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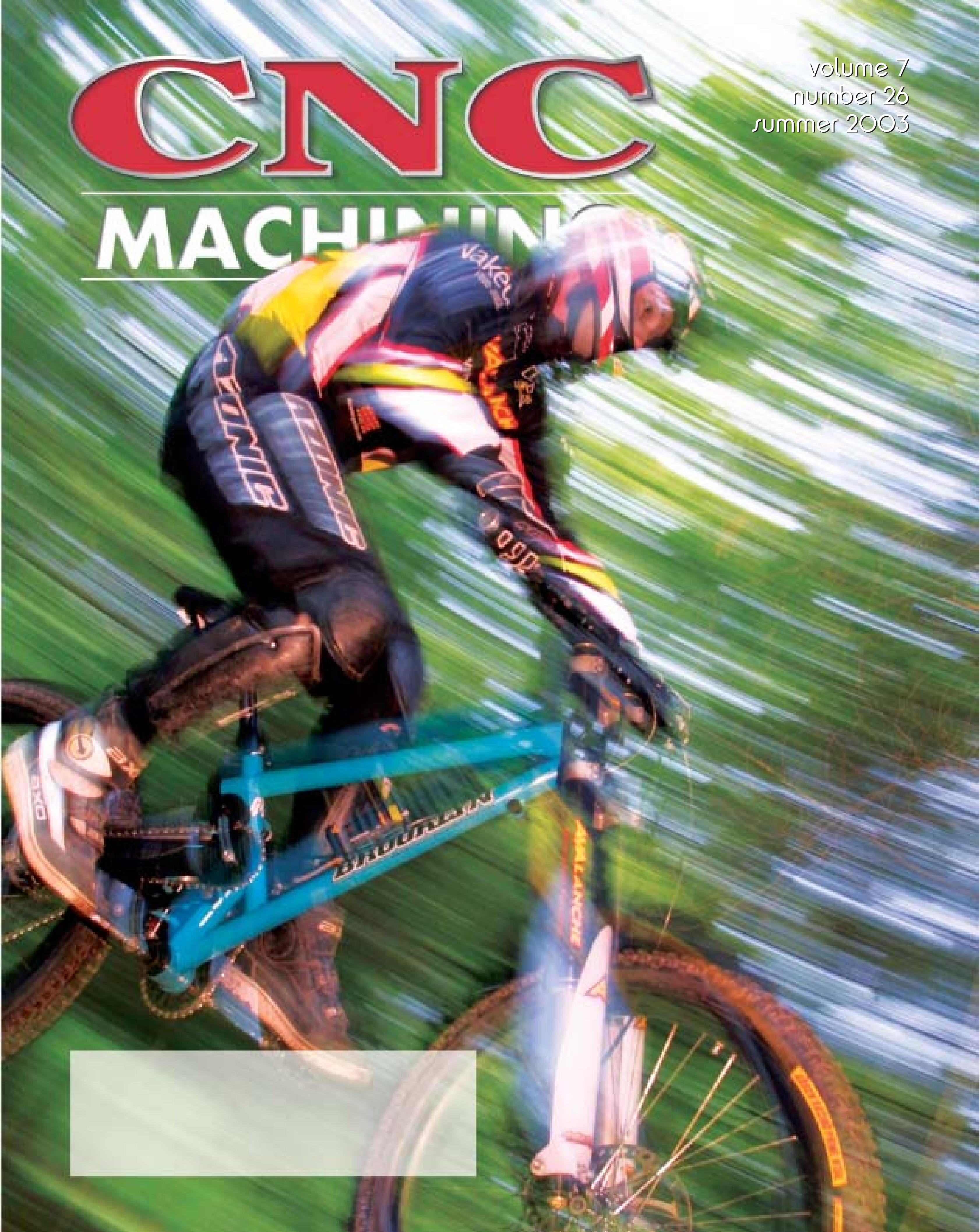


IN THIS ISSUE

About a year and a half ago, I received a call from a gentleman in Connecticut who had a bicycle he wanted to show me. He had machined some pretty high-tech suspension bits for it in his family's shop, and thought it might make a good story. Having a bit of an interest in two-wheeled transport myself, I agreed to have a look. We scheduled a meeting – he'd be in the area in a week or so, he said – and arranged to have the bike shipped out ahead of time.

The bike arrived a few days before the man from Connecticut . . . in pieces. Well, not in pieces really, just disassembled. We had agreed beforehand that I could assemble the bike myself – if I felt so inclined – or he would do it himself when he arrived. Never one to pass up an opportunity to turn a wrench – and wanting to save some time – I opted for the do-it-myself approach.

The bike arrived in a large, flat, hard-shelled case cinched together with heavy nylon straps. What I found when I opened the case was unlike any bicycle I had ever seen – it looked more like a small motocross motorcycle. It had a squat triangular frame of large-diameter tubing, a beefy tubular swing arm, a pair of alloy rims with wide knobby tires, disc brakes front and rear, and what looked like full-on motorcycle suspension.

This was no ordinary bicycle. It was a custom-built two-wheeled work of art designed specifically for downhill mountain bike racing. Hmm, there could be a story here, I thought. What intrigued me most was that the front fork and rear shock were, literally, just scaled-down versions of motorcycle components, complete with machined billet triple clamps, CNC-sculpted axle lugs, nitrogen-charged remote oil reservoirs and full adjustability. They certainly weren't the type of things you'd find at your local bike shop. Here was a shining example of applying modern manufacturing methods and existing technology to solve a problem in a different industry.

Maybe we all can learn from that. Many times, the solutions to our problems already exist. They may not be exactly where we expect them to be, and they may not be exactly what we're used to. They may even be from another industry, but they're out there – they just need to be applied. Why re-invent the wheel?

The man who called me about the bike was Eric Wold, the vice president of Wold Tool Engineering, a family-owned contract engineering company in rural Connecticut. For our cover story this issue, we'll show you how Eric combined his machining skills with existing motorcycle technology to develop a line of high-end suspension components for downhill mountain bikes. Wold formed another company – Avalanche Downhill Racing – to manufacture and sell the components. To give you some idea of how far mountain bikes have come since they arrived on the scene in the 1970s, we've also thrown in a bit of mountain bike history.

From the trails of Marin we head to Rockford, Illinois. For Abbott Plastics, the challenge was maintaining a balance between quality and output. We show you how their investment in new CNC equipment allowed them to increase production and reduce costs while improving the quality of their products and shortening delivery times.

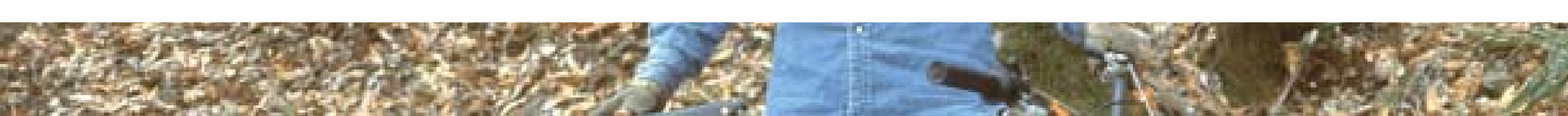
Then we venture south of the border to the third-largest city in the world – Mexico City – where, amidst the roiling masses of traffic and humanity, the John Crane Company is using five-axis technology to reduce cycle times and increase accuracy on precision parts for mechanical seals. They're using a dual-axis trunnion table on their Haas VF-5 to reduce setups and combine operations to speed their production.

Another popular method of speeding production these days is through high-speed machining. But as spindle speeds increase, toolholder balance becomes more of a consideration. At 10,000 rpm and above, even the slightest bit of unbalance can wreak havoc on a part's surface finish and accuracy. If left unchecked, it can even damage the machine. We contacted our friends at VibraSys, a company that specializes in vibration-measuring equipment and balancing machines, for an overview of what toolholder unbalance is, how it affects the part and the machine, and how to correct it.

For our education piece this issue, we visited Chippewa Valley Technical College in Wisconsin, where students are taught how to machine parts, rather than how to use a bunch of different controls. Again, it's a matter of balance; because once students master the concepts and processes – both on manual machines and CNC – they can apply them to any machine.

And there's more! You'll find a report on the latest Haas Demo Day, which showcased a variety of affordable production solutions, and a recap of the annual WESTEC show. Plus, there's the Race Report and Answer Man too. Be sure to check out the New Products section as well, for the latest information about new Haas machines coming off the production line.

It's another packed issue. So sit back, relax and enjoy!



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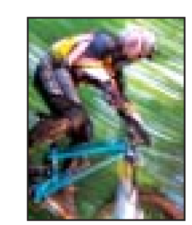

Eric Wold gets some airtime near his home in rural Connecticut. Wold is the co-owner of Avalanche Downhill Racing, a company that manufactures ultra high-end suspension components for downhill mountain bike racing and free riding.

Photo: Scott Rathburn

THE MASTHEAD

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This must be the bottom, right?

As a frequent business traveler, I visit many parts of the world. In my travels, you'd think I would have heard some good news about the machine tool industry. But alas, kind words are few and far between. Even though stock markets in the U.S. and other industrialized nations are recovering and holding steady – indicating economic improvement – sour news continues to plague the machine tool industry, with few exceptions. While I'm somewhat of a "mid-timer" to the industry (neither neophyte nor old-timer), my research shows that this is one of the few times in history that all of the traditional major machine tool markets have been subjected to suffering simultaneously.

The evidence is everywhere. The CIMT show in Beijing – which everyone was looking forward to, since China is now the largest consumer of machine tools in the world – was not as successful as expected, due to the emergence of SARS in the capital city. The show started off well, and some business *was* conducted, but the admission that SARS was indeed a health hazard in Beijing – an admission that led to the firing of Beijing's mayor and China's health minister – kept second-half attendance low. As a result, some of the show's marketing potential was lost. Add to that the travel restrictions imposed by SARS, and post-CIMT business likely will not meet anyone's expectations – but business in China will continue.

In Brussels, while visiting our European office, I was greeted with much the same malaise as I've encountered in the U.S. The German market is struggling, but statistics are few and out of date, so it's anyone's guess how bad the market really is. France continues to be riddled with strikes, harming any potential economic growth, and the Italian market appears to be struggling as well. As the big three go, so goes the rest of Europe. Thus, everyone in the industry is feeling the pain. Estimates of how much business is down vary from 15% to 50%. No one really knows.

There are some bright spots: There's a recovery in South America, and some of the Southeast Asian countries have finally worked through their currency crises of a few years ago. Unfortunately, these are traditionally small markets for machine tools, and they do not make up for the loss of business in the larger markets. Japan continues to protect its currency, and is trying to export its way out of deflation and the resultant recessionary effects. But, so far, all attempts at government intervention have yielded little benefit.

When will it end? If I could predict that, I would have foreseen the gains in the stock market and finally made some money – then I wouldn't have to stay in this business. Alas, being a mere mortal does not give me this insight, so like everyone else, I will continue trying to find business anywhere and everywhere – working harder for less, and remaining a member of the machine tool community. See you around.

Haas Shines Brightly at WESTEC '03

While WESTEC '03 was a slightly smaller affair than in some years, the show is still North America's largest annual manufacturing exhibition. In spite of a wavering economy and the war in Iraq, the Los Angeles Convention Center saw 600+ exhibitors and close to 21,000 attendees at this year's show, March 24-27. The Haas Automation booth was 50% bigger than usual, at just over 8,000 square feet of crimson carpet. There were 30 Haas machine tools diligently making chips – or fumes, in the case of the Haas Laser Systems. As always, Haas had the busiest booth in town: crowded, noisy and full of overflowing chip bins.

