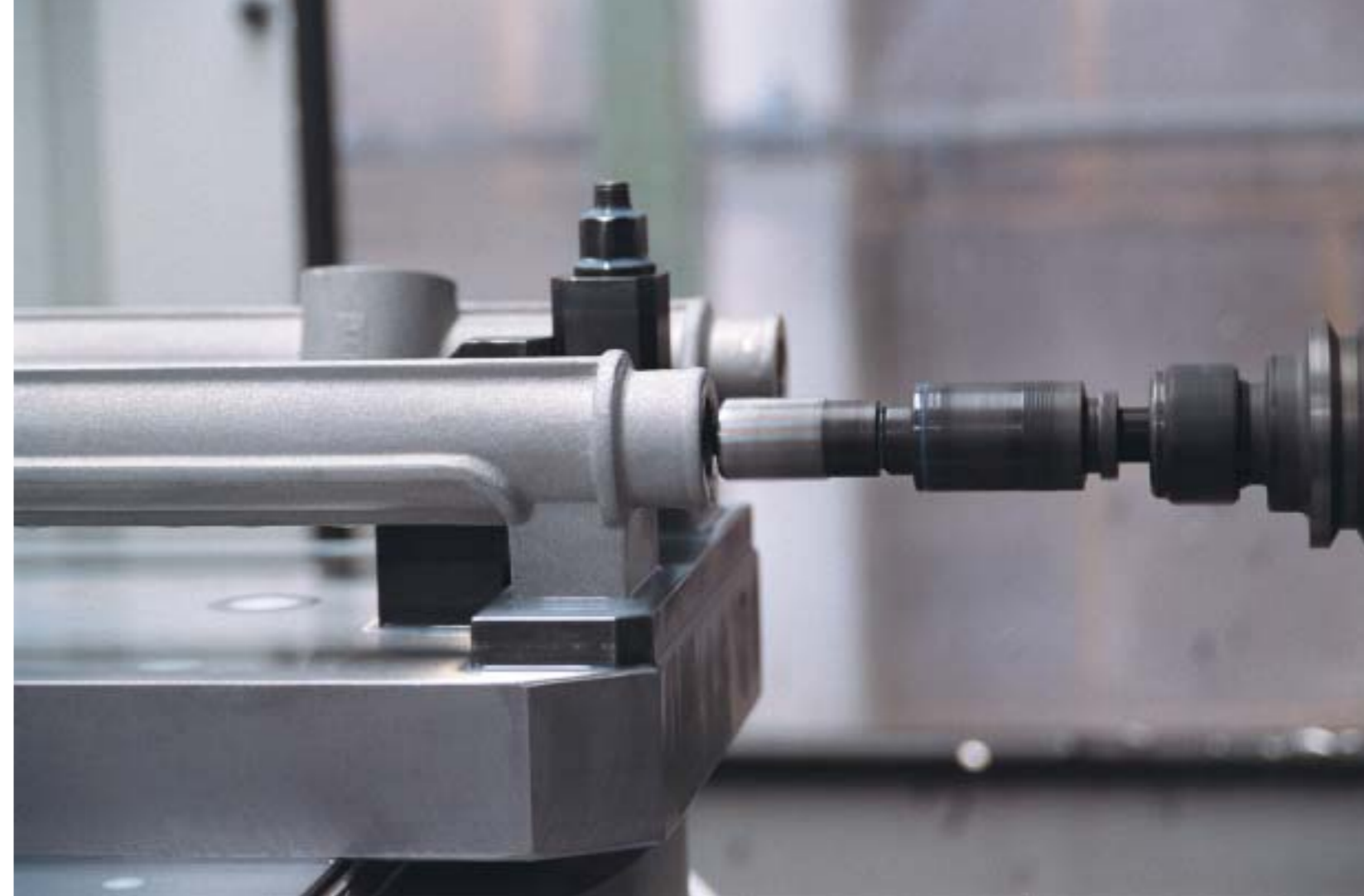
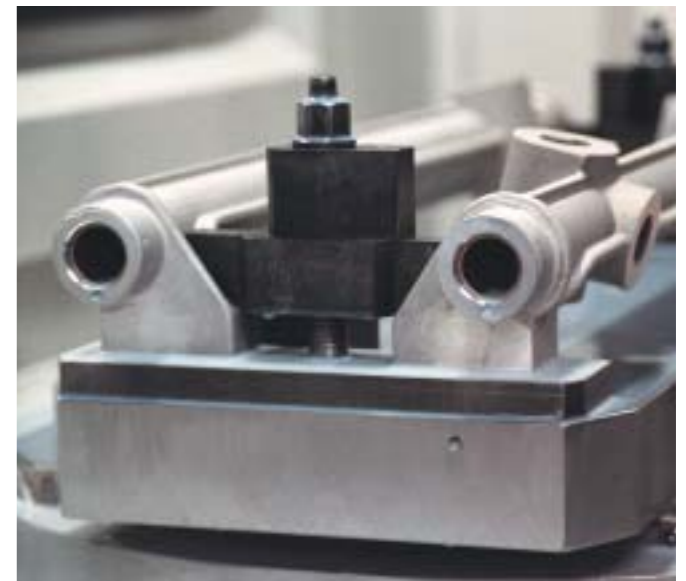


