CNC MACHINING

VOLUME 8 NUMBER 28 WINTER 2004

IN THIS ISSUE

WINTER 2004 VOLUME 8 ISSUE 28

Get your motor runnin'
Head out on the highway
Lookin' for adventure
And whatever comes our way ...

– Steppenwolf, "Born to be Wild" – the rock anthem from the 1969 classic "Easy Rider"

The biker lifestyle: speed, danger, adventure, camaraderie, rebellion. Its origins date back to 1941, before the United States entered World War II, when a group of American flyboys volunteered to help the Chinese Air Force fight against the Japanese. Officially known as the American Volunteer Group, they soon earned the name "Flying Tigers" for their courage in battle and success against the enemy. Arvid Olson, the leader of the 3rd Squadron of the Flying Tigers, dubbed his group the "Hell's Angels," and had the name painted on all his planes.

When Olson and other veterans of the Flying Tigers returned to Southern California after the war, they found they missed the speed and danger of combat, and the excitement and adventure of flying. Motorcycles were their salvation. They donned the leather jackets, heavy boots, helmets and goggles they'd worn during the war, and headed out on the highway.

For our cover story this issue, we visited the shop of Jesse James, founder of West Coast Choppers and the outspoken host of Discovery Channel's *Monster Garage*. Stepping into West Coast Choppers is like stepping onto the pages of Hunter S. Thompson's classic biker tome *Hell's Angels: A Strange and Terrible Saga*. It has a down-and-dirty vibe that would make even the most hard-core one-percenter proud. Dig below the surface, though – beneath the bad attitude, the extensive body ink and the testosterone – and you'll find a very successful and very profitable business. The WCC showroom abounds with kinetic sculptures of gleaming chrome, polished aluminum and exotic paint – it's a veritable gallery of high-speed, high-dollar, two-wheeled works of art.

Like the choppers he creates, Jesse James is brash, brazen and in your face. It's who he is, and he makes no apologies for it . . . which made for one of the most "colorful" interviews we've had here at *CNC Machining*. Rather than edit Jesse's colorful dialogue, we've chosen to run our story uncut and uncensored (well, almost). If this offends you, please do not read the story. The rest of the magazine carries a solid G rating.

If tricked-out choppers aren't your bag, maybe a trip to Mars will catch your interest. By the time you read this, a pair of Mars Exploration Rovers should be just about ready to touch down on the surface of the red planet. If all goes well, the rovers will begin beaming images of the Martian surface back to Earth for the first time since 1997. NASA's Jet Propulsion Lab in Pasadena designed the six-wheeled vehicles, but Next Intent, a small contract-engineering firm in Central California, manufactured the wheels, suspension arms and other bits.

Another company that's involved in aerospace, although not necessarily the interplanetary type, is Hydro Fitting Manufacturing. They produce high-precision valves for hydraulic and pneumatic systems. A long-time user of Japanese turning centers, the company decided to switch brands after their local machine tool distributor went out of business. Since long-term relationships are important to Hydro Fitting, they wanted a manufacturer they could count on in the long run. After reviewing their options, they purchased a Haas Mini Lathe; it has been boosting their production and reducing cycle times ever since.

That's the key to staying competitive these days, especially in the arena of contract manufacturing. Also key is the ability to generate a job quote quickly and accurately, and the latest trend to automate the process is computer-aided estimating. But how do you decide which software is best for you? We contacted the folks at Micro Estimating Systems for a few pointers.

For our education piece this issue, we visited the folks at Ranken Technical College in St. Louis, Missouri, a school well known for providing high-quality education. Considering 98% of Ranken grads land a job in their chosen field within six months of graduation, they must be doing something right. We'll show you what they're up to.

On the international side of things, we sent our roving reporter, Matt Bailey, to Italy for a look at the goings-on at EMO-Milano. You'll find his report in the News section. And as always, there's the Race Report, the Answer Man and much more.

It's another really, really brilliant issue, so sit back, relax and enjoy!

CNC MACHINING

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THE ANSWER MAN

ON THE COVER

***Monster Garage*, monster bikes and monster CNC machines: Jesse James at home in his shop in Long Beach, California.**

Photo: Byll Williams

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by Denis Dupuis

Days of Future Passed

"Only two people understand the future of interest rates. Both of them live in Switzerland. However, they're diametrically opposed to each other."

– Warren Buffet

As yet another year comes to a close and a new one begins, we find ourselves reflecting on the past 12 months. Looking back, we ask ourselves: Are we better than we were last year – as a company, as a person, with the quality of our products? Are we better off than we were last year – higher profits (if any profits at all), lower expenses, higher net worth? One would think we'd know the answers to these questions immediately. But in this computerized age of instant information, we are so deluged with data – much of it conflicting – that it is increasingly difficult to make heads or tails of it all.

In some ways, we probably are better – and better off – than we were last year. If nothing else, we know more than we used to. Or do we? We've been fed so much contradictory information over the years, it is almost impossible to know whether we really are smarter because of it. I'm reminded of the egg and coffee debates of a few years back. One day, we were told by a group of experts not to eat eggs, because they were full of cholesterol and would kill us. Not long after, though, we were advised by another group of experts that, no, eggs are full of good cholesterol and are actually good for us. The same thing happened with coffee: one day – bad, the next day – good. When even the Ph.D.s are confused, where does that leave us mere mortals?

Still, we should be able to determine if we're better off today than we were at the beginning of last year. Yet even that has become more difficult to determine. Sure, the stock market indexes are up, which is a good sign. But haven't we learned that this only represents paper gains, and we should be skeptical of whether we've made a profit or not? Unless we actually bought and sold stocks during this "upturn," we really can't count on having increased our net worth. Heck, after the bloodbath we've taken over the previous few years, weren't most of us out of the stock market last year anyway?

According to the market watchers, our houses are worth more today than they were last year. But, again, those are paper gains, so are we really worth more? Not unless we sell, and then we have to buy in an up market, so it all evens out. What about the reports saying personal incomes are up from the previous year? That means we're doing better . . . doesn't it?

What about our businesses? How are they doing? Well, on a month-to-month basis, the swings in sales volume have been wider than normal: more like a kid on a pogo stick than the steady uphill growth we'd like to see. With all of the mixed messages we receive on a daily basis, it's difficult to forecast what lies ahead.

Here at Haas, our sales are up, but our margins are not – again, a dichotomy that breeds cautious predictions of the future. On the plus side, though, we are beginning to hire replacements for the employees we've lost over the last few years through attrition. Our hope is that this is an indication of positive things to come for all of us, and an end to the conflicting market information of recent months. Let's take this opportunity to move forward and return to better days in 2004.

We wish you all the best in the New Year!

United Colours of Haas

CNC Machining's international correspondent Matt Bailey reports from Milan, Italy – venue for the 2003 EMO machine tool and manufacturing technology fair.

Milan – Italy's industrial north – late October. Temperatures had finally dropped after one of the hottest summers on record, and the rainy season had arrived *sul serio* – well and truly – as the locals say. Occasionally a weak sun broke through, but most days the sky was the colour of dirty snow – almost certainly a sign of things to come.

Once one of the Roman Empire's capital cities, Milan is now the financial and commercial hub of the modern Italian Republic, where ancient architecture and priceless works of art coexist alongside designer fashion boutiques, hip restaurants and heaving nightclubs.

The city centre is dominated by the Duomo, a gothic masterpiece that was started in the late 14th century and took five hundred years to complete. Puccini and Verdi lived and worked in Milan – the fruits of their labours are still performed regularly at the famous La Scala opera house; and in the 15th century, Leonardo da Vinci painted the sublime Last Supper fresco at the Santa Maria Della Grazia church.

As the host of EMO 2003 – the European continent's biennial machine tool and manufacturing technology fair – Milan certainly had plenty to offer its 155,000+ visitors.

CULTURAL DIVERSITY

Preparation for EMO 2003 started two years ago, immediately after EMO 2001 in Hannover, Germany. In that time, the staffs of Haas Automation Europe (HAE) and Haas Automation Inc. have worked together to plan and execute

Please see EMO on page 34

Teaching the Teachers

by Scott Hagen

It is midsummer, and the halls at Henry Ford Community College in Dearborn, Michigan, are nearly empty . . .

. . . except for the seven teachers who have become students for a few days. They're here to take a four-day teaching seminar, conceived by HFCC instructor Ken Wright, that offers teachers continuing education on Haas machines. These teachers, from community colleges and high schools in Michigan and Ohio, are discovering the developing technology of Haas products. They will take their new knowledge back to their classrooms and implement it in their lessons and labs.

As in any field with continuously changing technology or practices, machine tool instructors are required to obtain continuing education credits. Wright created the seminar at HFCC – the first of its kind – to do specifically that. The rapidly changing technology gives Wright the chance to teach his group exactly what is happening in the world of machining.

Please see TEACH on page 35

For a complete 2004 Trade Show Calendar, head over to http://www.haascnc.com/news/trade_show.asp

Photo: Scott Weersing

Haas CNC Racing Finds the Answer

It was a rough year for the Haas CNC Racing team in their inaugural season of NASCAR Winston Cup racing. Finding the right combination of setup, crew chief and driver was as hard as finding a four-leaf clover. But things quickly improved when the team signed Ward Burton to drive the No. 0 NetZero HiSpeed Pontiac for the final four races of 2003, and for the 2004 Nextel Cup season.

Burton, who won the 2002 Daytona 500 in the No. 22 car, was released by Bill Davis Racing in October. The veteran driver from South Boston, Virginia, chose to hang his hat with Haas CNC Racing after being courted by several other teams. "This is a great opportunity for me to bring my experience to an up-and-coming, young team," said Burton. "I've watched the team grow and progress in its first year, and it's definitely come a long way in a short time. I feel we can take this team to the next level together, and I'm thrilled to be a part of it."

Burton brings a wealth of knowledge and success to the Haas CNC Racing team. Since he began racing at NASCAR's highest level in 1994, Burton has scored 24 top-5 and 79 top-10 finishes. He has seven pole positions to his credit and has been to Victory Lane five times. So far in his career, he has finished as high as ninth in the championship points standings.

"We're thrilled to have someone of Ward's caliber joining our team," said Joe Custer, general manager of Haas CNC Racing. "The experience he brings will help us in so many ways. I just can't say enough about how excited we are about our future. We've had a lot of great people come on board this year, and we've made steady progress, but Ward is the icing on our cake."

Burton had an immediate positive impact, with a 13th-place finish in his team debut at Atlanta Motor Speedway. It was the team's best finish of the year. "It was a great start with the team for Ward," said Custer after the race. "We had to overcome a lot of adversity that weekend. First we had to go to our backup car after a crash in practice on Saturday. Then it rained on Sunday, delaying the race a day. And on Monday, we got a lap down when we pitted. But Ward drove just great and passed a lot of cars. He just kept battling back all day long."