Since WESTEC is the Haas "home town" show, there are always new models making their spring debut – and '03 was no exception. Booth visitors checked out prototype machines such as a small-footprint yttrium fiber laser system, a toolroom lathe with full CNC control, and an innovative line of pallet-changing horizontals. There was plenty of interest in the production machines as well: Sales leads were up more than 40% over last year, a trend also noted by other exhibitors.

The Haas trade show department continued to work its way throughout the spring season, at shows large and small, domestic and international. While summer is providing a much deserved rest, next fall's EMO in Milano, Italy, is already on the radar.

Productivity Demonstration

Improving productivity without straining the budget is sound practice in the best of times – and in today's economy, it's a necessity. Haas Automation, long a productivity provider for shops of all sizes, recently hosted Demo Day 4, "Affordable Production Solutions." On June 11th, Haas showrooms all over North America held an open house with a focus on the many high-productivity Haas machines and options. There were live demos running all day in every showroom – including the Demo Room at Haas headquarters in Oxnard, California, where visitors from a wide range of area businesses were in attendance.

Among the machines featured were the VF-2TR, -5TR and -6TR, which come equipped with a dual-axis trunnion table that provides simultaneous 5-axis motion. The Haas Super Speed VMCs – the VF-2SS & VF-4SS – offer a 12,000-rpm spindle, ultra-fast tool changer (1.6 seconds tool to tool) and 1,400-ipm rapids. Bar feeders, an automatic parts loader and pallet changers were among the high-productivity options demonstrated, and the Haas Z series laser systems – ZM-100, Z3-500 and Z4-500 – turned out a variety of high-tolerance parts. There were also technical seminars, refreshments and the opportunity to examine demo parts ranging from flanges to bone saws.

"Demo Day 4 was our best ever," reported one distributor. "People are looking for ways to get the most out of their equipment, and they pay attention to what Haas can do for a return on investment." Haas sales manager Bob Moraga noted that, nationwide, "These were very successful events. They were well attended, and we had a lot of students – they're always interested. And that's really our future."

For a complete 2003 Trade Show Calendar head over to http://www.haascnc.com/news/trade_show.asp

RACE REPORT

The NASCAR Winston Cup Series is no place for the weak of heart – or a slow car. The competition is fierce, and every race pits 43 drivers against each other with a single goal: to win. If you don't have a car that can run fast, you're going to end up at the back of the pack, and that's where the trouble is. Imagine trying to pass slower cars, while faster ones are bumping you from behind. It doesn't take much to send your car spinning out of control and into the wall. That's the kind of the year that Jack Sprague and the Haas CNC Racing team are having.

Sprague's rookie year in the Winston Cup Series has been marred by slow cars, accidents, rain and just plain old bad luck. A case in point is the Pontiac Excitement 400 at Richmond International Raceway. The three-quarter-mile oval is like racing on a crowded freeway. There isn't a whole lot of room to race, and it's even more difficult when your car isn't co-operating. Sprague started at 29th, but the No. 0 NetZero Pontiac was too loose and sliding all over the track. A bump by Kyle Petty caused Sprague to spin out, and allowed the rest of the cars to pass him by. Sprague managed to get back on the lead lap, only to be bumped twice more, and sent spinning in a cloud of smoke. "I felt like a pinball out there," Sprague said, after finishing 26th. "We got hit everywhere by everyone. If we could have just had a little luck, we might have had something tonight."

In April, the Haas CNC Racing team named Tony Furr as crew chief, replacing Dennis Connor. The change resulted in faster qualifying times almost immediately. Sprague qualified 14th at Martinsville, 12th at California Speedway and a season-best 5th at Lowe's Motor Speedway. But even starting out in front hasn't helped Sprague. At California Speedway, the car was loose right from the start. Sprague hit the outside wall on lap 8 and finished the race in 39th place.

In the Coca-Cola 600 at Lowe's Motor Speedway, Sprague had one of his fastest cars of the year, but things once again went awry. Some loose parts bouncing along the track managed to find Sprague's front tire, causing a flat. The pit crew replaced the tire, but Sprague was unable to regain the lost laps before rain ended the race with 124 laps remaining.

Sprague is 37th in the Winston Cup Series standings after 14 races, and 4th in the Rookie of the Year competition.

Hendrick Motorsports

The Hendrick Motorsports teams had a great start to the 2003 Winston Cup season, as three of the four teams have already visited Victory Lane. Jeff Gordon won at Martinsville in April, after capturing the pole in qualifying and then holding off Bobby Labonte for the checkered flag. It was Gordon's 4th victory at Martinsville, and his 14th from pole position.

With 14 races down, Gordon is 3rd in the NASCAR Winston Cup Series standings, while teammate Jimmie Johnson is in 7th place.

There have already been 11 different drivers who have visited Victory Lane this season in the Winston Cup Series, and one of the surprises had to be Joe Nemechek winning the Pontiac Excitement 400 at Richmond. It was Nemechek's first victory since November 4, 2001, and the first for the No. 25 team since November 2000. Nemechek is 18th in the series standings after 14 races, with one win, one top-5 and three top-10 finishes. Hendrick teammate Terry Labonte, who also has one top-5 and three top-10 finishes, is 17th in the points with 14 races down.

Jimmie Johnson felt right at home in the No. 48 Lowe's Chevy as he won back-to-back races at Lowe's Motor Speedway in May. First, he held off the best of the best to win The Winston and its one-million-dollar first prize, and then he found himself in the lead at the Coca Cola 600 when rain forced NASCAR officials to end the race. It was the third race this season ended early by rain. Johnson's back-to-back victories marked only the fifth time in NASCAR history that a driver has won both The Winston and the Coca Cola 600.

Busch Series

Things couldn't be better for Hendrick driver Brian Vickers and the No. 5 GMAC racing team. After claiming his first top-5 finish of the year at Gateway International Raceway, Vickers came back to take a career best, and season best, second-place finish at Nazareth. After 15 races, Vickers is 5th in the Busch Series standings.

Hendrick Motorsports seems to have a knack for discovering the best young drivers in the country. Several years ago they groomed Jimmie Johnson for success, and he is already one of the top drivers in the Winston Cup Series. It seems that Kyle Busch, 18, is on the same path, after taking 2nd place in his Busch Series debut. Busch, who is the younger brother of Cup driver Kurt Busch, led 33 laps in the CarQuest 300 at Lowe's Motor Speedway. Busch has started four events with Hendrick and sponsor ditech.com, winning two of three ARCA Series races in addition to his second-place Busch Series debut.

The Haas CNC Racing team had planned to run three races in the Busch Series this year with Troy Cline behind the wheel, but the No. 79 Haas Automation Chevy was only able to qualify for two races. The team decided to end its run on the Busch Series and concentrate on the Winston Cup Series. Cline finished in 27th place at California Speedway in April and in 38th place in the Hardee's 250 at Richmond in May.

Falcon Cars

Falcon Cars, the third approved chassis manufacturer for the 2003-05 generation of Indy cars, was unable to find a team willing to try out its new chassis in the 2003 Indy Car Series, but the company hopes to find a team willing to test their chassis this year.

"The current business climate and lack of sponsorship impacted almost every team that didn't already have their contracts in place for this season," said Falcon Cars president Michael Kranefuss. "And those teams currently not in action were our target market. We made every effort to entice them to run our chassis, but we knew it wouldn't be easy to convince any race team to commit to Falcon Cars. Understandably, the perception of being an unproven entity prevented current top teams from making commitments. But we still believe our design is innovative and competitive. I'm convinced we can have a future if we find a team willing to take a chance on us," said Kranefuss.

J & B Motorsports

J&B Motorsports had a great weekend at the Route 66 Raceway in Joliet, Illinois, as the NHRA Top Alcohol Funny Car finished in second place. Driver Paul Lee qualified in fifth place and then eliminated Kirk Williams in the first round with a top speed of 251.34 mph. In the second round, the J&B funny car slowed a bit, but Lee's better jump off the line enabled the team to hold on for victory. In the final round, Lee faced off against Jeff Craig, who was running faster than anyone over the weekend. The J&B team made a few adjustments and went to the line to try for the upset. But the car didn't like the changes and shook hard on the launch, forcing Lee to shut down.

In May, Lee advanced to the quarterfinals of the K&N Filters SuperNationals in Englishtown, New Jersey, by defeating Jason Rupert in the first round. But he was eliminated in the quarterfinals by Bob Newberry, who overcame a slow start to pass Lee by the halfway mark.

New Equipment helps Abbott Plastics stay Competitive

Story & Photos Scott Weersing

Improving quality while increasing output is a never-ending challenge. The dilemma is that high-quality commodities often take too much time to produce. One way to meet the challenge is by investing in precision, high-yield equipment, but how does a company justify new capital expenditures in a depressed economy? For Abbott Plastics, the answer was simple – by replacing inefficient CNC machining centers with modern, new equipment, the machines would pay for themselves.

Abbott Plastics, an ISO9001/2000 certified company, was founded in Rockford, Illinois, in 1980, as a distributor of industrial plastics. As manufacturing grew in the area, Abbott expanded its services to include the production of plastic parts. "We have a diverse customer base, ranging from manufacturers in the food industry to aerospace," explains co-owner Robert Nelson. "Our customers need machined plastic parts, because molding them is either too expensive or not accurate enough."

Abbot initially used manual mills and lathes to machine the plastic parts. Then, in the early 1990s, the company purchased its first CNC equipment. The CNC machines improved quality, but didn't have much capacity, and over the years, as demand increased and competition grew, the lack of capacity made it difficult for Abbott to meet delivery schedules.

"We were looking to upgrade our existing equipment to become more competitive," says Britt Anderson, who oversees the machine shop. "From my previous experience as a shop owner, I found that Haas gave me the best value for the dollar. There were a lot of machines at the same price and capacity, but when I asked people about their machines, they weren't happy with the service they were receiving. From my experience with Haas, I knew that service and reliability would never be an issue."

Abbott purchased a Haas VF-4 vertical machining center in 2001, and then added a VF-3 and another VF-4 a year later. "We replaced four older machines with three Haas machines, and we still increased our capacity," says Nelson. "The Haas machines increased our product flow and improved our quality by weeding out inefficiencies."

Even with the increased capacity, however, Abbot still was unable to bid on certain jobs. Plastic comes in all different shapes and sizes, and Abbott had been doing a brisk business cutting parts out of flat sheets. But the one router they had was limited by its size and difficulty of use. "We needed another router to keep up with the demand," says Nelson. "We had one that was four by eight feet, but we thought we could do more if we had a bigger machine."

Abbott didn't have to look far to find the right machine. They saw the Haas GR-510 Gantry Router at IMTS in Chicago, and liked what they saw. "It was the machine we needed, and we took delivery of one soon after the show. Then we had to work fast to get the machine up and running, because we'd already promised people products," says Anderson.

"The gantry's five-foot-by-ten-foot table is perfect for us, because the plastic sheets come in ten-foot-long pieces," says Nelson. "We were trying to machine ten-foot sheets on our other router, and it took a lot of extra time and effort.

Give people the right equipment and they often become better, more productive employees. That has definitely been the case at Abbott Plastics. "Our ability to machine parts has improved because of the Haas machines. The guys in the shop have gone up two tiers in their knowledge and their ability to machine parts," says Anderson. "Everyone has become a better machinist, because we all feel really comfortable with the Haas machines."

With the GR-510, we've eliminated the waste of time and materials."

Training on the new machine was fast as well, notes Anderson, because the GR-510 has the same user-friendly control as the other Haas machining centers in the shop. "Our other router has a PC-based control," he says, "and I only have one guy who can run it; it's an animal of its own. But the GR-510 has the same control as our other Haas machines, so now I have five different guys who can run it."