photo courtesy Lotus Group plc

once all of the **MACHINING** has been done, **TITAN BUILDS THE RACKS** and ships complete systems to the **LOTUS PRODUCTION LINE** at a rate of 600-800 a month.



used manual clamping; since the machine has twin pallets, one is in cycle whilst the other is free for unload and load.”

Once the machine and the project parameters were established, Haas UK worked closely with external suppliers to choose tooling and design the most effective fixtures. These elements were included in the overall project and a proposal was presented to Titan.

When the project was complete, the customer was invited to the Haas Technical Centre in Leicester, where the job was proven and cycle times and quality were accepted and signed off. The machine was then shipped to Titan, installed, and the whole acceptance procedure was repeated before the machine was put into production.

The raw rack castings arrive from the foundry and are loaded in pairs onto the HRT 160-2 rotary table mounted on the Haas VF-3. The castings are skimmed, and two dowel holes are drilled.

The rack castings are then moved to the HS-1RP where, again, they are loaded in pairs onto the manual clamps located on the machine’s built-in, rotary-mounted pallet. The castings are faced and the end holes are bored. A batch of castings is completed and bushes are inserted in the rack ends. Pairs of castings from the batch are then remounted on the HS-1RP and are roller burnished.

Then, it’s back to the VF-3, where finishing operations – drilling, tapping and profiling – are carried out. Once all of the machining has been done, Titan builds the racks and ships complete systems to the Lotus production line at a rate of 600-800 a month.



"Machining of the racks used to be done on two Haas VF-0Es," explains Littledyke. "Previously, a single rack would take 30 minutes on a smaller Haas vertical machining centre. We've reduced the cycle times considerably by installing the VF-3 with the twin rotary and the HS-1RP with its twin pallet changer and rotary table. But, that's exactly what automotive work of this nature is all about. Where the motorsport work is all about fast turnaround, automotive production work is all about productivity – reducing cycle times, improving the process, reducing the cost. We're under constant pressure from the client, and the Haas machines have to work very, very hard."

Titan's Haas VF-3 and HS-1RP are dedicated 90%-95% of the time to the Lotus work. "They handle the high-volume production work just as well as the 14 other Haas machines handle the quick turnaround motorsport jobs," says Littledyke. "We're delighted with the quality and the reliability." 🏎️



photo by Scott Rathburn



photo courtesy Glen Paulina ©

# Focus on Performance: A Small Shop Finds its Niche

Machine shop owners often want to produce parts of their own design, but limited runs and lack of demand often force them to bid contract jobs just to make ends meet. Fortunately for Kevin Cashman, owner of Black Diamond CNC, he is now in position to move his shop from doing work for others to manufacturing his own custom designs.

Located in Simi Valley, California, Cashman's 1,100-square-foot shop looks much like thousands of others around Southern California. "We started mostly as a job shop for random jobs," Cashman says. But there has always been a desire for more. Looking to broaden his scope, Kevin paid a visit to a former employer and asked if he could do any work for them – especially design work.

Kevin made contact with Dennis Hilliard of Central Coast Mustang, a company that specializes in aftermarket performance parts for the Ford Mustang. "I asked what he needed," relates Kevin, "and he said it would be great if he had a coil-over conversion kit for the rear of the Mustang. He said if I could design that, then he would buy it from me, and that's where the relationship got going. That was the first part I designed on my own for this business."

The coil-over conversion kit Kevin designed makes the Mustang's rear suspension adjustable for racing needs, allowing users to adjust ride height and suspension feel. The design was not only easier to install, but less expensive than other kits on the market.