More bad luck plagued Burton's second race in Phoenix, when an accident left the team with a 41st-place finish. But Burton bounced back the next week for an 18th-place finish at North Carolina Speedway after leading 30 laps. It was the team's third-best finish of the year, and fifth top-20 finish.

The final race of the year at Homestead-Miami Speedway saw Burton start in 24th position, and then fall back to the rear of the field with a loose-handling car. But crew chief Tony Furr ordered some adjustments, and Burton began working his way through the pack. By lap 175, he had worked his way into the 13th position. With 25 laps to go, Burton had fought his way into the top 10 and was passing Mark Martin, when Martin lost control of his car and made contact with the NetZero HiSpeed Pontiac. The car was too heavily damaged to continue, and Burton was credited with a 32nd-place finish when the race ended. Burton finished the season 21st in the driver points standings, and the Haas CNC Racing team finished in the 37th spot in owner points.

"We were racing pretty hard with Mark there at the end, and I guess he got loose and just got into me," said Burton. "It was a shame. I think we could have pulled out a top-10 finish to end the season. Nonetheless, I'm looking forward to next year with this team. We have a lot of potential; next year we'll just need a little bit of luck, too."

Busch Series team

Haas CNC Racing will run a full-time Busch Series team in 2004, with Jason Leffler behind the wheel of the No. 00 Haas Automation Chevrolet. Leffler, who joined the team in August, drove the No. 0 Pontiac for ten races in the 2003 Winston Cup series. He then moved back to the Busch Series, where he showed even better results in the final six races of the season. During 2003, Leffler finished no worse than 22nd in any race on the Busch Series circuit, and he finished 11th at Phoenix and Charlotte. His best finish of the year came in the final race of the season, when he finished 4th in the Ford 300 at Homestead-Miami Speedway.

"We finally put together a good run, with nothing unexpected happening," said Leffler after the final race. "The guys did a great job in the pits all day, and even though we started out a bit loose, we made good changes to the car to get it better and better throughout the race. This finish gives us a little momentum going into next year."

With Pontiac ending its support of NASCAR racing, the Haas CNC Racing team will switch back to Chevrolet bodies and engines from Hendrick Motorsports for 2004. "We recognize it was a business decision, and we appreciate everything Pontiac has done for us this year," said Custer. "Obviously, the decision will result in some extra work in the off-season, but this kind of thing is just a part of racing. Of course, there are issues that remain to be worked out, but right now, the plan for Haas CNC Racing is for both the Busch team and the Cup team to run Chevy Monte Carlos in 2004."

Hendrick Motorsports

Jimmie Johnson, demonstrating that his successful 2002 rookie year was not a fluke, won three times in 2003 and finished as runner-up to Winston Cup Series champion Matt Kenseth. Johnson was fifth in the points standings in October, but then had a string of six consecutive top-3 finishes to end the season, including a 2nd-place finish in the Ford 400 at Homestead. Johnson closed out his sophomore season with 14 top-5 finishes, 20 top-10s and two poles.

"It was just a great year for the entire team," said Johnson, who drives the No. 48 Lowe's Chevrolet. "I never in my wildest dreams expected to have three wins, two poles and a second-place finish [in points] this year."

Jeff Gordon had a tough time keeping up with his teammate for much of the season, but edged out Johnson with back-to-back wins in October. Gordon captured his 63rd career victory in the Subway 500 at Martinsville on October 19 – his second win on the half-mile oval in 2003.

Gordon continued his roll the next weekend at Atlanta Motor Speedway, winning the race during a rare Monday finish. Gordon was in 19th position when rain postponed the race on Sunday, but when racing resumed the next day, he was unstoppable, holding off Tony Stewart for the victory.

"Never count us out," said Gordon. "I know we haven't won a whole lot this year, but we're strong finishers. I'm just so proud of this team and their efforts right now. We've had five straight great runs, and we're going to keep it going." Gordon ended the year with a 6th-place finish at Homestead, and earned 4th place in the final Winston Cup series standings.

Hendrick Motorsports driver Terry Labonte also finished the season on a high note. Labonte's 15th-place finish at Homestead was just enough to edge out Kurt Busch for 10th place in the final points standings. It was Labonte's best season since 1998, with a win at Darlington Raceway, four top-5 finishes and nine top-10s.

Busch Series

Brian Vickers captured the Busch Series championship in the No. 5 Chevy, with an 11th-place finish in the final race of the year. It was the first Busch Series championship for team owner Rick Hendrick. Vickers, at the tender age of 20, also became the youngest champion in modern-era NASCAR history, supplanting Rob Moroso, who was 21 when he won the Busch Series title in 1989.

Vickers held a slim 22-point lead over David Green going into the Ford 300 at Homestead-Miami Speedway. He was able to hold off a late-charging Green to capture the title by a mere 14 points, making it the second-closest margin of victory in Busch Series history.

Vickers moves up to the Nextel Cup Series in 2004, where he will compete for the rookie-of-the-year trophy in the No. 25 GMAC Chevrolet.

J&B Motorsports

Paul Lee and the J&B Motorsports team ended their 2003 slate of events with the 19th annual Lucas Oil NHRA Nationals at Mohnton, PA. Lee qualified the Top Alcohol Funny Car in the 6th position, and lined up against Fred Tigges in the first round. Although Lee drifted right at the start, he was able to straighten it out to quickly pass Tigges and advance to the next round. But Lee had problems against Jim Sickles and was eliminated from the competition.

Rolling into History

Illustration: Courtesy NASA

For a small machine shop in California, the stars above are looking especially bright these days. The employees of Next Intent of San Luis Obispo are energized with anticipation as they look toward the heavens to one particular bright light: **Mars.**

Story & Photos | Scott Weersing

The team from Next Intent is not the only one looking to Mars, though. The scientists and engineers of NASA's Jet Propulsion Lab in Pasadena, California, have their hopes and dreams pinned on two spacecraft headed for the red planet. Aboard the spacecraft are two identical Mars Exploration Rovers that will investigate and photograph the planet's surface. The six-wheeled vehicles will roll across the rocky, red soil of Mars, and examine rocks that could help scientists determine whether there ever was enough water on the planet to support life.

"It is really exciting to know that the wheels, suspension arms and other components we made for the rovers are going to Mars," says Rodney Babcock, president of Next Intent.

Most of the components for the rovers were produced in-house at JPL, but some parts, such as the wheels, were outsourced to local companies. "Back in 1997, when our other business areas were slowing down, I called up the guy in charge of manufacturing engineering at JPL, and he said come on in," relates Babcock. "We started by doing a lot of fixtures and prototypes for them. As we gained experience with JPL, we got more and more complicated work. They visited our shop numerous times, and certified us for flight components. It was just good timing: When we needed work, they needed someone like us."

The red planet has always been a source of intrigue. Many books and movies have imagined the planet as home to little green men. While that is still just science fiction, many believe that, within our solar system, Mars holds the best chance of finding signs of life – either past or present. The red planet is also a prime candidate for future manned exploration.

Yet, despite all the new technology here on Earth, it has been several years since anyone has seen a picture of Mars from its own surface. No spacecraft has successfully landed on Mars since the Pathfinder, which beamed back photos from the surface in December of 1997. In September 1999, the Mars Climate Orbiter was lost in space due to a simple math error – a failure to convert English units to metric. Then, in December 1999, the Mars Polar Lander crashed when its rocket engines shut down early.

The Mars Exploration Rovers are NASA's latest attempt, and the agency is not alone in its quest for signs of life on Mars. The race to get back to the red planet is truly international. "It's one of the most intensive explorations of another planet in history," says Ed Weiler, associate administrator for NASA's Office of Space Science.

"Literally, the world is going to Mars."

The journey back to Mars has not been easy for anyone. Back in 1998, the Japanese space program launched "Nozomi," with the intent of visiting Mars in 1999. The spacecraft's first swing by Earth, however, did not provide it with enough speed to reach Mars as scheduled, so scientists decided to alter its orbit to reach Mars in December 2003, just ahead of the rovers from NASA.

The European Space Agency is making its first visit to another planet as well, with the Mars Express orbiter and Beagle 2 lander. The Mars Express space probe was launched on June 2, 2003, from Baikonur Cosmodrome in Russia on a Soyuz-Fregat rocket. It was scheduled to arrive in December 2003, and deploy the Beagle 2 lander to examine the Martian surface in the Isidis Planitia region. Named after the ship that carried Charles Darwin to South America, the Beagle 2 weighs only 66 pounds and has no wheels.

The Mars rovers from JPL, fully equipped with the wheels manufactured by Next Intent, were launched from Florida. The first Boeing Delta II rocket carrying the Mars rover Spirit left Cape Canaveral on June 10, 2003. But the second rover, Opportunity, waited on the launch pad for more than two weeks, as "everything that could go wrong did go wrong," says NASA launch director Omar Baez. First, a fishing boat came too close to the launch site at Cape Canaveral, forcing a delay. Then, there were numerous weather delays, along with technical problems, that kept the Delta rocket grounded. It wasn't until July 8 that the rover Opportunity was successfully launched.

With a pair of Mars rovers traveling to Mars independently, mission scientists feel confident they will have a very successful operation, despite the rough start. If all goes well, the rover Spirit will make its landing in the Gusev Crater sometime in January 2004. The rover Opportunity will touch down on the other side of the planet a few weeks later, in the Meridiani Planum region.