The machine's rigid tapping feature was another benefit to Abbott Plastics. "We now run parts on the Gantry that previously we could only run on one of the mills," Anderson says. "We can do parts on the GR-510 that we never would have thought of running on our other router."

Nelson agrees, adding, "When you have a machine with capacity like this, you start thinking of all the different things you can do to save time. It has given us the capacity we need, and allowed us to look at work that we couldn't have been competitive on a year ago." Abbott has used the GR-510 to cut plastic sheets up to 4 inches thick, and is already looking for more ways to use it.

By investing in new equipment, Abbott Plastics not only increased their productivity, but also reduced labor costs, allowing them to keep prices competitive despite increased material costs. With their old machines, says Nelson, "we had 20 people on two shifts. Now, we no longer require a second shift. We have fewer machinists in the shop, and yet, we're still getting more output. We've done studies where we look at how much time it used to take us to run a job, and we compare it with how long it takes now on the Haas machines," Nelson continues. "We've had a sixty percent increase in productivity over the other equipment."

Quality has improved as well, says Anderson. With the old machines, "We discovered that the guys were taking shortcuts to meet production deadlines, because they couldn't get the machines to do what they needed. Now, the Haas machines are able to do what we need, and with better accuracy. We used to have to do a final inspection on parts, but the Haas machines are so accurate that we've eliminated the final, and now we just use in-process inspections."

Give people the right equipment and they often become better, more productive employees. That has definitely been the case at Abbott Plastics. "Our ability to machine parts has improved because of the Haas machines. The guys in the shop have gone up two tiers in their knowledge and their ability to machine parts," says Anderson. "Everyone has become a better machinist, because we all feel really comfortable with the Haas machines."

As a result, Abbot is better able to meet production schedules and respond quickly to emergencies. "Our deliveries are much better since we purchased the Haas machines," says Nelson. "We usually take about three weeks, but if someone requests something special, we can turn it around in a day."

With the capacity problems solved on the milling side of things, Anderson looked next to replacing one of the shop's turning centers. "We needed the capacity to run larger diameter parts without the need to chuck blanks," he explains. "We were wasting a lot of time and material with our old lathe, because we had to cut blanks and load them individually." A Haas SL-30 lathe with Big Bore option and tailstock solved the problem. The Big Bore option increases the normal bar capacity from 3 inches to 4 inches, while the tailstock provides support for longer pieces of plastic. "Now, we can run jobs from a continuous length of rod up to five feet long," Anderson says.

Now that Abbott Plastics has invested in the right machine tools and is reaping the benefits of increased capacity, superior accuracy and better machinists, the company continues looking for additional ways to maintain a competitive edge. "I just finished taking a manufacturing course on Six Sigma, and the goal is to improve processes. So I'm trying to spread that thinking around the shop," says Anderson.

Abbott Plastics
815-874-8500


Photo: Scott Rathburn

Balancing Considerations for High-Speed Machining

Story Stephen J. Reimann

High-speed machining has become a fact of life for many machine shops today. In industries such as moldmaking and aerospace, it has become the norm rather than the exception. One clear benefit of this trend is greater efficiency and productivity through increasingly higher spindle speeds. As spindle speeds continue to increase, the potential for adverse effects on the machine and the workpiece due to vibration increases exponentially, because centrifugal force increases with the square of the speed. One of the major contributors to vibration, and the easiest to control, is unbalance.

WHY BALANCE?

Vibration in a spindle has many well-known effects on the machining process. The most obvious is chatter. One common reaction to chatter is to reduce the spindle speed, which of course reduces the capability of the machine. On the workpiece, the principal effect is poor surface finish and the inability to hold close tolerances. On the machine, you will get poor tool life and, ultimately, spindle and bearing damage. Since all spindles are balanced to appropriate levels, the remaining source of unbalance, which will cause the vibration, is the toolholder and tool. For high-speed applications – defined as 10,000 rpm or higher – balancing these components will reduce the vibration and improve process performance as well as workpiece finish. The impact is so significant that many machine manufacturers require balanced toolholders as a condition of the warranty.

UNBALANCE DEFINED

Unbalance is defined as “ . . . that condition that exists in a rotor when vibratory force or motion is imparted to its bearings as a result of centrifugal force.” Unbalance is caused by an uneven distribution of mass around the axis of rotation of a rotating body. In some cases, unbalance is inherent in the design. For example, the drive slots on CAT type toolholders or set screws in some milling holders are non-symmetrical. Other sources include irregularities, such as voids and porosity in the base material, and manufacturing tolerances. Unbalance comes in three forms: static unbalance, couple unbalance and dynamic unbalance.

Static unbalance arises when the principal inertia axis (mass axis) is displaced parallel to the axis of rotation (see fig. 1). It can be compensated for by either adding or removing material equal in weight to the unbalance amount in a single plane, perpendicular to the axis of rotation.

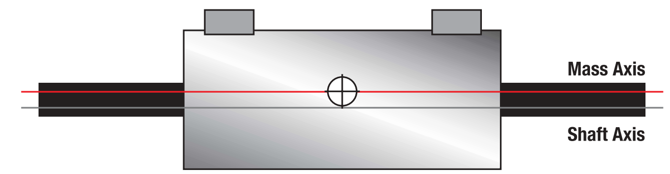


figure 1

Couple unbalance exists when two equal unbalance masses are positioned exactly 180° apart in two planes perpendicular to the axis of rotation. This causes the principal axis of inertia to displace, not parallel to, but intersecting with the axis of rotation at the center of gravity (C.G.) of the part (see fig. 2).

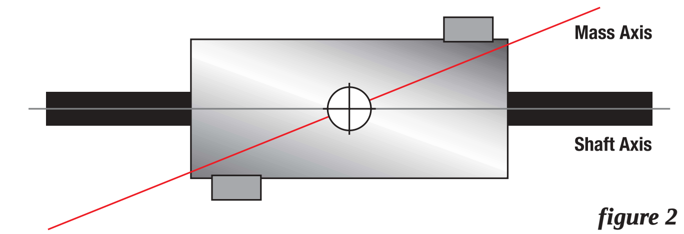


figure 2

Dynamic unbalance is the most commonly occurring type of unbalance. It is the combination of static and couple unbalance. It causes the principal axis of inertia to deflect from the rotational axis both non-parallel to it and not intersecting with it at the C.G. (see fig. 3). Dynamic unbalance can only be corrected in two planes by adding or removing material.

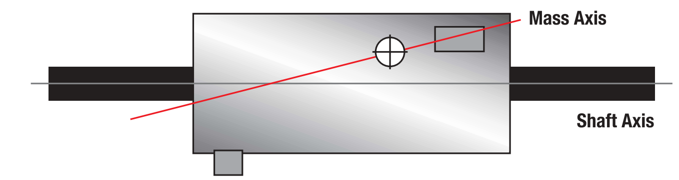
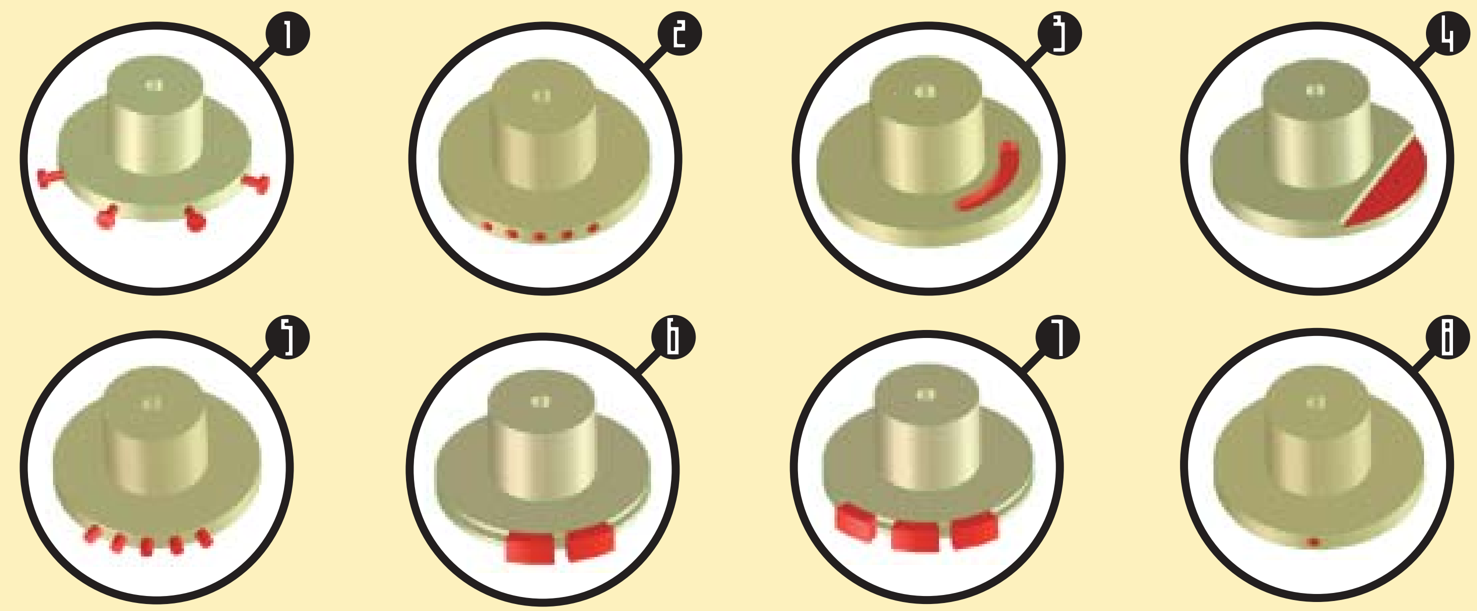


figure 3

PROGRAMS FOR CORRECTION ON ONE OR TWO PLANES



1) Correction by radial components 2) Drilling in fixed position 3) Contour milling 4) Face milling 5) Correction with screw on dedicated tapped holes 6) Correction with two displaceable masses 7) Correction with three displaceable masses 8) Drilling in free position

CORRECTING TOOLHOLDER UNBALANCE

In general, unbalance can be corrected by removing material at the "heavy spot" or adding material 180° from it. Several variations of these methods are used for toolholders. Balanced toolholders can be purchased from many manufacturers of toolholding devices. As the name suggests, these are pre-balanced at the factory, generally by material removal. Obviously, only the holders are balanced. Once a tool is added, the unbalance condition in the assembly changes, and re-balancing will likely be required. In fact, every time the tool is changed, balancing should be performed. To rebalance using material removal methods would prove to be disastrous after a few attempts. So much material would be removed in many different locations that the toolholder would become useless.

To overcome the above problems, and to simplify the balancing process, balanceable toolholders are also available from many suppliers. These devices make it possible to rebalance the tool and toolholder assembly every time the tool is changed. The common element in the different designs that are available is the ability to add or remove mass easily without drilling or grinding away the material. One method uses tapped holes equally spaced around the circumference of the toolholder. Depending on the design, set screws, lead balls, or other weights are added (or removed) to correct the out-of-balance condition. Another balancing approach is one that uses adjustable fixed weights. With this technique, the weights are already present in the toolholder and only have to be repositioned to add or subtract vectorially to compensate for any given amount of unbalance that is present.

Balanceable toolholders come in single-plane and two-plane versions, although the single plane is more common. Similarly, balanced toolholders are available pre-balanced in one or two planes. Many manufacturers, however, will balance the holders statically (that is, correct the unbalance in a single plane) but audit dynamically to make sure they are capable for all applications.