Once Kevin had proven his expertise in design and manufacturing, there was more specialty work for the Mustang, and then the Dodge Neon. But things really took off with a new model coming out of Detroit. The Ford Focus was initially released in Europe in 1998, and was awarded the 1999 European Car of the Year. With its long wheelbase and high roofline, no other

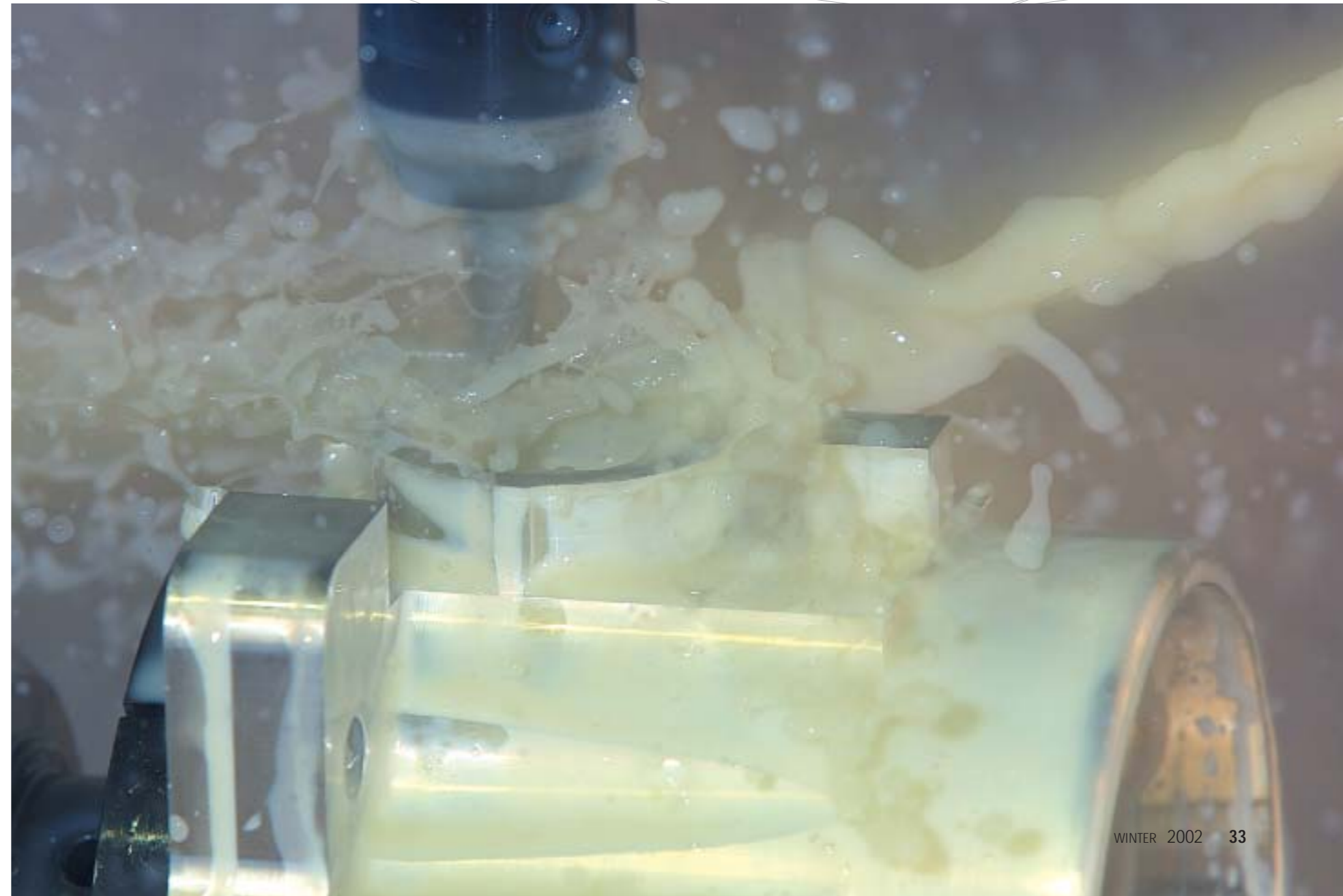
American car has the same look, making it attractive as the "hip car" to own.

Ford introduced the Focus in the United States in 1999, and it was not long before Black Diamond formed a relationship with the trendy little car. Designed for young buyers, the Focus fits perfectly into the category of sports compact car, the fastest-growing market for aftermarket accessories. With his experience in other brands, Kevin was asked to design aftermarket performance parts for the new vehicle. The throttle body for the Ford Focus is now one of Black Diamond's specialties.

"The first throttle body was a three-day project," explains Kevin. "It took a full day to design it, and about two days to machine it. It was a pretty crude prototype." But after installing it on the Focus, Kevin knew he was on the right path. "The car responds well to it," he says.

Black Diamond uses a Haas VF-0E with an HRT 210SHS rotary table to mill the throttle bodies. "The rotary table makes the throttle bodies possible. It's half the setups," says Kevin.