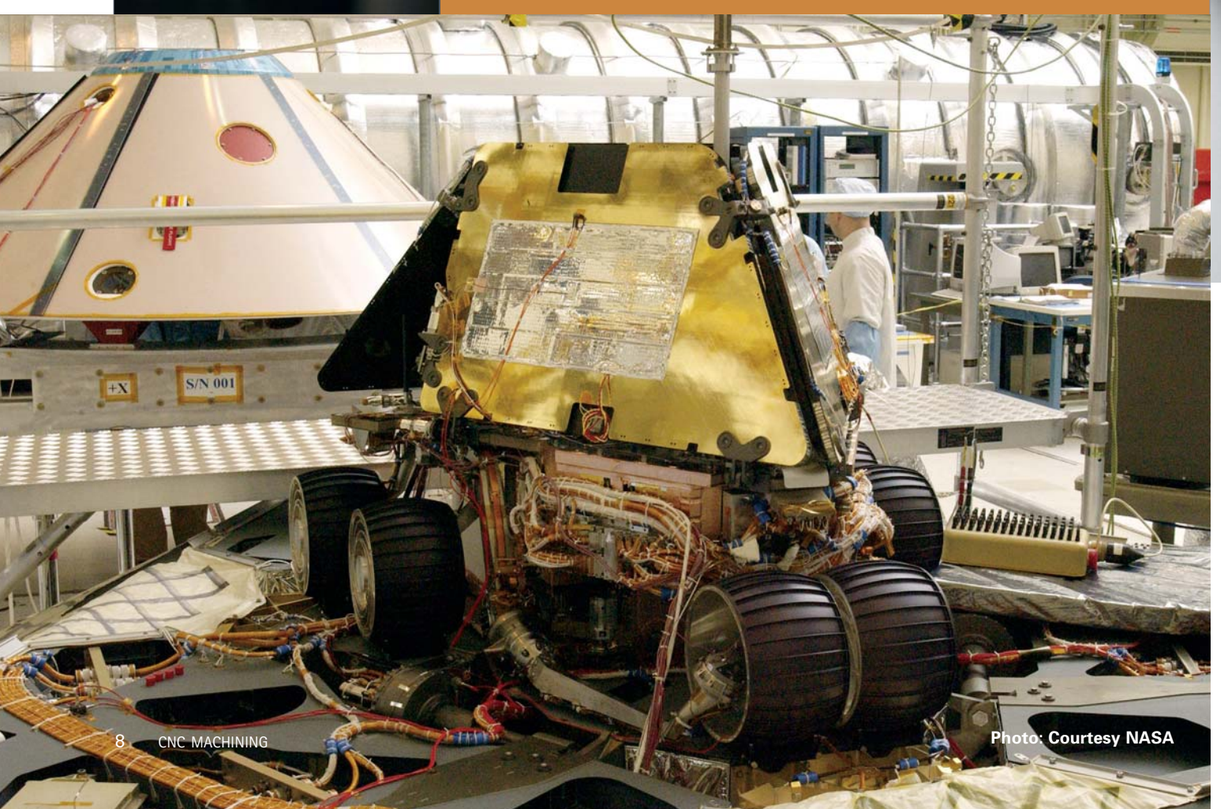


Photo: Courtesy NASA

"Gusev and Meridiani give us two different types of evidence about liquid water in Mars' history," says Dr. Joy Crisp, Mars Exploration Rover (MER) project scientist at JPL. "Gusev appears to have been a crater lake. The channel of an ancient riverbed indicates water flowed right into it. Meridiani has a large deposit of gray hematite, a mineral that usually forms in a wet environment."

The identical rovers can see sharper images, explore farther and examine rocks better than anything that's ever landed on Mars. The rovers each have a panoramic camera, a rock abrasion tool to expose fresh surfaces, a miniature thermal infrared spectrometer, a microscopic camera, a Mossbauer spectrometer and an alpha-proton-X-ray spectrometer. There are nine cameras on each rover: six for navigation, two for geology and one for microscopic investigations.

After past disasters, NASA budgeted resources to build and launch a pair of rovers, rather than one. With two, the chances of one making a successful landing are very high. "The rovers will use innovations to aid safe landings, but risks still remain," says Peter Theisinger, MER project manager. One risk is the parachutes getting tangled and not opening properly. The rover wheels, however, were designed to withstand a rough landing, and anything else that might go wrong.

"JPL designed a flat section on the inside of the wheel that has a large fillet radius to blend into the concave inside profile," explains Babcock. "The wheel has to be able to absorb the landing impact of 30 to 50 g's. Each rover is attached to the lander with a cable pulling 2,500 pounds of down force, holding the rover tightly to the lander. Strength and weight are critical, so when we machined the wheel, we had to control the wall thickness to a couple thousandths, all the way across."

Next Intent used GibbsCAM SolidSurfacer software to generate the tool paths for machining the wheels. The raw material was 11-inch bar stock of 7075 aluminum, and each raw piece weighed more than 54 pounds. After eight different operations and 25 hours of machining, each finished wheel weighs only 2.25 lb.

"This project was a tremendous challenge," says Babcock. "It challenged our CAM software and our programmers, and it took our manufacturing process control to another level, due to the extremely tight tolerances and delivery schedule."

Each wheel first underwent two roughing operations on a lathe, and then was sent out to be heat-treated and stress relieved. Following heat treatment, the wheel went back into the lathe for two more finishing operations. It then was moved to a Haas VF-5 to rough and finish the inside profile.

To machine the inside of the wheel to required tolerances, the company had to create some special tools. "We built our own keyway-style tools that went in and profile milled the inside of the wheel," says Babcock. "One tool we built for single-point finishing the interior looks like a lollipop with a round carbide insert. This tool created a very smooth surface finish, and allowed us to control the inside tolerances to one thousandth [±0.001"]. Another operation required us to tilt the rotary table at 15 degrees to get the tool down inside the wheel.

"We then took it over to the Haas VF-2 to machine the spirals on the hub of the wheel. It then went back on the lathe to create the convex OD profile. Finally, the VF-5 completed the outside profiling to create the unique tread pattern," Babcock says.

"It was a once-in-a-lifetime experience," Babcock enthuses. "JPL is great to work with, because they know how hard it was to make the wheels. One of the best things about this project is that it stretched our capabilities and made us better. We weren't just making a part with a part number, but a part going to Mars."

Next Intent
805-781-6755

COMPUTER-AIDED ESTIM@TING

Offering a quote isn't as simple as it may appear, and in these competitive times, getting it right could be what keeps you in business.

Story by Craig Hoffmann

Every time you send a quote to a customer, you are betting your business – your profit or loss – on the accuracy of the times in that quote. Figure in too much time and your quote may be too high; figure in too little and your profit goes out the window.

In recent years, computer-aided estimating has come to the fore as a means to take the guesswork out of the quoting process. Unfortunately, the industry has neither a standard definition of what an estimate is, nor standards by which to measure the results an "estimating" program provides. Before selecting a software program for your own estimating, it is important to understand the strategies the software uses to "build" a computer-aided estimate.

WHAT IS COMPUTER-AIDED ESTIMATING?

A better question might be: When is a computer-generated price really an estimate? When people talk about estimating software, they typically refer to one of two groups of software:

- *Quoting software* simply helps the shop owner determine a price. The estimator manually calculates or guesses the time a job will take.
- *Estimating software* not only provides a quote, it also estimates – using speeds and feeds – the actual time a job will require in the shop.

Time is the factor that differentiates between quoting and estimating software. And time is the overriding factor that determines the accuracy of an estimate, making the difference between profit and loss.

Within the estimating classification, some software systems are standards-based, some are engineering-based, some exhibit genuine intelligence by emulating actual machine motions, and others are evolving from one form toward another. Intelligent simulation attempts to determine how long each operation really will take, as opposed to how long it should take. And now, automated feature recognition has entered the picture.

Having the capability to account for rapid travel and idle times defines the difference between standards-based, engineering-based and intelligent–simulation estimating systems. The latter system tells you that it *will* take one minute – not that it *should*. Intelligently simulated estimates attempt to include every significant event, as opposed to interpolating average times and indicating what should happen.

The term "estimating" still sounds like a guess, no matter how sophisticated the software is. In fact, some computer-aided estimating software programs are true engineering-based process-planning and profit-predicting systems. Today, just as speed and accuracy are demanded on the shop floor, predicting profit before a job gets to the shop is a critical phase of manufacturing. It begins by computing an accurate price for each job.

THE BENEFITS OF NEW TECHNOLOGY

An exciting change in computer-aided estimating has emerged. Many shops have the capability to receive a request for quote (RFQ) electronically, with an accompanying drawing. The estimating program can automatically recognize the part features and develop a suggested production method for the part. The estimator can review the information, accept or modify the process as needed, and send the customer a price for the part – all in a matter of minutes. The customer can then accept the quote's cost – having reviewed the e-mailed information – and can reply with a confirming e-mail.

Upon receiving the confirming e-mail, the estimator can electronically forward the information from the estimating system to the shop management system, and to the part programming system for processing on the shop floor. Realize, as well, that this opens up the estimating process to a whole new department that has always asked, "If I make this change, how will it affect the cost of manufacture?" Now, design engineers using estimating/design tools as described above can make changes to the design, and reprocess the part in the estimating/part recognition system. There, they can see the instant impact of their design changes on part cost.

Those who have treated quotes lightly in the past "because it is just an estimate" may find themselves losing the job before they begin their quoting.

Remember, when it comes to estimating, you don't care that it *should* take one minute – you need to know how long it *will* take. In an estimate simulation, the software attempts to include everything significant that occurs, as opposed to what should happen. The simulation process must factor into its calculations many issues: How many types and styles of machines are used today by shops? How many different vendors? How much time is lost by lead-in and lead-out?

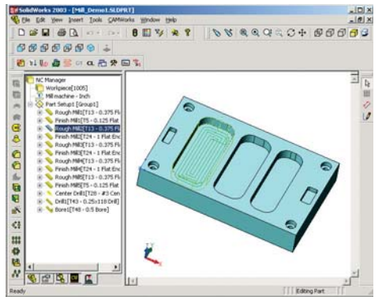
Rather than providing generic standards for turning or drilling, intelligent simulation will recognize perhaps 60 independent machine types for those processes.

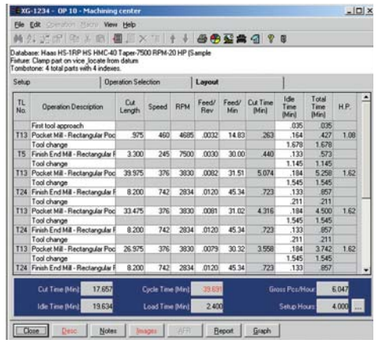
What was said earlier bears repeating: When buying estimating software, remember that each time you send a quote to a customer, you are betting your business on the accuracy of the times in the estimate.

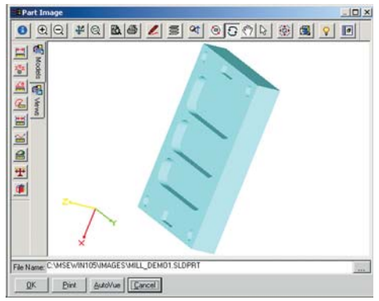
SIDE BAR

FEATURE RECOGNITION

Today, most CAD/CAM systems integrate with a solids package or have an internal solids drawing capability. Combined with that capability, feature recognition now is taking part design in a new direction. Solids packages enable feature recognition by other software – no more visualization, no more isometric views. Clusters of software packages that use solids will revolve around a technical database. This supports a consistent method of programming and manufacturing. In that technical database will be relationships of features to manufacturing methods. For example, a database entry for a 1/4"-20 tapped hole, 3/4" deep in 6061-T6 aluminum, may specify that a 0.125" center drill be used to spot the hole prior to drilling, and then a 0.201" diameter drill be used to drill the hole. When you machine a part out of 316 stainless steel with a certain finish, the technical database can suggest that you machine using the specified speeds, feeds and tools that you previously determined are appropriate. Additionally, knowing the material can provide the part weight, the center of gravity, and possibly highlight other challenges that significantly enhance a computer-aided estimating system's ability to create estimates automatically.