WHAT TYPE OF TOOLHOLDERS?

There are several practical issues surrounding the question of when to use balanced or balanceable toolholders. One of the issues is obviously cost. Balanced toolholders are more expensive than non-balanced, and balanceable toolholders are the most expensive. However, the technical issues should override the short-term cost concerns. If balancing (of any kind) is not considered solely on the basis of the cost of the toolholder, and balancing is in fact required, the ultimate cost will be much greater. This will lead to out-of-specification parts, extensive downtime of the machine, and possibly significant cost to replace bearings or a very expensive precision spindle.

Although 10,000 rpm is generally considered the threshold for the balancing of toolholders, other variables also determine whether balancing is required. These include the size and shape of the tool and toolholder. For example, a simple half-inch endmill in a CAT 40 toolholder at 12,000 rpm would generally be okay with a balanced toolholder, because the endmill itself would not contribute much variation in unbalance. On the other hand, a long boring bar in a CAT 50 holder might require balancing at 5,000 rpm.

To summarize, there are three decision-making levels: to balance or not to balance; balanced vs. balanceable holders; and single-plane or two-plane balancing. For most applications, 10,000 rpm is still the threshold at which to consider balancing. For small, relatively simple tools such as endmills and drills, balanced toolholders will suffice up to about 15,000 rpm. Above 15,000 rpm, the force generated by even the small amounts of unbalance created by endmills and drills will generate enough force to negatively affect the machining process, so balanceable toolholders will be required. Furthermore, at speeds below 20,000 rpm, only relatively long tools will require two-plane balancing. Above 20,000 rpm, two-plane balancing should be considered for all applications. Remember, these guidelines are suggestions only. For your specific requirements, you should discuss the balancing aspects with a toolholder or balancing specialist.

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BALANCE TOLERANCE

Like other machining processes, toolholders are balanced to a tolerance. In North America, the convention is to balance to what is known as ISO Quality Grade G2.5. Briefly, this means the toolholder balance is consistent with the spindle as recommended by the International Organization for Standardization. The actual value is a function of the weight of the assembly and its maximum rotational speed. This value can be easily calculated, or determined by the balancing machine.

BALANCING MACHINE CONSIDERATIONS

Once you have determined that your application will require balanceable toolholders, you must select a balancing machine with the proper features for you. There are a number of machines available that are designed specifically for balancing tools and toolholders. They come in a variety of styles with a wide selection of features and options. Before choosing the machine that best meets your requirements, you must determine the entire range of your application. The first question you must address is if you will need single- or two-plane balancing. It is important to note that a two-plane balancing machine is capable of single-plane and two-plane balancing, but a single-plane balancing machine is only capable of single-plane balancing. Most toolholder balancing requirements today are single-plane applications. However, even if you only have one toolholder that needs two-plane balancing, you will need a two-plane machine. With spindle speeds continuing to increase, your next machine may have a 20,000-rpm spindle instead of the 15,000 rpm you have today. Because of the relatively low cost differential between single- and two-plane machines, a two-plane machine is usually the best choice.

Flexibility and ease of use are critical elements. For these reasons, "hard bearing" technology is advantageous. This means the machine is permanently calibrated from the factory, and calibration is not required for every different toolholder. This provides the simplest operation and the most reliable results.

Next, make sure the balancer has provisions to handle all of the correction methods that your toolholders have. For example, for balls or set screws, it should have a "weight splitting" program. If you are using adjustable weights, make sure the balancer will precisely calculate where to move the weights.

There are a number of other features, as well, that could be important for your application. Among these are rotor memory storage, which allows you to save the setups for frequently repeated parts; an angle locating device, using an encoder or laser for example, which simplifies locating the angle of unbalance very precisely; a tolerance indication, so the operator will know to stop balancing when the tolerance is achieved; and a printer, to have a hard copy record that the assembly has been balanced.

SUMMARY

Many manufacturing operations today demand the use of high-speed machining. At spindle speeds above 10,000 rpm, balancing of the tool and toolholders must be considered to preserve the integrity of the work and protect the investment in the equipment. For some applications, balanced toolholders will provide a sufficient level of balance quality. For optimal results, balancing should be performed with every tool change. This requires balanceable toolholders and a balancing machine.

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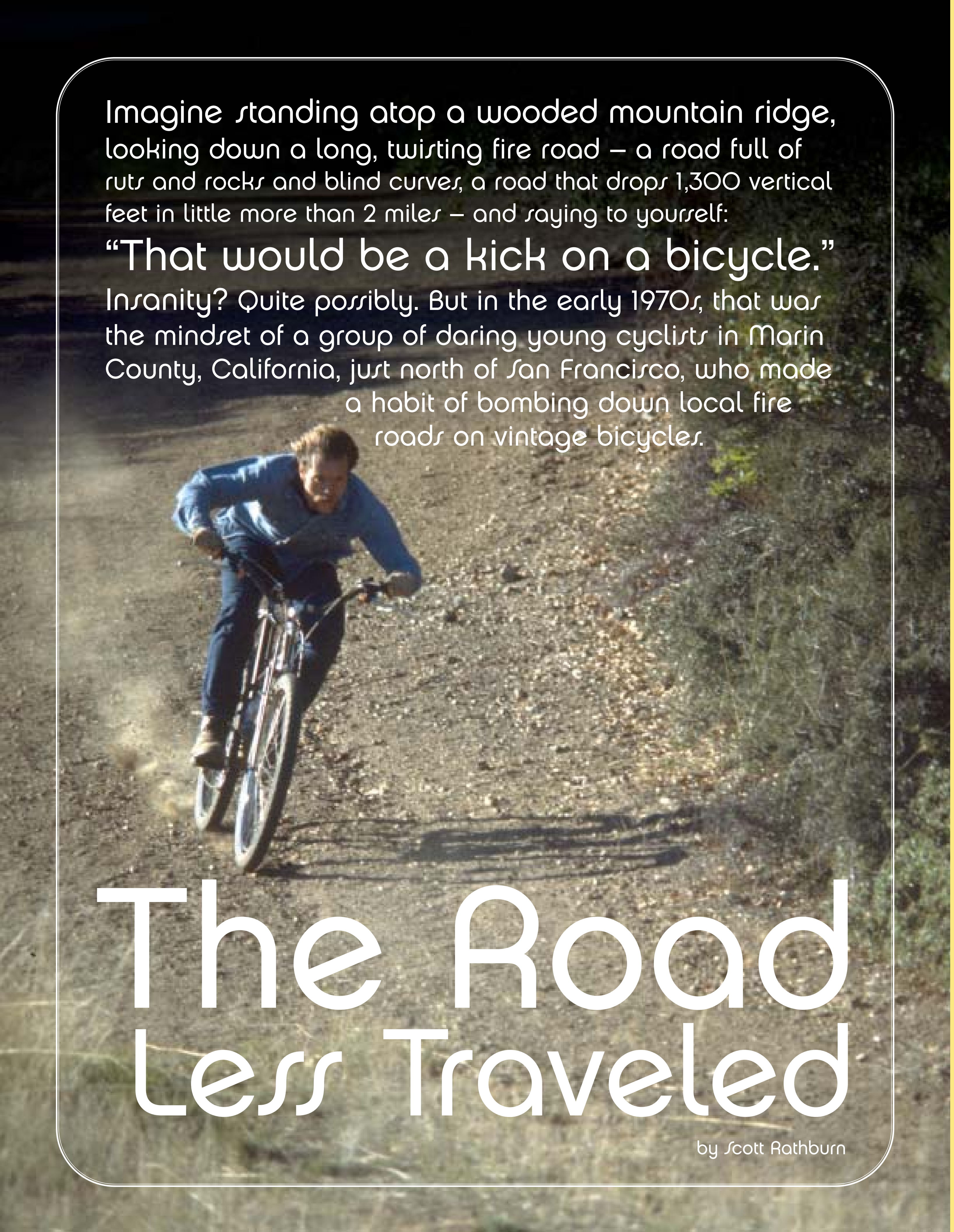


Imagine standing atop a wooded mountain ridge, looking down a long, twisting fire road – a road full of ruts and rocks and blind curves, a road that drops 1,300 vertical feet in little more than 2 miles – and saying to yourself:

“That would be a kick on a bicycle.”

Insanity? Quite possibly. But in the early 1970s, that was the mindset of a group of daring young cyclists in Marin County, California, just north of San Francisco, who made a habit of bombing down local fire roads on vintage bicycles.

The Road Less Traveled

by Scott Rathburn

Looking for new thrills and a change of pace from riding the local roads, these avid cyclists took to the wilderness on single-speed bicycles with balloon tires and coaster brakes – usually old Schwinns from the 1930s and ’40s. They’d ride or push these 45-plus-pound beasts – affectionately known as clunkers, ballooners, bombers, fatties or fat-tire flyers – up the hills, then blast down the treacherous slopes at death-defying speeds . . . just for the thrill of it.

Despite the seeming madness of this behavior, the clunkers of Marin were not alone in their antics. About 75 miles to the south, another group was doing much the same thing in the hills around Cupertino. Dubbed the Morrow Dirt Club (after the Morrow coaster brakes typically found on their fat-tire bikes) the Cupertino riders took their ballooners a step further by grafting on 10-speed derailleur gearing, thumb-activated shifters, drum brakes, motocross handlebars and motorcycle brake levers. These modifications enabled members of the Morrow Dirt Club to ride up hills, as well as down.

Surprisingly, given their geographic proximity, the two groups continued their two-wheeled adventures completely unaware of each other’s existence for some time. It wasn’t until December 1, 1974, at the West Coast Open Cyclo-Cross Championships in Mill Valley, California, that the clunkers of Marin and the Cupertino riders crossed paths.

Cyclo-cross is a European type of off-road circuit racing in which riders must occasionally dismount and carry their bikes to surmount obstacles – sometimes as much as they ride them. At the time, the cyclo-cross mount of choice was a traditional road bike with narrow tires and drop handlebars, but riders could compete on any bike. For the ’74 Mill Valley race, several members of the Morrow Dirt Club, headed by Russ Mahon, brought their modified ballooners to give the race a go.

Also at the event were four cyclists from Marin who chose a more traditional form of participation: Gary Fisher and Otis Guy raced their cyclo-cross bikes, and Charlie Kelly and Joe Breeze watched from the sidelines. While these names are no doubt familiar to anyone with more than a passing interest in mountain biking, in 1974 they were just four local riders out for a day of sport.

Photos courtesy Wende Cragg/Rolling Dinosaur Archives

When the Marin contingent spied the modified clunkers of Russ Mahon and the other Morrow Dirt Club riders, their interest was piqued: These were by far the most advanced balloon-tire bikes they'd seen to date, and they immediately recognized the potential for their own mountain bombers.

Unfortunately, the two groups had no opportunity to compare notes. After the race, Russ Mahon and the Morrow Dirt Club returned to Cupertino and essentially disappeared, not to be heard from again until 1994.

The same cannot be said of Joe Breeze, Charlie Kelly, Otis Guy and Gary Fisher, who left the race inspired by what they'd seen, and excited to discover that the interest in clunkers extended beyond their area. They began modifying their own clunkers . . . and then kept going.

What followed was a regimen of rigorous field-testing (also known as having fun) on the trails and fire roads around Mt. Tamalpais in Marin County. With each new design or modification, the Marin riders would head out for more testing. The Cascade Canyon fire road, just west of Fairfax, proved particularly suited to this activity. Plummeting 1,300 vertical feet in just over 2 miles, the twisting and often precipitous descent provided the ultimate field test for both bicycle and rider.