To make the throttle bodies, Kevin takes a 12-foot extruded bar of 6160 aluminum and cuts it into blocks with dimensions of 4" x 5" x 4". These are loaded one at a time into a vise on the mill. "We rough out the throttle body from the top down in the first operation," explains Kevin. "We finish the outside wall, we cut the taper (using a tapered endmill) and the bore, and drill the mounting holes." The part is then flipped over in the vise, and the second setup takes care of finishing the bore, cutting the outside perimeter and drilling three holes for the air bypass. The throttle body then goes onto the rotary table for the final operation, which includes milling, drilling and

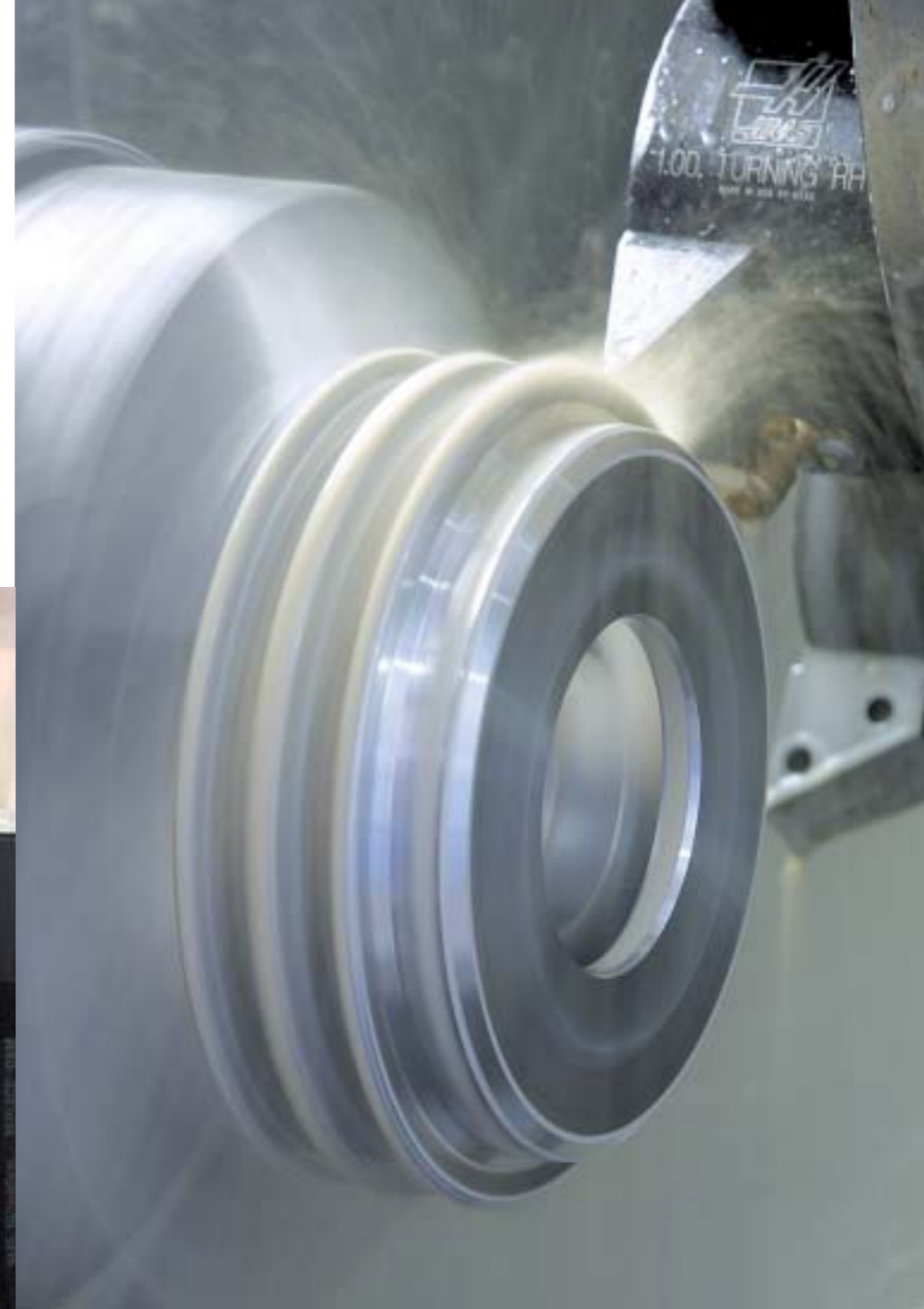


Story  
Scott  
Weersing

Photos  
Scott  
Rathburn  
&  
Scott  
Weersing



“The rotary table is invaluable for machining the throttle bodies and camshaft sprockets.”



company is so huge, the price is right and the value is there. The bang for the buck is there.”