FEATURE RECOGNITION AND ESTIMATING

It won't be long until an estimator – knowing a part was designed in a solids program – will click on a pull-down menu and choose "recognize features." When the software recognizes a "shaft adapter," and the estimator selects the machining center to run the part, the software will suggest a center drill, a drill, a face milling operation, a contour endmilling operation and a burnishing operation. That's the set of work instructions based on the features it saw. The estimator will be able to drag and drop and rearrange any tool or process, based upon his knowledge of the facility.

Feature recognition in computer-aided estimating is already in the marketplace. It's available for turning and milling, as well as fabrication processes. Consider a simple part, linked from a solids package to estimating, and then to a CAD/CAM system. The identified features from the solids technical database are matched with the estimating program's technical database.

With this data, the estimating program knows which tools to use. By automatically reviewing the machine parameters and the part, the estimator may find that the initially selected machine is unavailable, or otherwise not optimal for the job – perhaps it has insufficient tonnage, tolerances or size limitations. Therefore, the estimator – who is always in control – could select another machine.

Craig Hoffmann is Vice President for Product Development for Micro Estimating Systems, Inc. • 262-860-0560 • craigh@microest.com

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Looking for Solutions in New Places

Story & Photos by Scott Weersing

In these difficult economic times, many machine tool distributors, and even machine tool builders, are closing their doors, often leaving long-time customers without the support they require. This forces companies to look to other machine tool manufacturers for new relationships. But how does a company choose a new machine tool manufacturer and affordably try out one of their CNC machines? For Hydro Fitting Manufacturing of Covina, California, the solution came in a small package – the Mini Lathe from Haas Automation. >>

"When we first looked at Haas, their mainstay was mills," says Seth Schwartz, president of Hydro Fitting. "Fantastic product, but we aren't a mill house, we're a turning house. Then we saw the Mini Lathe at WESTEC, and we thought it would be a good way for us to step into the Haas product line. The whole purpose of bringing in the Mini Lathe was to see if we are going to switch over to Haas when we need new equipment. So far, it [the Mini Lathe] is working out really well."

Hydro Fitting manufactures high-precision components for aerospace and other industries. Their customers include some of the most technologically advanced companies in the world, such as Boeing, Rockwell, Cessna, Airbus and General Dynamics – to name a few. The company's mainstay products are pressure-charging valves and tank valves for hydraulic and pneumatic systems. "We are known for our charging valves," says Schwartz, "from zero psi all the way up to 20,000 psi. It's amazing all the different industries that are now using our valves. We just recently started supplying valves to a company in the monster truck industry."

Hydro Fitting's machine shop currently has 10 turning centers from a Japanese manufacturer, all equipped with hydrostatic bar feeders. The company usually replaces its CNC turning centers every seven years, so when their local distributor closed its door recently, it was time to look elsewhere for new machines.

"We don't switch over to a machine, we switch over to a company," explains Schwartz. "We've discovered over the years that if we stick with one particular company, we can get the service we want. They get to know us, and it winds up being a long-term relationship."

When Hydro Fitting needed a new turning center to produce small parts quickly, they looked to the Haas Mini Lathe as the solution. The compact machine is designed for just that type of job, with its unique gang-style tooling and high-speed cross-slide providing quick tool changes and short cycle times. To boost production further, Hydro Fitting added an automatic bar feeder to the Mini Lathe, which they load with bar and hex stock up to 1" diameter.

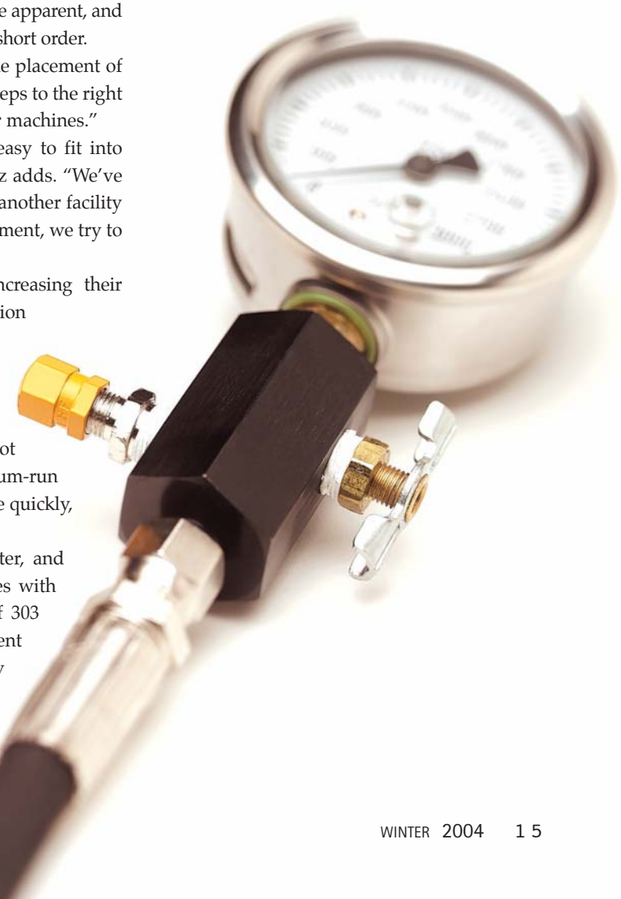
The unique design features of the Mini Lathe quickly became apparent, and Hydro Fitting began reaping the benefits of the new machine in short order.

"The Mini Lathe is well thought out," says Schwartz. "The placement of the control is where it should be. You don't have to take three steps to the right to be able to work the machine, as you have to do on our other machines."

The machine's compact 5' x 4.5' footprint also made it easy to fit into Hydro Fitting's crowded shop, which was important, Schwartz adds. "We've been at this location since 1977, and we don't want to move to another facility to fit in the new machines. Instead of growing with more equipment, we try to become more efficient with the equipment we have."

Reducing setup times is one way Hydro Fitting is increasing their efficiency, and the unique design of the Mini Lathe's 10-position tool platen has helped tremendously in this area. "We've been able to pick up a 12 to 15 percent productivity gain with the Mini Lathe," notes shop supervisor Angel Rodriguez. "The way the tools are held in a V configuration has saved us time. We have other machines with straight tables, and they're not conducive to setting up quickly. Because we're a short- to medium-run facility, if we can get something up and running on the machine quickly, we're much better off."

If they can run the parts faster as well, that's even better, and Hydro Fitting is realizing significant reductions in cycle times with their Mini Lathe. One example is a valve stem made out of 303 stainless steel: The Mini Lathe is faster than their other equipment in five of the part's seven operations. The bar feed takes only four seconds with the Mini Lathe, versus eight seconds on other equipment. The first turning operation saves three seconds, and then the second op, threading with a



32-pitch insert, shaves another three seconds off the cycle time. The biggest reduction, however, comes with a 0.0785" drill on the valve stem. The Mini Lathe takes only 12 seconds to drill the hole, compared to 20 seconds on Hydro Fitting's other turning centers. All told, the entire operation takes only 54 seconds on the Mini Lathe, compared with 80 seconds previously. That's a cycle time reduction of 32%. "We run five thousand valve stems at a time, so that adds up to savings of 36 hours over the entire job," says Schwartz.

The new machine has also paid off in the accuracy of the parts. The Mini Lathe's spindle design enables it to hold the tight tolerances required for many aerospace components. "We weren't aware that the Mini Lathe holds extremely tight tolerances," notes Schwartz. "I would say that there have been half a dozen jobs that we've run on this machine where we've had to hold five tenths (0.0005"), and it has consistently held with no problem.

"One of the jobs we did on the Mini Lathe was a very small cap. This cap is very sensitive and it gets inspected under a ten-power viewer. The reason it's so critical is because it goes up in satellites. And once it goes up there, there's no way to get it back," Schwartz says.

Another key ingredient in producing high-precision parts is a quality control system. Hydro Fitting is certified to ISO 9002 standards, and has gone to the next level by achieving AS9100 certification. The AS certification is the highest standard in precision aerospace manufacturing, and the Haas Mini Lathe helps the company meet the stringent requirements. "With AS9100," explains Schwartz, "we have to keep accurate records on the equipment: what it is doing, how it is performing and if there are any problems. The Mini Lathe gives us all the information we need right on the control. We're planning to tie in the information from the control to our computer system, so that we can maintain quality control and record keeping."

Other features of the Haas control are saving the company time as well, says Schwartz. "For example, we really like how it automatically zeroes the X and Z axes," he says. "We have to do it manually on our other machines, but with the Haas, you just push one button and it is accurate every single time. That will save us an incredible amount of time over the course of a year."

Haas Automation's reputation for outstanding service, says Schwartz, is another reason Hydro Fitting chose the Mini Lathe. "We love the Haas company philosophy regarding how the

equipment, the software and the control are all under one roof," he says. "That speaks highly to us, because on the other end of the spectrum, when we have a problem with our other machines, we have to contact one person for problems with the machine and another person for problems with the control. With Haas, we only need to make one phone call and we're going to get the answers we need."

What's next for Hydro Fitting? Unattended machining and Ethernet connectivity. "We want to go to lights-out production with the Mini Lathe, and be able to monitor off premises," says Schwartz. "That's something other manufacturers couldn't offer, or could only offer through a second party. But with Haas, we know we'll have full support for everything we want to do. When we're ready, they're ready to help us."

So while some companies are left scrambling to find new distributors and machining solutions, Hydro Fitting has found a cost-effective solution for their small parts machining, and discovered what a Haas turning center can do.

Hydro Fitting Manufacturing
626-967-5151

THE OUTLAW JESSE JAMES

READER ADVISORY
EXPLICIT CONTENT

PHOTO: BYLL WILLIAMS

PHOTO: ERIC HAMEISTER
WWW.HAMEISTERPHOTO.COM
562-331-1026

JESSE JAMES is a lot of things, but politically correct is *not* one of them. He is what he is, and he does what he does . . . and he really doesn't give a damn what anybody thinks about it. He is the quintessential outlaw biker, and he plays by his own rules.

Lately, Jesse's badass attitude and rebellious persona have gotten lots of attention, thanks in no small part to his current gig as frontman for the Discovery Channel's hit series *Monster Garage*. The popularity of the show, in fact, has elevated the 34-year-old James to near rock-star status. *People* magazine even dubbed him one of the sexiest men alive recently – further proof of his celebrity. No longer does the name Jesse James elicit images of a gun totin', horseback ridin', Wild-West bandit. Rather, it brings to mind a chopper ridin', blowtorch wieldin', West Coast biker with slicked-back hair and tattoos.

Despite his recent popularity, though, Jesse still considers himself "a glorified welder." Prior to his Discovery by the world of cable TV, he was just another custom-bike builder, plying his trade from his shop in Long Beach. Of course, the fact that his shop encompasses 18,000 square feet of showroom, offices, machine shop and manufacturing area, and that there's a serious waiting list for one of his bikes, says there's more to the man than just a pretty face, especially when you consider he started out in the corner of his mom's garage.