Affectionately known as Repack, the road had been popular with local ballooners for years. The nickname arose from the fact that the coaster brake hubs of those early bikes would get so hot during the descent that the grease would vaporize. After a run or two, the hubs would have to be re-packed with new grease.

As with any activity involving competitive young men (the predominant group, at the time), claims of being fastest were commonplace. But such claims are worthless without proof. To settle the issue once and for all, Repack, The Race, was established . . . and the sport of downhill mountain bike racing was born. Of course, the term "mountain bike" didn't exist at the time. Repack was just a friendly race between local riders on old clunkers, vying for bragging rights.

The first official downhill mountain bike race took place down Repack on October 21, 1976. It was a time-trial format, with riders leaving the start line at 2-minute intervals. Charlie Kelly, armed with a Navy chronometer and an alarm clock with a sweep second hand, handled the timing duties. Of the seven riders who started the race, only one finished. Alan Bonds won by virtue of being the only rider to make it to the bottom without crashing or breaking his bike. His time was a respectable 5 minutes, 12 seconds.

As the dust cleared and riders gathered to review their performances, strains of "If only . . ." and "I could have . . ." filled the air. Organizers quickly scheduled another race for the following week . . . and then another.

On October 30, 1976, during the third Repack race, Joe Breeze recorded a sub-five-minute time of 4 minutes, 56 seconds to claim victory over 10 other riders – all of them riding hand-modified fat-tire bikes.

Riding Repack required a generous mixture of skill, bravado and fearlessness, but above all, it required a bike that would make it to the bottom without breaking. Equipment failures were common, and riders quickly learned which components and modifications worked and which didn't – sometimes with painful consequences. The venerable Schwinn Excelsior was arguably the best platform to start with.

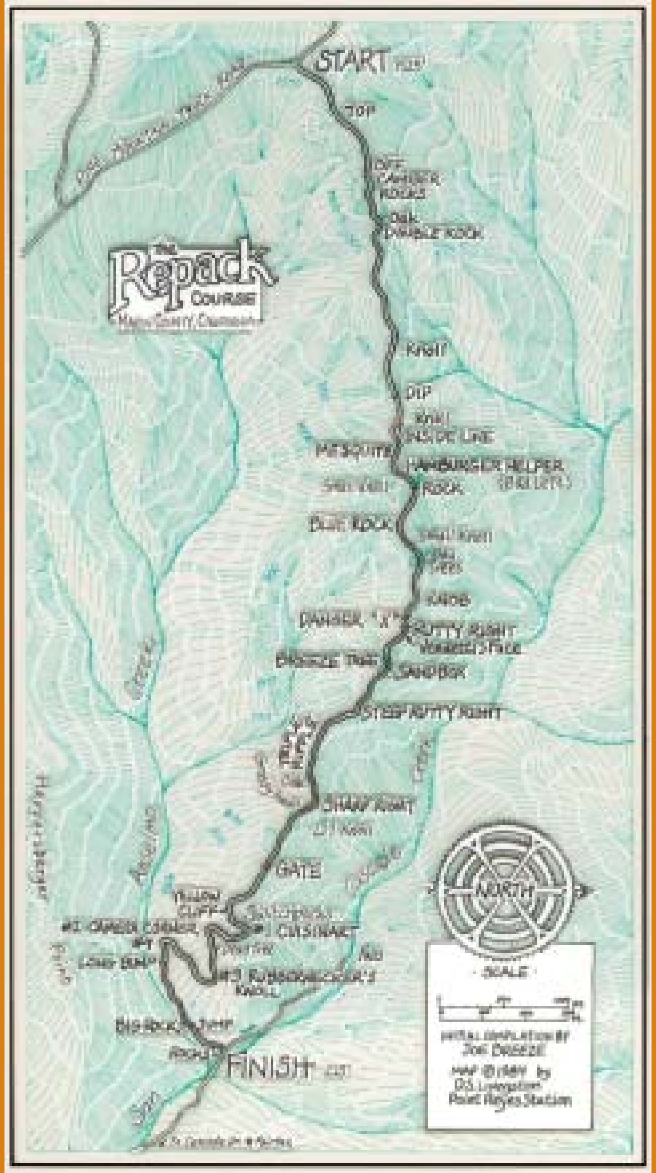
According to the logbook kept by Charlie Kelly, there were 24 Repack races in all – 22 between 1976 and 1979, and the final two in 1983 and '84. Gary Fisher recorded the fastest time for the treacherous run on December 5, 1976 – a blazing 4 minutes, 22 seconds that still stands today. Joe Breeze holds the second-fastest time at 4 minutes, 24 seconds, and placed first in 10 of the 24 races.

While Breeze's riding skills and familiarity with the course surely played a significant role in his success at Repack, so did the custom fat-tire bike he designed and built for himself in September 1977.

Much of the impetus for that bike, as well as a handful of cash to get the project started, came from Charlie Kelly. By his own admission, Kelly's downhill riding skills were less than stellar. He persuaded Joe to build a lightweight clunker frame for him that would (he hoped) provide a competitive advantage at Repack.

An experienced frame builder and skilled machinist, Breeze designed a frame that emulated the proven geometry of the Schwinn Excelsior, but was lighter and stronger. The prototype, Breezer #1, became Joe's personal bike; the second frame went to Kelly. Word of the frames spread quickly, and Joe soon had orders for 8 more. Those 10 Breezers featured lightweight, 4130 chrome-molybdenum frames, and were outfitted with all new components. They were custom-built fat-tire bikes designed specifically for mountain biking. By all accounts, they were the first modern mountain bikes – and the term "clunker" definitely no longer applied.

Before long, other frame builders – like Tom Ritchey in Redwood City, about 50 miles south of Marin – were getting into the act. Ritchey provided frames to Gary Fisher and Charlie Kelly, who built them up with components and sold them as complete bicycles. In the summer of '79, Fisher and Kelly formed a company called MountainBikes to sell the new creations. This was the first commercial use of the term mountain bike.



Map courtesy Dewey Livingston

The Japanese entered the market in 1982, with mass-produced bikes similar to (if not exact copies of) the Fisher/Kelly MountainBikes. These bikes, the Specialized Stumpjumper and the Univega Alpina Pro, brought the price below $800 and introduced mountain biking to the masses. By 1983, every major bicycle manufacturer in the world had jumped on the mountain bike bandwagon.

Today, mountain bikes make up more than 50% of the adult bicycle market. They range from inexpensive department store models with rigid frames, to fully suspended titanium and carbon fiber works of art that sell for as much as $8,000 – or more.

And what the next generation of riders does with those bikes makes Repack pale by comparison.

the next Generation

story and photos by Scott Rathburn

Compression damping, rebound damping, high-speed damping, low-speed damping, preload adjusters, progressive bump stops, shim stacks, spring rates, ride height – probably not what's on most riders' minds as they plunge their bicycles down a rocky mountain slope at speeds approaching 50 miles per hour. In fact, most of these terms probably don't even exist in the vocabulary of the average mountain biker. They certainly weren't part of the vocabulary of the sport's founding fathers, who braved local trails and fire roads on 1940s-era single-speed clunkers. But for a certain Eric Wold, these terms are everyday parlance.

Wold is the co-owner of Avalanche Downhill Racing, a company that manufactures high-end suspension components for downhill mountain bikes. And while Wold came to mountain biking nearly 20 years after the Fishers, Breezes and Ritcheys of the world, his contribution to the sport is no less notable: Avalanche Downhill Racing products represent the pinnacle of high-end forks and shocks for extreme downhill mountain bike racing and free riding.

Unlike those early pioneers, who were avid cyclists and successful road racers before discovering – nay, inventing – mountain biking, Eric Wold entered the sport rather reluctantly. Like most children, he always had a bicycle while growing up – he even did a bit of BMX racing as a kid. But adulthood brought with it a corresponding sense of responsibility: "I've got better things to do than ride a bike."

It was a friend's persistence in 1991 that showed Wold the error of his ways. "I had a few friends in town who were mountain bikers," he relates. "One guy had two bikes and kept hounding me to go for a ride. He bothered me so much that I finally said, Okay, I'll go! I didn't even know what a mountain bike was. I loved it instantly!"

Wold's indoctrination into the world of downhill came about a year later, when a friend told him: "I hear you can go up to Killington [a ski area in nearby Vermont] and put your bike on the lift, and then ride down the mountain."

"We decided to go one weekend," Wold says. "We bought lift tickets and rode up and down the mountain as many times as we could. It was great! We were riding completely rigid bikes at the time, with no front suspension. Insanity!"

My arms and legs are all the suspension I need . . .

. . . was a common refrain among die-hard cyclists and traditionalists, who saw bicycle suspension as an unnecessary extravagance that just added weight. For Wold and friends, however, just one run down a bumpy ski slope was enough to convince them otherwise.

"We went back to our local bike shop and said, We need front suspension," Wold explains. But the choices were few. The first RockShox front suspension fork had come out a year or two earlier, and Manitou had also introduced a version, but both forks were designed primarily for cross-country riding and provided only about 2 inches of travel.

It wasn't much, but it was better than nothing. Wold bought a Manitou fork and headed back to the mountains.

"There was already a national circuit of about five or six downhill races, and one of them was at Mount Snow in Vermont," Wold says. "That's where we learned about more serious racing, and started seeing some of the bigger teams. We began to realize that the tracks were so rough that all of the suspension was inadequate."

It was apparent that something more was needed to handle the rigors of downhill racing. It was also apparent, at least to Wold, that no one was filling that need. Taking things into his own hands – much like those early mountain bike pioneers – he decided to build a suspension fork of his own.

At first glance, this might seem like a daunting proposition, but Wold was an experienced machinist and had a full manufacturing facility at his disposal. "I grew up in a machine shop," he says. "My grandfather started Wold Tool Engineering in 1947, and my dad currently is the president of the business. I've been working there full time since 1987." (In fact, Wold started working full time the day he graduated from high school.)

Located in Moosup, Connecticut, Wold Tool Engineering, Inc. (WTE) is a contract machine shop that serves a number of manufacturers in the area. Among WTE's customers are Moroso Performance, a manufacturer of racecar products, Linemaster Switch Corporation, which makes industrial foot switches, and Kenyon Marine, which manufactures stoves for marine applications.

For Wold, fabricating the components for his mountain bike fork was the easy part: It was just another machining job. The challenge was designing a fork that did what he wanted it to do. He readily admits: "I'm a machinist, not an engineer."

Wold built his first prototype around 1995. "It was an upside-down fork with about five inches of travel," Wold explains. "It was very small, and didn't last very long, but I learned a lot."

Wold raced his prototype fork through the season, and then spent the winter diagnosing what had worked and what hadn't. "I took what I learned and applied it to a new fork," he says. "I built three more prototypes, raced them during the '96 season, and had much better luck than with the first one. By the end of the season, I was already thinking, Okay, I can improve this even more."

In Wold's mind, the solution was obvious. The motorcycle industry had already done what he was trying to do. Why re-invent the wheel? He just needed to adapt motocross technology to mountain bike forks. He spent the winter figuring out how – searching the Internet and visiting local motorcycle shops for any information he could find on how motorcycle forks are built.

It was through this research that Wold met Craig Seekins, his partner in crime and the co-owner of Avalanche, in 1997. "Craig owned a motocross suspension tuning shop about half an hour from my house," Wold relates. "I called him up, and we talked for a while, and then I went down there to show him my fork. He took the bike for a ride, just around his driveway, and came back and said: 'Wow! The fork looks beautiful . . . but it works like crap.'"

While some might take this as an insult, Wold saw it as an opportunity. Seekins had the engineering skills and motocross experience to complement Wold's own machining skills and mountain bike experience. It was a perfect match.