Black Diamond also has a Haas SL-20 lathe which complements the VF-0E. “We picked up the lathe initially because we were missing work. We had to farm out the lathe work. So it was a natural progression of the company to do turning and milling.”

Even without any experience on a lathe, the Haas controls are virtually the same between the lathe and the mill, making it simple for Kevin to learn. “It’s been really easy to pick up,” he notes. “I find the Haas to be intuitive, and that’s why it is so easy to pick up. It works the way I would have it work if I designed it myself.”

Kevin likes the new user features on the SL-20, such as the clips on the enclosure for holding prints. He even took one of the extra clip holders off the lathe and put it on the mill so he could hold prints. “The little things like that go a long way,” he says. The lathe is loaded with options such as a parts catcher, a tool presetter and a bar feeder interface, but it’s the auto door that really impresses Kevin. “The auto door is really trick. At first I thought it was a fancy gimmick – ooh, ahhh, the door opens by itself – but when you run a lot of parts, it gets tiring opening and closing the door.”

The time saved with the machines is invested back into the design process as Kevin keeps improving the throttle bodies. “Every time we make one, we change it,” said Kevin. “Since it is our own design, and we are not making it off a print, we can change it constantly. We speed something up or we improve the part.”

The ease of using the Haas control, combined with the Quick Code programming system, allows Kevin to make changes right at the machine as he modifies designs. “I just add to the existing program right at the control. I’m changing it constantly, especially since I am not always working off a print.”

tapping on three sides, and finish work on all four sides of the part.

“The rotary table is invaluable for these throttle bodies,” says Kevin. “If we had to load that part three more times, we wouldn’t be able to sell it. No one would be able to make their margin of profit.”

The engraved butterfly and steel shaft for the throttle bodies are also manufactured in the shop. After machining, the bodies are sent out for color anodizing to give them that custom-part look, and then everything is assembled in-house.

Kevin also uses the HRT 210SHS to machine an adjustable camshaft sprocket for the Focus. The sprocket is first roughed with a ball endmill, then finished with a form tool. With the rotary table, cutting the 40 teeth with the formed cutter takes only six and half minutes.

“They can’t be machined any other way but on a rotary table,” says Kevin about the camshaft sprockets. “I know a person who tried to machine the same part by fixing it to the table and interpolating the shape, but the diameter ratio of the cutter necessary to do that made it impossible.”

Kevin got his start in machining at Haas Automation, where he worked in the manufacturing and applications departments. So it was natural for him to choose Haas machines when he started Black Diamond CNC.