Jesse James is a skilled craftsman who sculpts two-wheeled works of art for the likes of Shaquille O'Neal, Kid Rock, Keanu Reeves and anyone else who can pony up the $50,000 to $150,000 asking price for one of his creations. *[Well, almost anyone. Word is, if you piss Jesse off, or if he just doesn't like you, no amount of money will get him to build a bike for you.]* His company, West Coast Choppers, rakes in an estimated $6 million in annual revenues – 60% of which is generated by the company's clothing line. It seems everyone wants to be a biker these days, or at least look like one. And for a mere 24 bucks, anyone can show off their outlaw tendencies with an original West Coast Choppers Iron Cross T-shirt.

Jesse's own outlaw tendencies surfaced at an early age. The fact that his great-great-grandfather was the infamous bandit's cousin probably had something to do with it. "I guess it's kind of in my blood," he says. "I just do whatever I want, and don't usually do what too many people say." *[Interestingly enough, if you compare pictures of the two men side by side, there's a distinct family resemblance.]*

Growing up with such a legendary name understandably brought with it in a certain level of abuse. "There was always teasing and shit, like, the first day of school," Jesse explains. "Whenever they read off your name, you know? Shit like that."

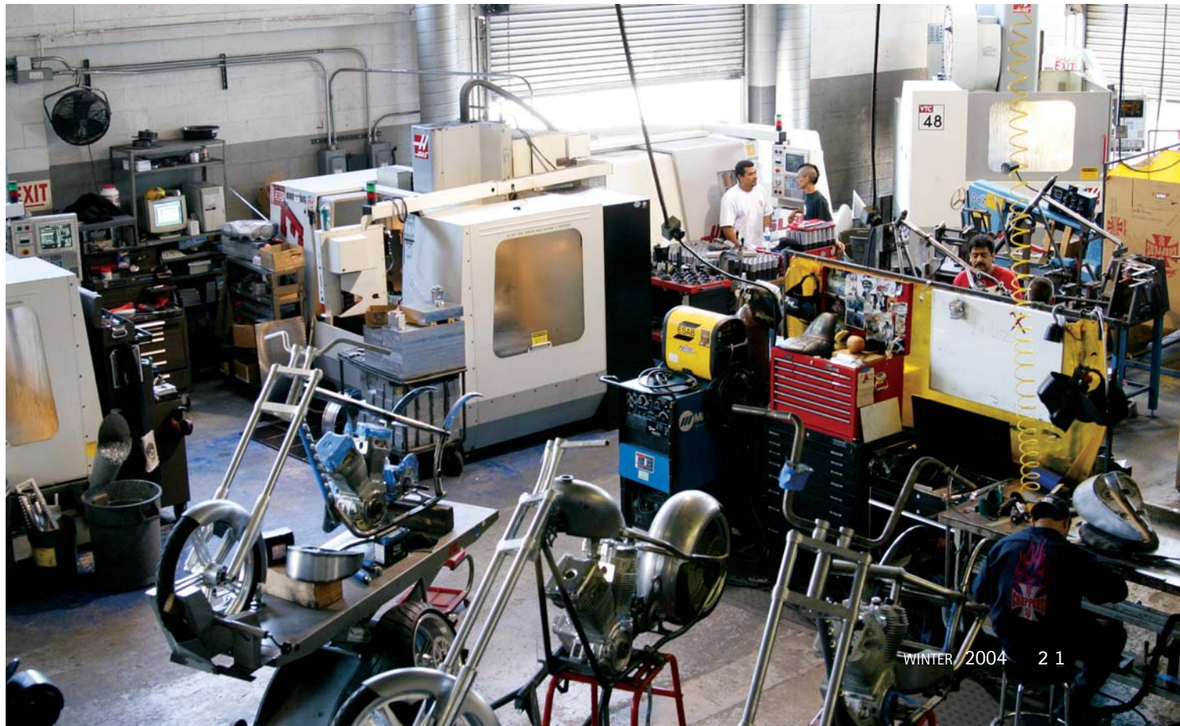
Jesse's parents split up when he was five, and he lived with his dad, who owned an antiques business. "He was busy workin', so I was by myself a lot," Jesse notes. "So, naturally, if there's no parent around, you're going to do whatever, and learn right and wrong the hard way. And that's exactly what happened."

But some things are worth getting in trouble for.

His dad's antiques business happened to be next to Performance Machine, a company that manufactured aftermarket brakes and accessories for Harley-Davidsons and other motorcycles. The young Jesse found himself inexplicably drawn to the bikes and machinery next door. He would sneak into the machine shop and watch as the lathes and mills transformed chunks of metal into motorcycle parts.

"My early, early memories are going next door and playing with all the metal chips, and seeing those guys," Jesse says. "They had, like, metalflake *@#$%&** trikes and flashy choppers and stuff like that. I was like four or five years old when I was around that. I don't even remember the inside of my dad's shop, but I can remember what it looked like inside Perry's shop [Performance Machine], and where the machines were laid out, and stuff like that. And the smell, you know? Cutting oil and stuff like that."

By the age of 7, Jesse had a motorcycle of his own: a Kawasaki 50cc mini bike. It wasn't much, but it had two wheels and an engine. "That's the first bike I had," he says, "and I used to ride it every day after school. I'd use, like, almost two tanks of gas every day . . . I probably shoulda been doing homework."



That's not to say Jesse didn't do homework – he just did homework of a different sort. By 9, he was already developing his fabrication and marketing skills. He took an old 1940s Schwinn Straight Bar bicycle, customized it, added new chrome and pinstriping, and then sold it at an antiques show for a considerable profit.

Jesse continued his habit of learning things the hard way throughout his teens. He readily admits to having a "fondness for other people's stuff," which led to frequent visits by the local constabulary, and three all-expenses-paid "vacations" courtesy of the California Youth Authority.

Unlike his namesake, though, who continued his life of crime until he was murdered by a member of his own gang at the age of 34, the modern-day Jesse James saw the error of his ways before it was too late.

"When I turned 18," Jesse says, "this, like, automatic alarm clock went off in my head: Okay, quit *@#$%&** around now. If you flush it now, you're going to go to big-boy jail, you know, and it's going to end up on your record. Your hall pass is over."

But walking the straight and narrow didn't mean Jesse had to conform. "When I was in high school, I was kind of a loner," he says. "I hated everybody and everybody hated me, and I built a big, loud, obnoxious bike just to make 'em hate me more – you know, the administration at the high school, and stuff like that. "

And that first bike is where it all started.

According to Jesse, he always wanted expensive bikes when he was in high school, but he didn't have any money (like most teenagers, he had a bit of a cash-flow problem). But the lack of funds didn't stop him from wanting a cool ride. He built a chopper – a rigid-framed bike that's all trimmed down – because it was all he could afford. And the only way he could afford that was by doing everything – the bodywork, the paint, the engine – himself.

The finished project soundly met Jesse's primary requirements: It was loud and obnoxious, which satisfied his desire to piss off the administration, and it scored pretty high on the cool meter – his friends couldn't believe he'd built it himself.

Jesse continued honing his skills after high school, building bikes for himself and for friends. He was still working out of his mother's garage when he coined the name for his future business around 1988. It happened while he and a buddy – "We went to school together since the fourth grade," says Jesse – were gearing up for the Laughlin River Run.

"I came up with the name West Coast Choppers," Jesse explains, "and he drew the first logo, which is actually the logo we have now. We made some T-shirts – I think we made, like, 10; we couldn't afford a full dozen, so we made 10 – then we rode to the Laughlin River Run. I gave them to all my friends, and they're like 'What the hell is this?' I'm like, I swear, trust me, this is my shop. And they're like, 'You don't have a shop. What are you talkin' about? You work in your garage.'

"I think, out of those 10, I passed out only, like, three – three of my friends wore them . . . reluctantly. And, you know, I kind of knew: Even though I had a good job doing something else, working for other places, I always knew that West Coast Choppers was gonna be it. That was my dream."

But dreams don't pay the bills. Jesse trained to become a professional bodyguard, and over the next several years, he traveled the country as hired muscle for such big-name bands as Soundgarden, Slayer and Danzig. He continued building bikes between gigs.

He was making good money as a bodyguard, but motorcycles remained his passion. After sustaining a dislocated elbow during a concert in Detroit, Jesse decided to give up his career as a bodyguard and pursue his dream of having his own shop.

Unlike most people who start a new business, Jesse refused to take out a loan or

solicit investors to finance his venture. “I think a lot of people, you know, their business plan is to get a loan, and get a bunch of money, and buy a bunch of shit,” says Jesse. “Then, when it dies, they’re like, ‘What the @#$% happened?’ They never figure in themselves working hard and sacrificing their own time and profits.”

Jesse’s business plan was much simpler: work hard, stay out of debt, re-invest profits back into the company and, most importantly, soak up all the knowledge he could about metalworking and building bikes. “I’m kind of like a sponge,” he says. “I want to learn everything I can from everyone.”

For his education, Jesse sought out some of the top names in the industry, including master metalsmith Fay Butler, custom hot-rod builder Boyd Coddington and Ron Simms, owner of Simms Custom Cycles. It was a mix of old-school hand-fabrication methods and modern machining techniques. Jesse worked with Boyd for about two years before going out on his own.

West Coast Choppers became a reality in 1992. It wasn’t long before Jesse couldn’t fit everything in his garage anymore, so he rented the corner of a friend’s building. When that wasn’t enough, he moved to a 3,000-square-foot building of his own. As West Coast Choppers continued to grow, Jesse stayed true to his business plan, always working hard and pumping every dime back into the company. “Whenever I sold a bike,” he says, “I took the profit and put it back into the business, or bought another sheet metal machine, or tooling, or whatever, you know.”

Those investments paid off. West Coast Choppers developed a loyal following of fans and customers, and Jesse’s bikes started getting serious play in the biker mags. But it wasn’t until 2001 that Jesse got his first mainstream exposure, when the Discovery Channel aired a pair of specials – *Motorcycle Mania I* and *Motorcycle Mania II* – documenting the inner workings of West Coast Choppers. It was the world’s first glimpse of this modern-day outlaw – and apparently the world liked what it saw. The extreme popularity of those shows – *Motorcycle Mania II* was the highest-rated show in Discovery Channel history – in turn led to Jesse’s current stint hosting *Monster Garage*.

Despite his new celebrity status, and the demands placed on him by *Monster Garage*, Jesse is still very hands-on when it comes to building custom bikes and designing new products. “People are paying a premium price for a Jesse James bike,” he explains. “Jesse James should be making some of it, right? I’ve got a whole row of bikes that are lined up and waiting for me to make tanks and fenders and exhaust systems for them.”