"Craig was already considering getting into the mountain bike market," says Wold, "so we started talking about possibly modifying the fork that I already had, or maybe building something new. We decided to scrap the fork completely and start over. Since I'd already made the triple clamps, which were pretty large, Craig figured out that we could design a 43 mm fork that would work with the triple clamps."

(Putting that size into perspective, Honda's CBR954RR sport bike and XR650 off-road motorcycle both use 43 mm forks, while the current crop of mountain bike forks run between 28 and 32 mm in diameter.)

The choice of 43 mm was no accident: It's a common size for motorcycle components. "We wanted to build a prototype as quickly and cheaply as we could," Wold explains, "so we bought a lot of off-the-shelf motocross parts and adapted them to the mountain bike. We chose 43 mm because we could buy Honda seals and bushings, which were known to be high quality and long lasting. And since Craig already manufactured high- and low-speed compression adjusters for motocross forks and shocks, we could put his products right into the mountain bike fork."

The result was unlike anything the mountain bike industry had ever seen: a fully adjustable motocross-style fork with machined aluminum triple clamps and a full 8 inches of travel – nearly double that of anything else on the market. "It worked really well, but it weighed 19 pounds!" Wold exclaims. "It was a beast!"

In 1998, Wold and Seekins formed Avalanche Downhill Racing to manufacture the new creations. Working after hours at Wold Tool Engineering (his day job), Wold set about making the fork lighter, fabricating pieces for two new prototypes. But WTE was primarily a lathe shop, so "a lot of the mill parts were done by hand," says Wold. "We had a bunch of Browne & Sharpe screw machines, and a CNC lathe that we'd bought around 1989, but we did the secondary machining operations, like drilling, tapping and light milling, by hand on Bridgeports."

Once complete, Wold put one of the prototypes through its paces during the '98 race season, and gave the second prototype to other riders to try out and provide feedback. After making some minor adjustments to the design, "We did a pre-production run of about seven forks and started a small race team," Wold says. "Things went really well with them that year, so we geared up for a production run of 20 forks."

Making prototype parts by hand is one thing, but making production parts is another. The more forks Wold built, the more he realized that WTE needed a CNC mill – and not just for the Avalanche work. "The triple clamps are definitely a CNC job, and the same goes for the lower lugs for the axle – definitely CNC work – but we also had all these secondaries coming off the lathe, and off the screw machines."

With a little arm-twisting, Wold convinced his father to buy a CNC mill in the fall of 1998. After researching a number of different machines, they settled on a Haas VF-0 vertical machining center. "We really liked that Haas was an American company," says Wold, "and the Haas machines were more affordable than any other machine we looked at. We went down to Hartford to the Haas Factory Outlet (a Division of Trident Machine Tools) for a demonstration, and bought a VF-0 with a Haas HA5C rotary indexer."

In a way, Wold's work at Avalanche Downhill Racing drove the decision to buy a CNC mill, but the benefits to Wold Tool Engineering were immediate. "It made every job so much more productive," says Wold, "not only making the new parts, but also the secondaries we were doing on the Bridgeports. The cycle times were cut in half, and we had less operator fatigue, better accuracy and repeatability – everything."

The benefits for Avalanche were also immediate. "We started making our own triple clamps," says Wold, "and also the lower lugs, and we made our own slider tubes; it dropped the weight of the fork down quite a bit. The 43 mm fork became our first product."

Dubbed the Mountain 8 (MTN-8), it was not a fork for the faint of heart . . . or for the faint of pocketbook. Despite the CNC-assisted diet, it still weighed in at a hefty 14 pounds, and only a few people would race with them. "Plus, the price tag," says Wold. "That fork retailed for $3300 – but it was completely custom. It was built specifically for you, based on your weight, your riding style, whether you're aggressive or light on the bike . . . the parts were all in stock and it would be totally assembled for you. Plus, we offered a 60-day setup on the spring rate and the valving, and a two-year warranty on wear and workmanship."

For Wold and Seekins, though, the goal was never to sell mass quantities of product. The goal was to build an ultra-high-end mountain bike fork that was the absolute highest quality available and completely indestructible. That accomplished, it was time to tackle the back end of the bike.

"There are only about four manufacturers in the world that make shocks for mountain bikes that are at least decent," says Wold. "But they all shoot for the OEM market and try to keep the cost very low. We wanted to build the highest quality, high-end shock, without regard to weight or price – just to prove to people what we could do."

Thus was born the Mountain 3 (MTN-3) – a very large, motocross-inspired shock that, like the MTN-8 fork, was completely custom-built for each rider. "It was eleven and an eighth inches eye-to-eye," says Wold. "The spring alone weighed two pounds – more than any other shock out there. We had a high- and low-speed compression adjuster on it – again, right from a motocross shock. It was very high-end, indestructible."

The problem was, "You couldn't just slap that shock on someone's bike," says Wold. The shock was so large that Avalanche needed a manufacturer willing to build a frame around it. Prototype in hand, Wold and Seekins headed to the 1999 Interbike Show (an annual trade show for bicycle and parts manufacturers) in Las Vegas to drum up some interest.

Unlike most manufacturers, who consider their designs proprietary and keep them tightly under wraps, the Avalanche crew put theirs out for everyone to see. "We pulled our shocks apart to show people the internals," says Wold. "This isn't a secret; this is technology that every motocross company uses."

Maybe so, but the folks from Brooklyn Machine Works – a small frame builder in New York – were amazed, nonetheless. "They came from a motorcycle background, and had just been waiting for someone to make a shock like this," says Wold. "We sent them a prototype, and they immediately started building a bike around it.

"At the same time," Wold continues, "we asked another company, Cortina, to build custom bikes for our team. They had a bike I felt could easily be modified to fit our shock. We were rolling on those bikes in the '99 race season."

Armed with full-on "works" bikes – Cortina DH Extreme-8 frames with Avalanche MTN-8 forks and MTN-3 rear shocks – the Avalanche race team hit the slopes. "We wanted to have the team out there so people could see and try out our product," says Wold. "You can have the best product in the world, but it takes time for people to have confidence in it."

By the end of 1999, confidence was building: The Avalanche Downhill Racing team had amassed more than 20 visits to the winner's podium.

"At that point," says Wold, "we felt we had really established a good reputation, and we decided we needed to start making some money. Up until then, the business had basically been an expensive hobby for us. We did it in our spare time – nights, weekends, things like that.

"We decided to come out with a rear shock that would fit the majority of the downhill bikes out there," Wold continues. "We felt that the shocks on the market still were not up to what the downhill and free riders were doing. It was a perfect market for us."

Avalanche began developing their DHS shock during the summer of 2000. Essentially a scaled-down version of their MTN-3 shock, it "was difficult to design and manufacture," says Wold, "because it's so small, and you have to cram so much into such a little space. We'd build 10 prototypes, and as we were fitting the parts, we'd find a problem: Oh, the shaft is crushing the hole for the rebound adjuster, we need to move that a millimeter. Now we have to gain a millimeter somewhere else in the shock."

With the CNC capabilities of Wold Tool Engineering at their disposal, such changes were easy, even during production. "The Haas machines are so versatile – quick, easy to set up – that we can make quick changes on the machines for even minor problems."

As Avalanche geared up for a production run of 500 DHS shocks in January 2001, it became apparent that Wold Tool Engineering didn't have the capacity to handle the extra work. "We were getting really backed up," says Wold. "We needed another lathe."

More mill work was coming in the door as well, thanks to an employee with a penchant for custom cars. "Our foreman met a guy who manufactures parts for custom cars," Wold explains. "He was having problems with his suppliers – one guy couldn't ship on time, one guy was too expensive and another guy gave him bad parts – so he threw us a job . . . and then threw us a couple more. The next thing you know, we're doing all his work." The Haas VF-0 began to back up as well.

More machines clearly were in order, and this time, no arm twisting was required.

"We found a used Japanese lathe – one year old – that suited our needs, but it was expensive," says Wold. "So, of course, we went to look at the Haas lathes. At the same time, the Mini Mill had just come out, and what a great price tag on that! We could buy a used lathe for $98,000, or we could buy a new Haas lathe and a Mini Mill – with options even – for the same price. It was pretty much a no-brainer."

An SL-20 lathe and a Mini Mill were installed in short order, and immediately put into production. Wold had 500 shocks to build.

"I turn the shock bodies in one shot," says Wold. "I

start with the material close to the chuck and do all the ID work. Then I pull the material out, put a plug in the end and bring the tailstock up, so I can do the OD work. The Haas has the ability to use multiple work offsets, so I can do it all in one program. I use an M00 to stop the program, and then pull the bar out for the rest of the operations. With the Haas control, I can put messages on the screen – you know, pull the part out 8 inches.

"The secondary machining takes place in the two mills," Wold continues. "With the exception of the triple clamps and the lower lugs for the forks, we can pretty much do every other job on the Mini Mill."

The lower lugs, Wold says, are probably the most complex Avalanche component he makes, requiring a total of seven setups – two on the SL-20 and five on the VF-0.

Each lug starts as a block of 6061 aluminum approximately 2" x 4" x 2.75" (depending on the lug, the left and right are slightly different). The material goes into the VF-0 first, where a "lathe nub" – 1.75" diameter by 0.75" high – is milled on one end, so the part can be mounted in the SL-20 lathe.

The first operation in the SL-20 comprises the ID work for the area where the fork tube attaches. The lug is drilled, rough bored, finish bored, the ID is threaded and then an O-ring groove is cut on the ID. The part is then flipped (using a fixture threaded into the end), and

the nub is cut off and the part is faced to length. A pocket is then bored in the end to accept the compression adjuster.

Once the lathe operations are complete, the lug goes back to the VF-0. First, the bottom profile is cut, and then the lug is flipped and the top profile and the mounting boss for the fork guard are machined. The lug is then mounted on its side and the profiles of the axle clamp and the disc brake flange are cut. A pocket is milled to lighten the lug, and then mounting holes for the disc brake are drilled, and the hole for the axle is drilled and reamed to size. A serial number is also engraved at this point using the G147 command.

For the final operation, the lug is fixtured in the HA5C indexer. A series of holes are drilled and tapped on two sides, and then the axle clamp is completed using a slotting saw.

"I actually program the machines and do all the Avalanche machining myself," says Wold. "Craig does all the engineering, and I handle the machining. We use Mastercam to program the mills, and I actually do quite a bit of on-the-control programming, especially for simpler parts. The Haas machines are so easy to program that, a lot of times, it doesn't make sense to go to the CAD/CAM. We don't have a lathe module – we haven't really found a need for it – so I program all of the SL-20 parts at the control."

For Wold and Seekins, this hands-on approach is the only way to do business. "We're not looking to sell massive quantities of forks and shocks, and mass produce them," says Wold. "We want to produce custom shocks and forks specifically for the customer. No one else does what we do."

A successful approach, it seems. "Our shock sales have been excellent," Wold says. "The DHS shock has become our mainstay product. It's durable, it works well, it's custom built for the rider – people love it." Avalanche has also introduced a 37 mm version of their fork, the DHF-8, which is much lighter than their 43 mm fork, but still provides 8 inches of travel and has all the same adjustability and features.

While light weight has never been the driving force behind Avalanche, it is a concern for most riders. But rather than compromise safety and durability to shave a few ounces, Wold and Seekins design Avalanche products for strength, and look to other ways to reduce weight. "We've come out with a titanium version of the DHF fork," Wold explains, "that has a titanium spring in one leg and the valving in the other leg, rather than two steel springs and two oil cartridges. It's 2 pounds lighter, but it's still very strong." For riders wishing to shave additional weight out back, Avalanche also offers titanium springs for its shocks.