“It was a machine that I knew,” says Kevin. “I buy Haas because the

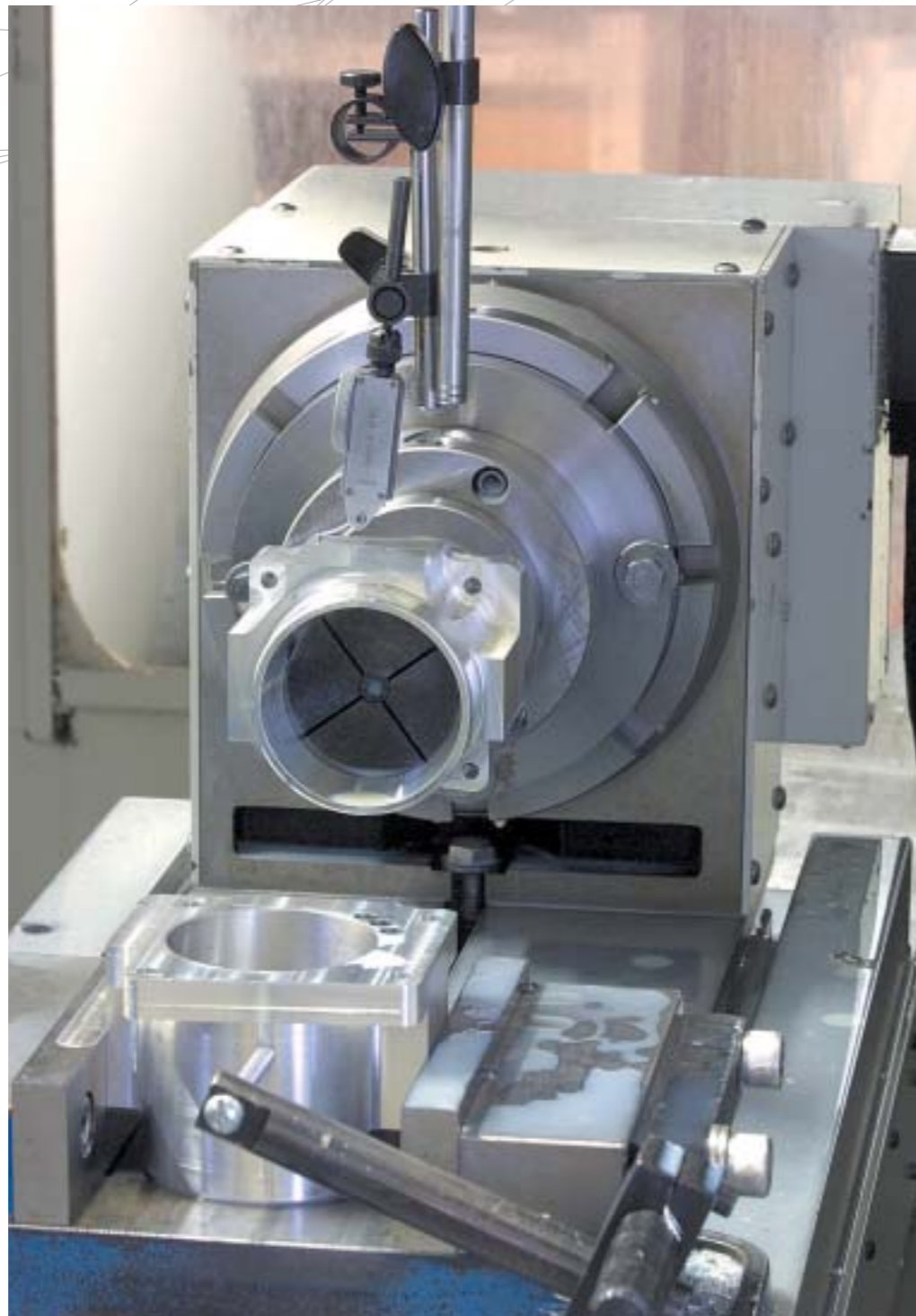




photo courtesy Randy Lorentzen ©

The coordinate rotation feature of the Haas control also allows for easy changes in design. “I’ve often started out holding the throttle bodies one way in the machine, then decided I could make a more accurate part, and worry less about tolerances, if I located it differently,” Kevin explains. “So a lot of my programs are rotated 180 degrees or something like that. I can do that right at the control without having to rewrite the entire program.”

Things were not always so easy. G code was once a foreign language for Kevin, but it has now become part of his vocabulary. So much so that he was able to help a neighboring shop. “My neighbors recently bought two Haas machines; they were coming from a PC-based, touch-screen control with lots of bells and whistles. Since I know Haas, they kept coming over and asking questions and questions. I just showed them how to use the Quick Code and better than half their questions are answered right there.”

Black Diamond CNC is looking to launch a second company, Black

Diamond Performance, in January 2002 to reflect the move to performance parts of their own design. “I would like to progress to purely manufacturing my own designs,” says Kevin. “I like closing the loop with designing it, manufacturing it and selling it.”

To help out with the design process, Kevin recently added a 2001 Ford Focus to the company’s list of equipment. “We got the car for research and development,” he says, “and to use for promotions at races.” He is quick to add, however, that he isn’t going to limit Black Diamond Performance to products for just one model of car. “I have intentionally left the word Focus out of the name so that we can branch into other vehicles. We are going where the trend is, and we’ll have to see what the next trendy car will be.”

Black Diamond currently produces throttle bodies in batches of 60, but Kevin says that number will double to build inventory for the retail business. So far, keeping up with demand has not been a problem. “We haven’t utilized multiple shifts or additional manpower, yet,” he says. But with only two

employees and two machines, it might become necessary to run two shifts or use multiple fixturing to free up an operator to run another machine. With the shift to design and an increase in production, there also may be a need for a new machine.

“As we add more products to the line,” Kevin explains, “the machines need to run more and more. Since we are constantly designing more and more parts, we would need another machine to do all the prototyping. Making the initial prototype is really time-consuming – you tie up a machine doing that – so the next machine would be a prototyping machine. We are considering a Mini Mill, because we could use it to machine the prototypes, and it is really capable of doing some production, too.”

With the growing popularity of the Ford Focus and the move to designing new performance parts, Black Diamond CNC is taking advantage of Haas machining to reach new heights. 🏠

Black Diamond CNC  
805-583-8255



“I would like to progress to purely manufacturing my own designs. I like closing the loop with designing it, manufacturing it and selling it.”