When Jesse builds a custom bike, he wants it to be a reflection of the person who ordered it. He refuses to duplicate what he’s already done for someone else. He spends time with the customer to find out what they like, and what they don’t like. Once he’s got a feel for what the customer is trying to achieve with the bike, he moves on to the design process.

Not everything West Coast Chopper produces is custom, though. The company also manufactures three production frames, several exhaust systems, an assortment of front and rear fenders, and myriad aftermarket accessories, such as air cleaners, belt guards, pulley covers, kickstands and handlebars.

While the wait for one of Jesse’s hand-built customs (if you make the list) is around a year – each one takes 500 to 800 man-hours to build – the production bits are available off the shelf, for those do-it-yourselfers who prefer to, well, do it themselves. Like the customs, the production parts are manufactured in-house to ensure everything meets Jesse’s exacting standards.

The manufacturing side of West Coast Choppers is a unique blend of old-world metalworking and high-precision CNC machining. Vintage Yoder power hammers,

bandsaws and drill presses sit just a stone's throw from modern Haas CNC machining centers and lathes.

Sheet metal and tubing for fenders, tanks and exhaust systems are painstakingly shaped by hand and sculpted to fit perfectly. Frames are carefully assembled and meticulously welded. Power hammers, grinders and saws produce a constant deafening roar. At the same time, the Haas CNC machines are busy churning out all of the components that require precision machining.

"Most people in the industry use flame-cut, plasma-cut bullshit," says Jesse. "Every part on our bikes that isn't hand fabricated is CNC machined – all the brackets, all the engine mounts, everything. You know, it's a lot more expensive to do it that way, but the quality's better. It makes a better end product. I think a bike should be fifty-fifty: fifty percent programmed and fifty percent made by hand. And I think if you can blend that mix, it's perfect."

Jesse didn't always feel that way about CNC, though. "I was resistant to it at first," he says. "I could run a Bridgeport really well, you know, turning both cranks at the same time [to create curves]. Some Swedish guys at Boyd's taught me how to do that, and I thought, Well, @#$%, I could just make that. But you can't; as much as you think you can, you can't. There's just some stuff that, you know, you can whittle on a manual mill and make by hand, but it's really not going to be the same. You're not going to get the nice curves, and perfectly indexed holes, and stuff that you can on the CNC.

"Working for Boyd [Coddington] kind of helped me understand how the CNC works – what it will do, what it won't do – which I don't think a lot of people understand," says Jesse. "And that's helped me to make cooler stuff."

Jesse also learned that buying used equipment could be more hassle than it was worth. "He [Boyd] always bought used machines and got a deal on them," Jesse explains, "but he was always @#$%&*' with them – all the time. You know, this one was down, that one was down. I'm like, You know what? I just want a new one that I can just make shit with and not have to worry about it."

The first CNC at West Coast Choppers was installed in 1998: a Haas VF-3 vertical machining center. That was followed by an SL-30 turning center in '99, a second VF-3 in 2000 and a VTC-48 vertical turning center in 2003. Jesse went with Haas, he says, "because they were a pretty good deal, and they're versatile, and if something goes wrong, you guys are, like, right there. They've been really dependable; they're workhorses."

Jesse knows how to run the machines, and has a bit of programming experience, but he's really more of a sheet metal guy and a welder. The CNC programming duties at West Coast Choppers are handled by Michael Warth, a skilled machinist with 18 years of experience running machines, and 12 years of experience programming them. His background is predominantly aerospace work – "I made C-17 parts, mainly," he says – with a heavy emphasis on 5-axis work prior to joining the crew at WCC.

Warth left aerospace because he was "aggravated with the 5-axis programming job," he says. "My boss didn't understand what was involved in it." He actually turned down the job at West Coast Choppers at first. "I was going to take another job," he explains, "and Jesse called me in on a Saturday and talked to me, and he says, 'Look, I really need you here; I need somebody that can do what you can do.' Okay, we'll try it. The rest is history; here I am."

It's proved to be a good decision on both sides. "It's a lot more relaxed here," says Warth. "It's a situation where I decide what is the best way to approach something, and how to design something. Whereas, in aerospace, you have a blueprint that gives you specifications that you have to hold. It's really fluid around here; you never know what you're going to get."

Which is exactly how Jesse likes it: "What we do mixes my skills, which are predominantly as a fabricator, with Mike's skills as a CNC guy, and blends them together."

The thing is, Jesse doesn't like his machined parts to look like machined parts – "I hate that '80s-lookin' billet stuff," he says. He wants them to look like they're sculpted out of metal, with smooth curves and complex shapes, and polished to a mirror shine.

And that's where Warth's skills as a programmer and an engineer come in. "Jesse will give me an idea – 'I want something that looks kind of like this' – and I have to look at what he wants and decide what's realistic," Warth says. "I try to get as close as I can between the artistic approach and the realistic approach. I have to try to bring the two things together and merge them into one."

Sometimes Jesse's ideas come to Warth in rather unusual forms.

"Usually, if Jesse draws it," says Warth, "it's just a rough sketch on whatever paper is available. I've gotten things drawn in black marker on a cocktail napkin. Sometimes he draws right on the tables out here, and I have to go out and look at the table, and then go back to the computer and design it . . . 'cause I don't have it on paper!" he exclaims.

Just because something looks bitchin' on paper, though, doesn't mean it will work in the real world – the laws of physics still apply. "If it's not strong enough," says Warth, "it will buckle and fold if we put it on a bike."

Warth's job is to make sure that doesn't happen, and his aerospace background and materials experience play a key role. "I work formulas out of the Machinist's Handbook, based on material strengths," he says. "I have an idea of how much horsepower comes out of one of these motors, how you can transfer it through the drive, and I just run it through the formulas. I make sure that I've got enough material and enough strength there to do what I think it's going to do, plus a margin of error."

"That's where knowing what the machines will do and won't do comes in," adds Jesse. "And having a clear knowledge of what the tool paths are. He and I go back and forth with dimensions and stuff like that."

Warth designs primarily in MasterCam, but uses SolidWorks for the more complex parts, such as wheels, or when designing linkages and assemblies. "In SolidWorks, you can build a whole assembly and make sure that everything moves the way it should," he explains. "The real simple production brackets and things like that, I won't mess with the solid, I'll just create a wireframe profile and derive a program and be done with

it. All of the wheels, though, I design in solid, because solids are easier to deal with, as far as manipulation of the shape.

"I probably do more one-off stuff than I do production," Warth continues, "because once I do a production thing, it runs and runs and runs, and I don't have to deal with it anymore. So, I spend probably 80% of my time designing and doing one-off parts."

Once the programs are written, they're downloaded to the Haas machines via Ethernet (except the lathe, which uses RS-232, because the programs are so small).

"The Ethernet cards are great," says Warth, "because I don't have to stop what I'm doing. The operators can get everything they want, whenever they want it. It's a lot less headache for everybody. They can pull the files right off my computer."

Having been on the receiving end of questionable programming, Warth is very conscientious about what he gives the guys who run the machines. "I've worked for programmers where you were scared to death to push the button, 'cause you didn't know what it was going to do. I try to keep that in mind when I write programs," Warth says. "These guys down here on the floor don't have to worry too much about it. They put the part on, they load my program and they run it. I think in two years, I've scrapped one part."

That's a good thing, because Jesse is always pushing the envelope with his designs and with what he wants to do with the machines. His latest project is machining some very unique wheels.

"Jesse, he likes to do things that nobody else does," notes Warth, "and for one of his bikes, he decided he wanted some wheels out of solid billet."

"They're carved from a solid aluminum block," says Jesse. "Fifty-eight hours of machine time."

"Nobody in the world makes solid billet wheels," Warth continues, "because of the cost. They're incredibly expensive before we even start."

At the time, West Coast Choppers didn't have the machining capability to turn the large chunks of aluminum, so they had to send the material to an outside shop for the lathe work. The results were disastrous.

"We started with two sets of material, enough for front and rear wheels for two bikes, and they messed both the front wheels up, and they didn't tell us," says Warth. "They blew the lathe work, and then laid this weld bead all the way around and re-machined it. When we had the wheels anodized, it showed up."

Considering the wheels were for a prototype concept bike for Honda, Jesse was not pleased. He told Warth to find a machine that would allow them to do the wheels completely in-house.

"We already had the Haas, so I started looking at Haas machines," says Warth. "Going through the catalog, I saw the VTC [the Haas vertical turning center, which has a 48" rotating platter and 50-taper live tooling], and I said: That's the machine we want right there. It will do the turning work, plus we can come in and machine it in the same rig. We don't have to move the part." The Haas VTC was installed in April of 2003.

The machining processes for the wheels differ slightly, depending on whether it's a front or a rear wheel. The rear wheel starts out as a 550-pound block of aluminum, and the material for the front wheel weighs in at about 330 pounds. The finished weight of the rear is about 58 pounds, and the front comes in around 48 pounds. "They're still pretty heavy," says Warth, "because of the shape and the profile we have. It's solid, and it's almost enclosed."

The front wheel is by far the easier of the two to machine. Everything is done using the 50-taper live tooling on the VTC. "Because I don't have to go that deep," Warth explains, "I can go with the live tooling, and I can machine that thing into a round – five-thousand rpm and we just go to town with it.

"The rear wheel, I've got eleven-and-a-half-inch stock," he says. "Try to mill eleven and a half inches deep! It doesn't work too well. So I go into turning on the rear wheel. I come in with an OD turning tool, and I just step it and turn it down to the diameter I want. It takes a hundred steps – a hundred cuts – to get there, but it does it great. Two hundred rpm, five thou' per rev – it takes a day, a day and a half, just to do the rough turning."

The wheels are rough machined first, and then sent out for heat treatment and stress relief. Then they're finish machined and polished.

Cycle times are measured in days, rather than hours. "The rear wheel – to machine one complete out of square material like we do – takes about 8 days on the machine," says Warth. "The front wheel takes about 5 days. It depends on the amount of 3D, and the amount of detail, but the style that we're running right now, that's about what they run."