Of course, there are lighter forks and shocks out there, but that's not what Avalanche is about. "We really don't want to compete with them," says Wold. "Our plan is to stay small, at least for the time being, and sell the high-end product. We like what we do."

But Wold likes his day job too, and has no plans to quit the family business. "I still love the machining side of it," he says. "Owning Wold Tool Engineering (Eric's dad plans to retire soon and hand over the reins) keeps a lot of the overhead away from Avalanche, and lets me control the quality and delivery of the parts." At the same time, Avalanche Downhill Racing – no longer an expensive hobby but a paying customer – provides WTE with a steady flow of work.

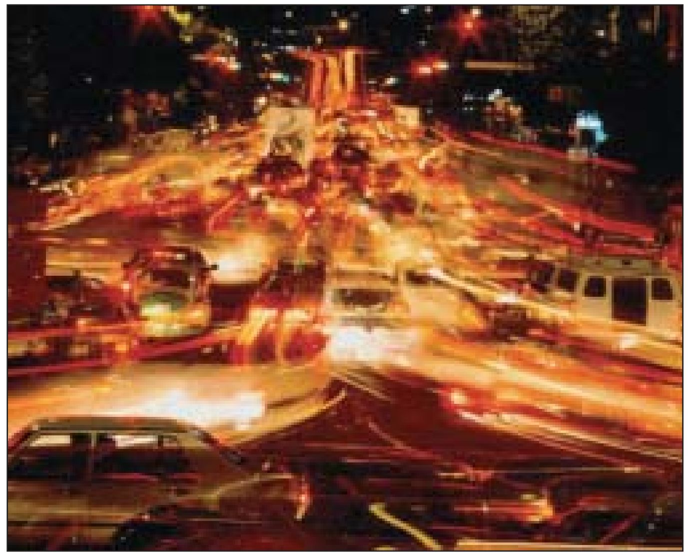
"For me, the two go hand in hand," says Wold. "We're a job shop at Wold Tool, and it is a difficult business, but I do enjoy it."

Precision Amidst Pandemonium

At first glance, Mexico City appears to be a jumbled mass of humanity – everyone trying to go his or her own separate direction, all at the same time. How many people in all this humanity? A little research confirms it: There are a lot of people living in Mexico City.

Story & Photos Scott Weersing

Recent surveys claim that more than 20 million people consider Mexico City home, making it the third largest city in the world, right after Tokyo and New York.



Mexico City is a very active metropolis. Its streets are crowded with people, cars and trucks – all trying to go as fast as they can, despite the bumpy roads, potholes and apparent lack of lane markings. Amazingly, there is some sort of logic to the traffic. Everyone seems to know and follow the unwritten rules of the road. At some of the city's busiest intersections, traffic officers using hand signals manage to keep the traffic flowing. On other streets, traffic is slowed by giant speed bumps. People travel by car, bus, truck, taxi, bicycle and by foot – which at times seems like the fastest way to go.

Although the traffic moves slowly, Mexico City is also a place of activity, prosperity and success. And in the middle of this agglomeration is John Crane Mexico, a company that is using state-of-the-art technology to reduce cycle times on high-precision parts.

John Crane Mexico is part of an international company that designs and manufactures mechanical seals and sealing support systems worldwide. The John Crane company, part of Smiths Group plc, has more than 200 facilities in 47 countries. There are 10 John Crane facilities in Mexico alone.

Mechanical seals can be found in a range of places. There are, for example, mechanical seals in oil pipelines, automobile water pumps, air conditioning compressors and beverage processing systems. Simply put, a mechanical seal is a containment device that prevents leakage over a rotating shaft. Every time a shaft turns, the mechanical seal keeps the gas or liquid from leaking out into the environment. Depending on

its application, a mechanical seal has a number of components, and each one needs to be made to exacting tolerances.

The demand for mechanical seals continues to grow as manufacturing, processing and pipeline operations are constructed all over the world. To keep up with orders from Central and South America, John Crane realized that they needed additional CNC equipment. "We were looking for a machine with five-axis capability that would be reliable," says Ricardo Almazan, production manager at the Mexico City facility. "So we did some investigating, and Haas was recommended by other John Crane facilities in Illinois and Rhode Island. They were using Haas machines for the same things that we are doing here."

In January 2002, Hi-Tec, the Haas distributor in Mexico, installed a VF-5 vertical machining center equipped with a Haas TR 210 dual-axis trunnion table. "We had purchased our other machines from Hi-Tec, so we were happy to work with them again," says Almazan. The VF-5 TR quickly went into daily operation, which led John Crane to purchase a VF-4 six months later. "We liked the service we received from Hi-Tec in installing the VF-5, so it was an easy decision to buy another Haas," Almazan continues.

John Crane purchased the Haas VF-5 with five-axis capabilities to improve accuracy on difficult parts. "On one part, we were having problems with a thread," says Almazan. "The thread was the last operation, so we would have to scrap the entire part if it was bad. But with the five-axis machine, we've had very few rejections. There has been a drop of three hundred percent in the number of rejections."

The mechanical seal components are made of 316 stainless steel, and must meet high tolerances in order to work properly in high-stress environments, such as oil pipelines and food processing plants. "We have to hold tolerances of five tenths to one tenth [0.0005" to 0.0001"]. We've had no problems with the Haas machines holding tolerances," Almazan comments.

Components of the mechanical seals are first turned on lathes, and then moved to the Haas VMCs for drilling and tapping. At one time, parts went to three different machining centers, but now the Haas VF-5 can do everything, says Almazan. "One way we save time is that we're able to do multiple operations. With the Haas machines, we have combined work from three machines into one. As a result, we have reduced cycle times on some parts from five hours to just two and a half hours."

With the reduction in cycle times, of course, came a reduction in delivery time. "We have been able to fill orders faster," relates Almazan. "We went from taking 19 days on orders to 12 days, and this past month, we were filling orders in five days," he says. "Jobs are sometimes just one piece, but can be as many as 15 to 20 pieces. The machines give us flexibility, and we need the flexibility because we are making parts to order."

The company has taken advantage of special editing features on the Haas control to reduce production time. "The main reason we're saving time is that we program right on the control, using the background edit feature," says Almazan. "This feature saves us a lot of time, because we have so many different parts that we make. The programs are already loaded, and then we just have to make small changes to each program using the background edit."

Almazan and his staff plan to use more of the five-axis capability to reduce setups and combine operations. "We have received a great deal of help from Hi-Tec in learning how to use all the capabilities of the trunnion," says Almazan. "So we've been doing more and more four- and five-axis work in order to reduce our production time. The more experience we have, the faster we will be able to deliver seals to our customers."

Machine is a Verb

Story & Photos Scott Weersing

Should machining students be taught how to use the different controls they'll encounter out in the industry, or should they be taught how to machine? A practical question, to be sure. For Chippewa Valley Technical College, the answer was simple – teach the students how to machine.

"We look at the word machine as a verb, rather than a noun," explains Wade Lutz, one of CVTC's machine tool instructors. "We aren't teaching the noun, we're teaching the whole gamut of the verb. We aren't teaching the different controls, we're teaching machining."

Steve Michaud, Chippewa Valley's dean of manufacturing technology, is quick to agree. "If you have too many different types of controls, then students spend all their time learning controls and not enough time learning machining."

At one time, Chippewa Valley had four different types of CNC machining centers, which understandably made teaching difficult. The college now has 14 CNC machines, all from Haas Automation – nine VMCs, three turning centers and two horizontals. "We're all about machining," says instructor Wade King. "And with Haas, the students master the control quickly, and then they can really focus on their machining skills."

Located in the city of Eau Claire, CVTC is part of the Wisconsin Technical College system, offering a diploma in machine tool technics, along with diplomas in industrial mechanics and mechanical design. The college is unique in that it operates year-round, permitting students to start their course of study at five different times during the year.

CVTC students come from 11 surrounding counties, and have varying degrees of experience when they enter the program. "Twenty-five percent of our students have been through a high-school tech ed program," explains King, "but then we have students who don't know what a mill is, or a lathe. Our program is set up for that type of student. The first projects we give them have wide tolerances so they can get used to the machines, and then things get tighter and tighter from there."

Students first learn the basics on manual mills and lathes, King adds. "They get a good understanding of the process with the manual machines, and then they can bring that knowledge to the CNC side. There are still a lot of manual machines out in industry, so we want to get them proficient on the manual mills and lathes," he says.

Once they graduate to CNC, students create their programs in the school's CAD/CAM lab using MasterCam software. The Haas machines are connected to the lab through a computer network, so students can download programs to each machine. "They can log into the network, select the machine they want and then send the program to that machine," says King. "They can also feed programs to multiple machines at the same time, and drip feed a program when it is really large."

Chippewa Valley Technical College has been a Haas Technical Education Center (HTEC) since August 2001. The Haas Factory Outlet in Minneapolis, a division of Productivity Inc., was a key partner in the college becoming an HTEC. "Scott Peterson, a salesman with Productivity, found a way for us to get the first five machines in here," says Michaud. "And then we worked with him and Productivity to get the other nine Haas machines. It's been a great deal for everyone involved. Our students get to learn machining instead of having to learn controls."

Since CVTC is located in the heart of the Midwest and manufacturing, people are aware of the need for trained machinists, but it still takes support from everyone to build a successful program. "We've always had support from the top," says Michaud. "Our community leaders and our college president know there is a need to train people in manufacturing, because that is where wealth is created."

College president Dr. Bill Ihlenfeldt also recognizes that world-class training requires state-of-the-art machining equipment. "The people of Wisconsin appreciate how important CNC automation is to being competitive in manufacturing. We're committed to advancing world-class manufacturing skills in the Chippewa Valley, because that's what it takes to succeed."

The fact that the manufacturing program has its own campus is proof of the commitment and support the school has from the college district and the community. "We were going to build the manufacturing center in the middle of the city," says King. "But city and county officials came to the president and said they wanted it here in the Gateway Industrial Park. We're right in the middle of the industrial part of Eau Claire." The city initially donated 10 acres to the college, and then the school purchased an additional 18 acres to complete the campus.

"There were 27 different partners who got together to put this facility together," Michaud adds. "We are where we belong – with industry. That wouldn't have happened without people working together."

Making sure the school's manufacturing technology program stays on track is an 11-member advisory board made up of local employers and employees – the majority of whom graduated from Chippewa. They keep the program in touch with what's going on in local manufacturing, and make sure the content remains relevant to the needs of local manufacturers.

CVTC is also active in exposing middle- and high-school students to manufacturing technology. "Several high-school tech ed teachers have brought their classes to the Center for a half day of hands-on experience," says Michaud. "Each student gets the opportunity to program a part using the CAM software, and then run the part on one of our Haas machining centers."

The school's recruiting efforts have brought new students to careers in manufacturing. "We're starting to get the video-game age students," says Lutz. "When I'm giving tours to high-school students, I tell them: Come on in and we'll let you run the coolest video games out there – games where you draw it on the screen and then machine it."

The Haas Toolroom Lathe: Powerful, Flexible Simplicity

Toolrooms and small machine shops have long been bastions of manual machine tools. But to survive in today's competitive market, it is increasingly necessary for these shops to make the move to CNC. The new TL-1 Toolroom Lathe from Haas Automation, Inc., eases the transition from manual machines to CNC – without breaking the bank.

The Haas TL-1 Toolroom Lathe combines the full functionality and simplicity of a manual lathe with the power and flexibility of the easy-to-use Haas CNC system – all in an American-made machine that is base-priced less than $20,000 (US).