RACE REPORT continued from page 5

PacWest Racing celebrated a second Rookie of the Year Award as Indy Lights driver Dan Wheldon captured the honor while finishing second in the final points standings. Wheldon, whose victories included races at Gateway International Raceway and Road Atlanta, finished second to series champ Townsend Bell by only 0.051 seconds in the final race of the year in Fontana. Wheldon also won the Bosch Platinum+4 Speedway Challenge for earning the most points in the year's oval races. PacWest Racing's Mario Dominguez (17) finished in fourth place in the final series standings. With the Indy Lights Series ending, plans for 2002 are unknown for Wheldon and Dominguez.



photo courtesy Dan R. Boyd ©

**NHRA**

J&B Motorsports driver Todd Veney reached the semifinals of the Keystone Nationals at Maple Grove, Pennsylvania, in the NHRA Federal-Mogul Funny Car Series. After qualifying in the seventh position, Veney defeated Bobby Martin before losing to Bob Newberry in the semifinals. Veney finished the year tied for 17th place with 411 points.

**C&C Motorsports**

Troy Cline of C&C Motorsports finished fifth in the final standings of the USAC Western States Sprint Car Division. He captured a fourth-place finish in the final race of the season at Irwindale Speedway on Thanksgiving Day. In the

desert, Joe Custer and Gene Haas clinched the title in the Best in the Desert Off-Road Truck series after winning the Las Vegas 200 in December and placing second in the final race of the season. 📷

**TRADE SHOW CALENDAR**

For additional information go to [www.HaasCNC.com/news/trade\\_show.html](http://www.HaasCNC.com/news/trade_show.html)

Date	Show Name/Location	Booth #
Mar. 5-7	<b>SOUTH-TEC</b> Charlotte Convention Center, Charlotte, NC	Booth 1900
Mar. 18-21	<b>WESTEC</b> Los Angeles Convention Center, Los Angeles, CA	Booth 3229
Apr. 9-11	<b>HOUSTEX</b> George R. Brown Convention Center, Houston, TX	Booth 1101
May 21-23	<b>EASTEC</b> Eastern States Exposition Grounds, W. Springfield, MA	Booth 1420
Sept. 4-11	<b>IMTS</b> McCormick Place, Chicago, IL	Booth A8232

SUBMARINE continued from page 3

high-density foam, creating the mold for the hull of the submarine.

In July 2002, the submarine will compete in the American Society of Mechanical Engineers/IEEE Human-Powered Submarine Competition, trying to best the world record for the one-person, propeller-driven class. The current world record in this class is 6.97 knots. The sub will travel at a depth of approximately 20 feet. A scuba-equipped driver will fit inside the hull and use a bicycle-style crank to propel the submarine. During the competition, the sub is allowed 150 feet to accelerate before entering a 30-foot speed trap and passing in front of underwater video cameras. The team from UCSD has experience in setting world records. They set the speed record in the non-propeller class in the July 2000 competition with their sub named "SubSonic."

The submarine is composed of three major systems within the hull. The drive train is the system that transfers power from the driver to the propeller. The control system allows the driver to maneuver the submarine to maximize speed. The ballast system controls the buoyancy of the submarine. The UCSD team has spent the last year designing these three systems and is now into the construction phase of the project. The submarine will hopefully be ready for testing and modifications in April 2002. 📷



photo by Scott Weersing

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**Dear Applications:**

We are trying to connect our two Haas machines up to Surfcam but are experiencing problems. Our cables match your diagrams, and the Surfcam SDNC shows it is downloading, but it is not going into the machines. Can you help us out?  
Bill Schwab

**Dear Bill:**

First, are you sending programs to the memory or are you trying to DNC? If DNC is what you want, first check settings 11, 12, 13, 14 and 37, and make sure they coincide with the settings in the PC. To prevent problems with cables, it's best to use a straight-through cable with a null modem, keeping the length of the cable to less than 100 feet if possible. To receive a DNC file at the Haas, check the bit in parameter 57 called ENABLE DNC; this needs to be set to 1. Also, make sure setting 55 in the Haas is set to ON. Then press the MDI button once, then again, and the control will display "WAITING FOR DNC" at the top of the screen. At this point, you can send the DNC program from the PC.

If all you want to do is send a program to the Haas memory, first press the LIST PROGRAM button, move the cursor to ALL and then press the RECEIVE RS-232 button. The control will display "WAITING FOR DATA" at the bottom of the screen. Now send the program from the PC. Programs must start and end with a percent sign (%), to signal the beginning and the end of the file. The second line of the program must contain the program number – the letter O followed by up to five characters – without a block number.