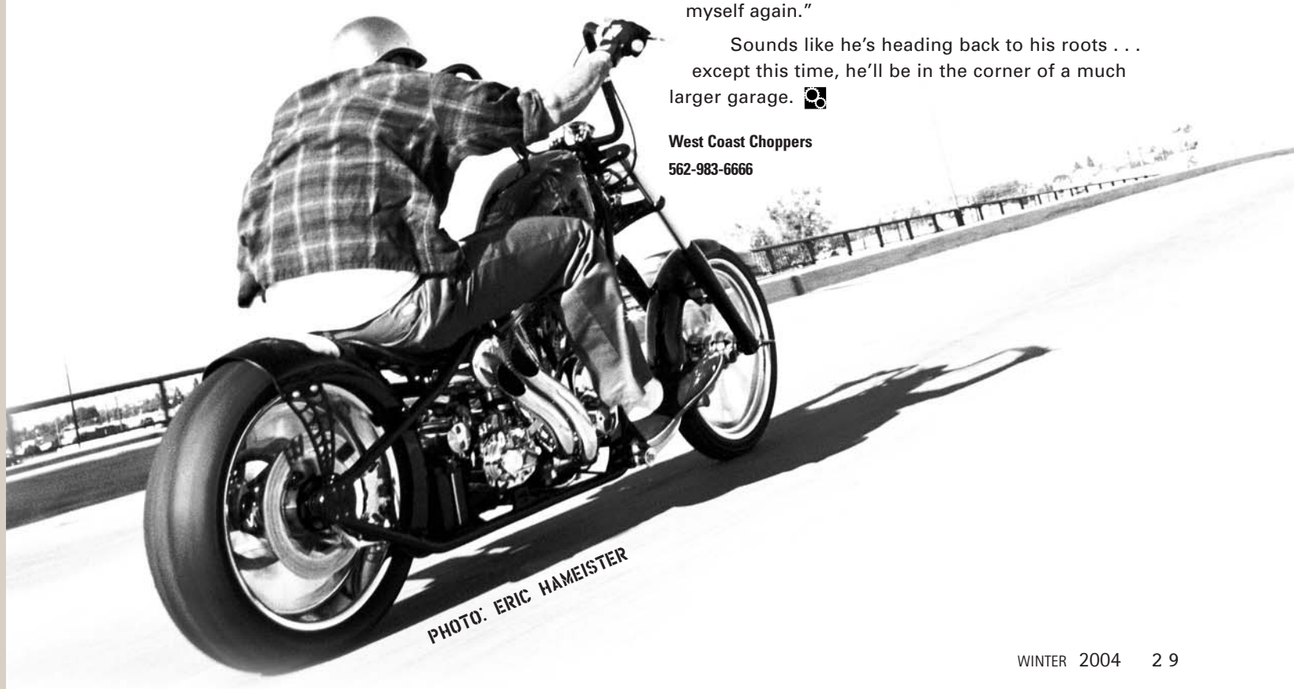
Although the VTC is a turning center, Warth prefers to use a mill post-processor for his programming; he makes extensive use of the Cartesian-to-polar interpolation feature of the Haas control. "It converts a standard X,Y program into X and rotary," Warth explains. "It converts it on the fly in the machine; I run that all the time. So that's a great feature for me, 'cause all I have to do is post it a little bit differently. I modified the mill post a little bit to put the codes out the way I wanted it to. It works great."

Don't plan on seeing a production version of the billet wheels any time soon, though. Jesse has no interest in high-volume manufacturing. "We make a few sets of each style, and then go on to something else," Jesse says. "I want to keep them cool, so I only make a couple of them. It just separates us that much farther, you know. I mean, there's not too many shops that are gonna want to put twenty-five-thousand-dollar wheels on a bike . . . but I will."

One of the definitions of the word outlaw is a person who refuses to be governed by the established rules or practices of any group: a rebel; a non-conformist. That pretty much sums up Jesse James, and it seems to be working for him. The success of West Coast Choppers is undeniable. The company is bursting the walls of the 18,000-square-foot building that has been its home since 1998, and business couldn't be better. And Jesse recently closed the deal on the 50,000-square-foot building across the street, so space won't be a problem much longer. "We're just going to split it up so everybody's got more space to work," he says. "And I'm moving my office, and my shop, and all my power hammers and fab stuff across the street . . . so I can be away from everybody and be by myself again."

Sounds like he's heading back to his roots . . . except this time, he'll be in the corner of a much larger garage.

West Coast Choppers
562-983-6666



GATEWAY to SUCCESS

IN the St. Louis area, the words "Ranken Technical College" are synonymous with "high-quality education." On the official side of things, Ranken is the only private, non-profit technical college in the state of Missouri that is accredited by the North Central Association of Colleges and Schools. On the practical side is the consistent fact that a degree from Ranken is a huge advantage when you're job hunting: 98% of Ranken grads land a position in their chosen field within six months of graduation.

Story Linda Dorr **Photos** Ranken Technical College

Ranken's calling card is two-sided: hands-on experience plus an old-fashioned work ethic. When you see the heading "Institutional Purposes" in a school catalog, you expect statements about educational excellence and well-rounded students. What may be surprising, though, is Ranken's Purpose No. 3: "To instill within Ranken students the work ethic . . . in demand by industry, including" a long list of such qualities as honesty, dependability, industriousness and teamwork. Add to this the fact that every program on campus requires up to 15 hours per week in a workplace situation, and you begin to understand why area businesses are so enamored of Ranken graduates.

The school's Precision Machining Technology (PMT) program, always highly regarded, came to a crossroads about three years ago. The machine shop had quite a variety of CNC equipment, and, says lead instructor Bob Arcipowski, "Each machine was a different brand, with a different control." When the department began considering a switch to Haas machines, "initially we were a little reluctant. We thought we were going to sacrifice the diversity of our students' exposure to different controls. What would happen to the skill level of our students?

"So we went to local industry," he continues, "to the companies that sit on our advisory board, and we asked them what they thought. And it was unanimous – companies that owned Haas machines and companies that did not – they all said, 'Do it.' They saw it as an opportunity for our students to get exposure to the newest technology. They said, 'You teach them good fundamentals; we can teach them our control. Teach them the new technology, and they'll bring that to our company and help us advance.' For them it was a no-brainer."

Hence, in the fall of 2001, it was out with the old and in with the new. Ranken became an official Haas Technical Education Center (HTEC), replacing its assortment of CNC machines with eight new Haas models, including five vertical mills, two lathes and a horizontal mill. The first order of

business, Bob notes, was "the learning curve for us instructors. It was a very short learning curve – we adapted very quickly to the Haas machines, so we knew the students would also."

For the instructors, it was pretty much love at first sight. "We were just in awe of some of the little, subtle things Haas does that are designed for the operator standing at the machine. Simple things like having an air hose hooked to the front of the machine. Most manufacturers don't supply them. We used to run an air line across the floor, hang it from the ceiling, something – it certainly didn't look professional. And on every machine prior to Haas, we had to have a garden hose hooked up for the coolant system. We had to do it all ourselves – buy the plumbing components, plumb it in ourselves, buy the garden hose, buy the nozzle. On a Haas it all comes with the machine."

The lack of diversity among controls went unlamented by all. "We found that we had been spending a tremendous amount of time teaching the specifics of the different brands," Bob says. The intimidation factor has decreased exponentially, too: "Students are able to just walk up to a machine, and the control looks the same – the buttons are all in the same place, whether it's a mill or a lathe, a vertical or a horizontal. So their initial response is 'I can handle this.' They can take off."

The quality of student projects improved dramatically with the advent of Haas technology. "We didn't even see that coming," Bob admits. "The quality of the parts they're producing is much higher than it was in the past."

A case in point is the team manufacturing project. This popular assignment, part of the PMT curriculum for several years, was featured in the October 1999 issue of *Technology Teacher*, the journal of the International Technology Education Association. The article concluded, "the degree of skill and workplace savvy [students] achieve at Ranken starts them on the road to becoming giants in their field."

"They said, 'You teach them good fundamentals; we can teach them our control. Teach them the new technology, and they'll bring that to our company and help us advance.' For them it was a no-brainer."

The task of each team is to manufacture a one-tenth scale model of one of the machines in the shop (four models, actually; one for each student and one for the school). "They start out with a tape measure, a pencil and paper," Bob says, smiling, "and some of them take it to a level we never would have guessed." While it's always been a requirement that essential moving parts have to be mechanically sound enough to work, the availability of the latest technology seems to be inspirational. "They put motors in them, they put batteries in the base – the spindles run on some of them. We didn't expect that much detail."

The first step in the team project is a detailed verbal proposal – what the team will build, the materials they'll use and how they'll build it. After they've sketched the machine and its dimensions, blueprints for each component are created in the CAD/CAM lab. Once the models are manufactured, students turn in a written report and make a verbal presentation. "We ask them questions like, 'If you had to make ten thousand of these, what would you do differently?' We try to give them the bigger picture," Bob explains.

Another goal is to address the manufacturing industry's image problem. The Ranken machine shop is not your grandfather's shop – it's not grungy, and it is high-tech. "We have 50 to 100 high-school groups touring the school every year, with 20 to 50 kids per group. We wanted students to walk in here and go, 'Wow!' We wanted to change their impression of manufacturing." Bob feels fortunate to have the support of the Ranken administration in this regard. The president of the college came by while the first Haas machines were being moved in, and, Bob relates, he offered suggestions. "He was concerned about better exposure, better presentation when you walk through the door – his approach was how to market this program. Some of his suggestions were great, but we didn't have the budget for it. So he said, 'Okay, let's take another look at this whole project' – and we ended up remodeling the entire shop, investing a significant amount of money." Not content to have won over the president, "We brought our Admissions reps down here and gave them a crash course – they produced parts on our CNC machines. I wanted them to fully understand what we do," Bob says.

The local Haas Factory Outlet (HFO), a division of NYMAT, also gets credit for helping create the professional atmosphere at Ranken. "They've been fantastic. From Day 1 they have been professionals. It's a pleasure working with them – when you request something, they respond. That's not the case with some other manufacturers," Bob says. "Partnering with Haas has helped change the image of manufacturing for a number of young adults who have come through our doors, whether they just toured the place or actually took the program."

Ranken doesn't require students in the PMT program to learn manual machines prior to learning CNC – if students enter the program with no background in machining, they learn manual and CNC simultaneously. And some students with no machine shop experience (but with a talent for machining) have, in their first semester, learned to write G and M code programs and to set up a machine, including tool offsets and setting up the part. Bob has had spirited discussions with other educators about teaching CNC to students who haven't learned manual machines. "Many people in manufacturing education say you can't do it – they say there's too much of a learning curve. A lot of people who have been in the industry for years will tell you that you have to be able to feel the machine by hand-cranking it; you have to understand what it's like to do that to be able to control the tool. Well, I'm sorry, but kids nowadays have grown up with computers, with video games, and they can do it. We're proving it can be done."

As an educator, Bob appreciates the fact that "Haas has allowed manufacturing educators to start networking. There's so much sharing of information that's just priceless to us. We wrote tutorials for each Haas machine, and one of the training instructors at the Haas factory put them on the website, so any Haas Technical Education Center can download them to use at their school. We've talked to other instructors who've said, 'We use this software to support our Haas machines, and it's great,' so we bought it. Networking has just helped us tremendously, and I really commend Haas for that. It's a great shot in the arm for manufacturing education."

It's all in a day's work – for Haas and for Ranken.

EMO continued from page 3

what turned out to be the largest and most successful Haas exhibition presence in Europe to date.