The Haas Toolroom Lathe provides a maximum cutting diameter of 16" and a maximum cutting length of 30". The maximum part swing is 16" over the front apron and 8.5" over the cross slide. The TL-1 features a powerful 7.5-hp (peak) vector drive spindle that spins to 1,800 rpm, and it comes standard with an A2-5 spindle nose that

accepts a number of optional chucks. For additional part support, an optional manual tailstock is available that provides 30" of travel. Brushless servo motors on all axes provide precise positioning, and a one-piece cast-iron base damps vibration and provides rigidity for heavy cuts. The TL-1 runs on either single- or three-phase power.

Super Fast, Super Accurate, Super VF-3SS

Haas Automation continues to advance its line of VMCs with higher speeds and increased capabilities. The new VF-3SS is a high-performance vertical machining center that comes standard with an innovative 12,000-rpm inline direct-drive spindle, an ultra-fast tool changer and 1,400-ipm rapids.

Based on the shop-proven Haas VF-3 (40" x 20" x 25" travels), the VF-3SS takes performance and affordability to a whole new level. The machine is equipped with a 12,000-rpm, 40-taper spindle that features a unique inline, direct-drive system that couples the motor directly to the spindle rather than using belts. This results in less vibration, less heat and less noise than other drive systems, providing better surface finishes, extreme thermal stability and very quiet operation. Powered by a 30-hp vector drive system, the spindle yields plenty of low-end torque, as well as the speed necessary for high-speed machining operations.

The VF-3SS also features a newly designed high-speed side-mount tool changer with 24+1 tools. Lighter materials and a high-performance servo motor make this tool changer the fastest that Haas has ever built, with tool changes taking less than 1.6 seconds tool to tool. To further reduce cycle times and keep non-machining time to a minimum, the VF-3SS uses high-pitch ballscrews and high-torque servo motors on all axes to provide rapids of 1,400 ipm.

While the VF-3SS offers substantial performance in base configuration, it is possible to boost capabilities even further with a high-performance package of options. This package includes an auger-style chip conveyor, programmable coolant nozzle, 16 MB program memory, Visual Quick Code programming, floppy disk drive, spindle orientation, 4th-axis drive, coordinate rotation & scaling, user-definable macros, remote jog handle and high-speed machining software – all for less than $10,000 (US).

A smaller VF-2SS and a larger VF-4SS are also available.

Built to Perform: The New Generation of Haas HMCs

When Haas Automation set out to design its new generation of horizontal machining centers, company engineers started from the ground up to build a machine that would meet the needs of today's customers right out of the box – without requiring them to invest in a lot of expensive options. The performance is built into the machine.

Haas introduces the new EC-400 HMC, a T-base horizontal machining center with a generous 20" x 20" x 20" work cube, a dual pallet changer with 400 mm pallets and a built-in rotary indexer. The EC-400 comes standard with an 8,000-rpm, 40-taper spindle powered by a 20-hp vector dual drive system. Also standard are a side-mount tool changer (24+1 tools), 945-ipm rapids and a high-volume coolant system. To eliminate downtime associated with manual chip removal, the EC-400 is equipped with a triple-auger chip conveyor system that removes chips from the enclosure quickly and efficiently.

For added performance, a 12,000-rpm spindle powered by a 30-hp vector dual drive system is available as an option. This spindle provides additional horsepower for heavy cuts, as well as 50% more speed for high-speed machining operations.

Both spindles feature a unique inline, direct-drive system that couples the motor directly to the spindle rather than using belts or gears. This results in less vibration, less heat and less noise than other drive systems, providing better surface finishes, extreme thermal stability and very quiet operation.

The EC-400 comes standard with a pallet indexer that provides 45-degree indexing. An optional face-gear indexer (1-degree indexing) is available for high-precision work, and a full 4th-axis rotary table is available for shops requiring simultaneous 4-axis motion. A 5th axis can be added for complex work.

The servo-driven pallet changer on the EC-400 swaps pallets in just 10 seconds, and each 400 mm pallet has a load capacity of 1000 lb. A separate load station allows the operator to safely load / unload parts or change fixtures on one pallet while parts are being machined on the other, keeping spindle run time at a maximum.

Find out more online:

Go to **www.HaasCNC.com.** In the top menu bar, click on **news/communications**, and then scroll down to **New Machines & Applications**. Here you'll find our newest products, features and options, along with data sheets, dimension drawings, photos, news releases and videos available for online viewing, or for download.

www.HaasCNC.com

EC 400 TOOL CHANGER

- The EC-400 comes standard with a 24-tool, side-mount tool changer
- A double-arm gripper swaps tools in just 2.8 seconds

OPTIONS

- High-speed, servo-driven SMTC with 1.6 second tool-to-tool times
- Add extra tool capacity with a 40-pocket side-mount tool changer

the answer man

Dear Applications:

When I'm down near a part with a tool, is there a quick way to rapid just one axis home? When I press HOME/G28, it rapids all three axes home. I have a VF-8, which wastes time if I send the X axis all the way to the left when all I want is to rapid the Z-axis home, or the Y and Z axes but not X.

Jason Scott

Dear Jason:

As you noted, the HOME/G28 key will rapid all axes to machine zero. Yes, you can also rapid just one axis (X, Y, Z, A or B) to machine zero. Enter the letter X, Y, Z, A or B, and then press HOME/G28 and that axis alone will rapid home.

(Any Mill Control ver. 9.49 and above; any Lathe Control ver. 2.24 and above.)

Sincerely,
Haas Applications

• • •

Dear Applications:

I have some trainees that I need to restrict from getting into certain areas of the Haas control. Is there a way to keep them from getting into programs and editing them, or into Parameters and changing them?

Bill Hall

Dear Bill:

Yes, you can lock out unauthorized users. The Memory Lock Keyswitch (KEY) is a Haas control option that locks certain settings – including those for program memory, offsets and macro variables – and parameters. Since the KEY option locks the Settings, it also allows you to lock areas within the settings: Applying it to Setting 8 locks all programs; Setting 119 locks offsets; Setting 23 locks and hides O09xxx programs; Setting 120 locks macro variables; Setting 7 locks parameters; and Parameters 57, 209 and 278 lock other control features.

In order to edit or change these areas, the keyswitch (if installed) must be unlocked and the settings described here turned off.

(Any Mill Control ver. 9.25 and above; any Lathe Control ver. 2.23 and above. This option can be field-installed on 1997 and later Haas mills and lathes).

Sincerely,
Haas Applications

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Dear Applications:

If I hook up an auxiliary axis on my Haas VF-3, can I use it like a full 4th axis, or just as an indexer? My VF-3 does not have a 4th-axis option. The auxiliary axis is an HRT160 Haas indexer with the red control box.

Jose Garcia

Dear Jose:

When you connect a rotary product, such as the HRT160, as an auxiliary axis without the 4th-axis control option, you will not have 4th-axis interpolation – that is, the 4th-axis motion will not occur simultaneously with movement of the other 3 axes.

Still, using your HRT160 for indexing can save you a lot of setup time. For example, you could machine four sides of a block with one setup. You can also program the auxiliary axis (C axis) through your VF-3 control, either in a program or in MDI. You could, for example, mill a slot around the circumference of a bar by programming a C-axis move with a feedrate.

If you need to do true 4-axis machining, you will need to have the 4th-axis option installed on your machine.

Sincerely,
Haas Applications

• • •

Dear Applications:

I work as a mold maker, where I machine complex mold plates with a VF-5. It can take a couple of hours to machine a complex contour with one tool. If I break a tool in the middle of a programmed contour, is there a way I can go back and start in the middle of a tool sequence, where I left off when the tool broke?

Dan Mitchell

Dear Dan:

You can do this using Setting 36, Program Restart. When this setting is off, it is difficult to start machining from anywhere except the beginning of a program or tool sequence. When it is on, you're able to start from the middle of a tool sequence. Here's how:

With Setting 36 on, cursor onto the program line where you want to begin, and press CYCLE START. First, the entire program will be scanned to ensure that the tools, offsets, G codes, and axis positions are set correctly before starting from the block where the cursor is positioned. Note that some alarm conditions may not be detected prior to motion starting.

You can leave this setting on all the time if you want, but it might do some things unnecessarily (such as changing a tool or moving the table, and then changing/moving it back) in response to the program scan, so it is recommended that you turn it off when you're done using it.

(Note: For a detailed discussion of the Haas run-stop-jog-continue (RSJC) feature, see the Answer Man column in the Winter 2003 issue of *CNC Machining*.)

Sincerely,
Haas Applications

• • •

Dear Applications:

I would like to be able to fine-adjust my feedrate while testing out a program, but the control only has Feed Override buttons of plus or minus 10%. Other CNC machines in my shop have a separate feedrate control knob that can be used to adjust the feed and speed on those machines. Is there some way I can have more control over the Haas machine's feedrate when running through a program?

Troy Smith

Dear Troy:

If you press the HANDLE CONTROL FEED button, you can then use the jog handle for feedrate overrides. Clockwise motion of the jog handle increases the feedrate in 1% increments (up to 999% on Haas mills and 200% on lathes). Counterclockwise motion reduces feedrate by 1% with each click (down to 0%). The feedrate display will blink while this feature is active. Pressing the HANDLE CONTROL FEED button again will turn this feature off. You can similarly control spindle speed with the jog handle by pressing the HANDLE CONTROL SPINDLE button.

If you turn on Setting 144, Feed Overide ➔ Spindle, then a feedrate override will affect the spindle speed proportionately. The jog handle will adjust the feed and speed simultaneously, in 1% increments. This is to keep the chip load constant while adjusting the feedrate on a programmed move.

If you turn on Setting 101, Feed Overide ➔ Rapid, then – you guessed it! – a feedrate override will also proportionately affect rapids, in 1% increments when using the jog handle.

Sincerely,
Haas Applications

• • •

Dear Applications:

We've had a Mini Mill for a couple of years, and recently we got two more. The first one had Quick Code as a source program in the list of programs. I was able to make some nice modifications to this file for our own specific shop use. The two newer machines have a different version of Quick Code and also Visual Quick Code. How would I edit the new Quick Code programs in the newer machines if it's not in the list of programs? Also, I don't know where to change the settings or parameters to run the version I loaded in the new machines.

Frank Huszar

Dear Frank:

Check to see if Setting 23, "9xxx Progs Edit Lock," is on. If it is on, you will not be able to see the Quick Code or Visual Quick Code (VQC) source program files, since they are defined as 9xxx numbers, O09999 and O09997. You will still be able to use Quick Code or VQC, but you won't be able to select the source program files to edit the menus and program format. If you turn this setting off, these programs should then be visible, so you can create your own custom menus and program formats.

If you decide to edit your Quick Code source file, you should first save the original program under a different program number (or onto a floppy disk) as a back-up. Then go ahead and modify program O09999 for your custom version of Quick Code. Be sure to back up your customized version after it's created.

For your own version of Visual Quick Code, edit and customize O09997 (after making a back-up copy). Note that when learning to edit the source program files, it's easier if you start with Quick Code and progress to VQC later.

You can then load your customized Quick Code or VQC source files on any of your Haas machines that are equipped with the Quick Code options.

Sincerely,
Haas Applications

New, Fast, 40x20 Super-Speed VMC

More Parts, Less Time.

THE NEW HAAS VF-3SS FEATURES: 40"x20"x25"TRAVELS | 12,000-RPM INLINE DIRECT-DRIVE SPINDLE | 30-HP VECTOR DRIVE | 1,400-IPM RAPIDS | 24-POCKET SMTC | 1.6 SEC TOOL SWAP