Sincerely,  
Haas Applications



**Dear Applications:**

I have a question about entering cutter compensation on the lathe offset page. On another CNC machine, I enter the tool radius and the tip direction on the wear page, and the tip measurement is automatically entered on the geometry page. On the Haas, the wear page only lists radius, and the geometry page lists both radius and tip. Do I have to enter the radius on both pages?

Gene Calderone

**Dear Gene:**

No, the tool radius does not have to be entered on both pages. Both tool radius and tip direction are entered on the Tool Geometry page. Wear compensation is entered on the Tool Wear page only as the tool breaks down,

and is returned to zero when the tool/insert is replaced.

Sincerely,  
Haas Applications



**Dear Applications:**

If we turn our machines (a VF-2 and a VF-3) off at night, do we have to run the spindle warm-up program each morning? Also, is there a timer or some other mechanism to turn the machines on automatically at a specified time?

Doug Messersmith

**Dear Doug,**

It is recommended that you warm up the spindle each day. The warm-up program should be on the disk that came with your machine. There is also

a sleep function that will start the machine after a specified time and run a program of your choosing – a warm-up program if you desire.

If you have the function available in your machine, you will find it in the operator's manual under the M-code listings: M95, Sleep Mode.

Sleep mode is essentially a long dwell, but with power to the servo motors turned off. Sleep mode can be used when the user wants the machine to begin warming itself up early in the morning and be ready for use upon the operator's arrival.

The format of the M95 command is: M95 (hh:mm)

The comment immediately following the M95 command must contain the number of hours and minutes the machine is to sleep. For example, if the current time were 6 p.m. and the user wanted the machine to sleep until 6:30 the next morning, the command would be: M95 (12:30). Up to 99 hours can be specified, thus allowing the machine to sleep for more than 4 days. If the time is specified using an incorrect format, Alarm 324, "Delay time range error," will be generated.

When the machine enters sleep mode, it will turn off power to the servo motors and display the following message:

HAAS SLEEP MODE  
REMAINING TIME nnn MIN

The message will be displayed in a different position on the screen each second, to prevent it from being burned into one spot on the screen. When less than one minute of sleep time remains, the message will change to: REMAINING TIME nn SEC. If the user presses any key or opens the door, sleep mode will be canceled, power will be restored to the

servo motors and the active program will wait at the block following the M95 until the user presses the Cycle Start key. For the last 30 seconds of sleep time, the machine will beep and display an additional message: WAKE UP IN nn SECONDS. When the sleep time has elapsed, power will be restored to the servo motors and the active program will continue at the block following M95.

Sincerely,  
Haas Applications



**Dear Applications:**

What is the maximum speed that can be safely used in threading? I want to keep my cutting speed up, but I am concerned about running out of Z axis feedrate.

Thank you.  
Jim Jarosik

**Dear Jim:**

You can safely work at 150 inches per minute. You can determine feed per minute by multiplying rpm times feed per revolution. Let's say you want a 4-pitch thread, which would be 4 threads per inch or 0.25 per revolution. If the rpm is 200, then  $200 \times 0.25 = 50$  inches per minute.

Sincerely,  
Haas Applications



**Dear Applications:**

One of our customers wanted to perform deep rigid tapping by changing the Z value (Z = 20 mm, then 26 mm, then 31 mm) using G84. However, each time the tap penetrated in a different position it destroyed the tap. Any suggestions?

Jacob Atlas

**Dear Jacob:**

You need to enable parameter 57, bit 7, REPT RIG TAP. Set this value to 1.

This enables repeatable rigid tapping and will allow you to peck tap any hole.

Sincerely,  
Haas Applications



**Dear Applications:**

I need to DNC from my Zip™ drive. I go to LIST PROGRAM while in DNC mode and type in "ZIP," but the machine does not recognize the Zip drive. DNC is enabled in Parameter 57, and Setting 55 (ENABLE DNC FROM MDI) is also turned on. Any step-by-step advice would be helpful.

Thanks.  
Mark Dame

**Dear Mark:**

Be sure you have a disk in the Zip drive, press the LIST PROGRAM button, enter the letters ZIP in the Haas and then press the F4 key. This will switch the machine from the floppy drive to the Zip drive.

Next, you have to know the name of the program that you want to call up from the Zip drive. This will be the full program name with extension; for example, O12345.NC. For the control to recognize the file, you will have to enter the entire name: The letter O followed by five digits, a period and the letters NC.

Press the MDI button and type in the full name of the program you want from the Zip disk. Press the MDI button again; the control should display DISK READ at the bottom of the screen. When the file is ready, it will display DNC PROG READY. When the control finds the end of the file, it will display DNC END FOUND.

Press CYCLE START at any point after you see the message DNC PROG READY. The machine will operate normally.

Sincerely,  
Haas Applications



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