By the beginning of the show, most of the Haas Automation exhibition team had been away from the company's Oxnard, California, headquarters for 2 to 3 weeks. Some more. Fuelled by regular jolts of espresso and comforted by homely *cucina Italiana*, they were close to having honorary resident status. One or two had even started to dress Italian; most had acquired at least a smattering of the language.

On booth A06, in Hall 22 at Fiera Milano, the *lingua franca* depended on where you found yourself at any particular moment. In some quarters, warm French tones washed over functional English like café au lait. In others, authoritative Teutonic sounds mingled with the less familiar languages of Scandinavia, Eastern Europe and the Baltic countries. Wherever you were, the musical staccato of Italian was prevalent, loud and always accompanied by lively animation. This was the first time the seven Italian Haas distributors had come together sporting Haas colours. It was a debut worth getting excited about.

ITALIAN HOSPITALITY

The stunning 1,029-square-metre Haas booth displayed 23 Haas machines – many of them new to European markets, including the EC-300 and EC-400 horizontal machining centres, the long bed SL-40L CNC turning centre, two high-speed vertical machining centres – the VF-2SS and the VF-4SS – and a number of Haas Mini machines. In common with all Haas exhibitions, the machines were arranged to be as accessible to the public as possible, and were making chips from lights-on to lights-out.

In the centre of the booth was a hospitality area with an Italian-style coffee bar, where ever-attentive *baristas* in black and red aprons and crisp white shirts served cold drinks, hot cappuccinos and, at lunchtime, pasta and panini.

The booth was constructed in less than half the time normally allocated at other major manufacturing fairs, and brought together a daily average of around 100 Haas representatives and distributors from more than 20 European countries.

Thanks to their combined efforts, October closed as the best European sales month since the opening of HAE in February 2001, pushing the YTD sales figures to 50% over target!

The numbers were undoubtedly boosted by a huge, continent-wide mailshot in the weeks before the exhibition. All over Europe, hundreds of thousands of companies received an invitation to Italy – from the Iberian peninsula to the Middle East. The result was a response that the United Nations would have been proud of.

TEACH continued from page 3

<< Pictured from left to right: Chris Goodman, Guy Pizzino, Dave VanDyk, Ken Wright, Tobin Huebner, Fritz Smydra, Brad Bauer and Larry Shoemaker.

Wright's idea for the course came about because of his interactions with area instructors. "I found through conversations with teachers at the high school level, and even at the community college level, that the new technology in CNC is new to many of them," Wright said. "They purchased equipment to upgrade their respective programs, and now *they* needed to be upgraded, too! This wasn't just my perception – the teachers themselves felt the same way. So, with some help from our local Haas Factory Outlet, I developed this class."

One of Wright's teachers-turned-student is Fritz Smydra, who has been working with machine tools for 22 years. After more than two decades in the machine tool business, he appreciates the content of the seminar and what he will be able to bring back to his students at Lansing (MI) Community College. "It's good, usable material," says Smydra. "Sometimes you go to a class and it's 'nice to know' stuff, but this is 'need to know.' It's very application oriented."

The dedication of this group of teachers, who forfeited vacation time to learn more, is without question. Wright originally planned for the Monday-through-Thursday seminar to be held from 8 a.m. to 5 p.m. Monday's class concluded at 5:45, Tuesday's at 6:30 and Wednesday's at 8:45. "These people were there to learn," Wright said. "Also, to my knowledge, not one participant was being paid to be there. They gave up some of their summer so that they could go back in the fall and give students their best."

Wright's original outline planned to cover an array of Haas machines, including vertical machining centers and turning centers. Time limitations, though, allowed the class to learn only the material on the VMC. Basic elements of CNC were covered, and then the class proceeded to work on looping sub-routines and utilizing special canned cycles that the Haas control has resident. After Wright touched on thread milling – a new topic for this class – they moved toward the use and application of solid carbide cutting tools and cold forming taps.

At the end of the seminar, Wright passed out a survey to gauge positive and negative responses to the course, and to see if it would be something that teachers would want to attend again. Although the material came from an HFCC Intro course, a few thought the class was too advanced. Most, however, were happy with the results. "Overall, everyone was very pleased," Wright said. "The summation of their comments was that they wanted more next summer – not only on the VMCs, but also a separate class on the CNC turning centers."

Thanks to Ken Wright and HFCC, many students who headed back to classrooms last fall learned the new technology of Haas Automation's CNC machine tools through seven teachers. Next fall there will be even more.

the answer man

Dear Applications:

I want to use the G47 (Text Engraving) command for two different jobs. I'm having trouble getting the text placed exactly where I want it. On the first one, the specified start position is X0 Y0, but there is an X axis move before engraving takes place. The first character is an M, and the first line it does is an X0.2197 move. Why is this? On the other job I need to center the engraved text on the workpiece. What's the best way to do that? Thanks.

Lee Ward

Dear Lee:

Graphics mode and the single-block function are very useful for engraving jobs. Be sure that Settings 74 and 75 are both turned on.

The macro program for engraving allows a small amount of space before and after each character. The X0.2197 move occurs when the default size characters (1.0" tall) are being engraved. If you use a J value in the G47 line to change the size, you'll find that the spacing between characters is reduced or enlarged in proportion to the text size. To start the characters exactly at X0 Y0, run the program in Graphics to see what the first space allowed for the character size is, then program a negative X value in the G47 line. This will compensate for the initial spacing.

For the centered engraving, again, run the program in Graphics mode and in single-block. Start in the X0 position (on the G47 line) in your work offset. Take note of the work coordinate readings when the last character of your engraving has been completed. That gives you the exact length of the engraving. Subtract this from the width of your part, divide by two, and the result is your starting point on the X axis for perfect centering. Enter this X axis value in the G47 line. This will work with any size font.

Sincerely,
Haas Applications

• • •

Dear Applications:

Do you know of any PC-based G-code interpreters that closely match (or identically match) the Haas interpreter on the Mini Mills? We have many students learning to use the Haas machines. When they generate G-code (using Virtual Gibbs), the Mini Mill inevitably discovers errors with the code during screen pass. Rather than waste valuable machine time, it would be better to have students run a screen pass on the PC and make necessary changes. Does Haas offer such a utility? Do any exist elsewhere?

Adam Bowen

Dear Adam:

You have a couple of options. Haas offers low-cost CNC control simulators, which are popular items at a lot of schools that use Haas machines. In addition to proving out programs, simulators let students get familiar with the Haas control without taking up valuable machine time.

You can also use MetaCut Utilities, a very handy program for verifying tool paths. On the Haas website, www.HaasCNC.com, go to the **solutions/applications** menu, click on **Industry Links** and look under CAD/CAM Utilities. MCU offers a free 30-day trial.

Sincerely,
Haas Applications

• • •

Dear Applications:

I recently purchased a Mini Mill, as well as a new laptop computer in order to program (MasterCam) on the road and to drip feed. I was unaware that the new laptops are not equipped with serial ports for the RS-232 connection. Do you have some sort of adaptor to connect the serial port to the USB port, or can we use the 15-pin outlet on the computer?

Brian Reynolds

Dear Brian:

You can purchase a USB-to-serial-port cable from your local computer store. Be sure the software drivers supplied with the cable support your computer's operating system. This will add a serial communications port to your laptop. Once this is installed and working on your computer, you can connect a null modem cable between your Haas machine and the USB-to-serial-port cable. Make sure that the communication settings on your Haas match the ones on your computer.

Sincerely,
Haas Applications

• • •

Dear Applications:

When I'm using a G76 threading cycle on my Haas lathe, how do I distinguish between OD and ID threading?

Mike Barney

Dear Mike:

The way to distinguish between internal or external threads is by verifying the direction in which the tool is going to travel in the X direction. For instance, if the start point position has a larger value than the final dimension on the G76 line, then you will be cutting an external thread. If the start point is smaller than the final dimension on the G76 line, then it is an internal thread.

Sincerely,
Haas Applications

• • •

Dear Applications:

I have a VF-6 50-taper VMC with a 30+1 side-mount tool changer. Is there a way to advance the tool carousel to the next tool while machining? The tools are spaced quite a distance from each other, and it takes too long for tool changes.

Thank you.
Blaine Bowman

Dear Blaine:

Yes, you can easily speed things up. The Haas CNC control automatically "pre-calls" the next tool – unless your programming format stops it from doing so. If you have an M01 at the end of each tool, the Haas control will not pre-call the next tool without further information. We are going to assume you have an M01 at the end of each tool in your program. Option 1 is simply to remove the M01s from your program. Option 2, if you prefer to keep them, is to program the tool number (Tnn) of the next tool just after a tool change. Here's an example:

```
O00004 (Sample program)
T1 M06
G00 G90 G54 X1.5 Y1. S2000 M03
T10 (pre-call tool 10)
G43 Z1. H01
Z0
G01 G41 X0.3437 D01 F10.
Y0
G02 I-0.3437 Z-0.0625
G02 I-0.3437 Z-0.125
G02 I-0.3437 Z-0.1875
G02 I-0.3437 Z-0.25
G02 I-0.3437 Z-0.3125
G02 I-0.3437 Z-0.375
G01 Y-1.
G01 G40 X1.5
G91 G28 Z0
M01
M06 (tool 10 now loaded into spindle)
G00 G90 G54 X1.5 Y1. S2000 M03
T1 (pre-call tool 1)
G43 Z1. H01
Z0
G01 G41 X0.3437 D01 F15.
Y0
G02 I-0.3437 Z-0.0625
G02 I-0.3437 Z-0.125
G02 I-0.3437 Z-0.1875
G02 I-0.3437 Z-0.25
G02 I-0.3437 Z-0.3125
G02 I-0.3437 Z-0.375
G01 Y-1.
G01 G40 X1.5
G91 G28 Z0
M01
M06 (tool 1 now loaded into spindle)
M30
```

Sincerely,
Haas Applications

• • •

Dear Applications:

We have a new Haas Super Mini Mill. When I run a drill program, the coolant doesn't turn on until it gets to the second hole. It should turn on for the first hole, when it reads the line that has the M08 command, but it doesn't seem to be doing this. The machine seems to working fine otherwise. Any idea what the problem could be?

Lee Nines

Dear Lee:

There is a normal 2- to 3-second delay for the coolant to reach the nozzle from the tank. In your particular case, it would help if you turned on the coolant right after the tool change. Also make sure the coolant level in your tank is high enough. For your information, there is an optional high-pressure coolant pump available for your machine.

Sincerely,
Haas Applications

New Full-Function CNC Toolroom Lathe.

Small Package, Big Opportunity.

THE NEW HAAS TOOLROOM LATHE FEATURES: 16"x30" MAX CAPACITY

| MANUAL HANDWHEELS | 7.5-HP VECTOR DRIVE | 1,800 RPM

| USER-FRIENDLY HAAS CNC | SINGLE- OR THREE-PHASE POWER