CNC MACHINING

volume 3
number 10
summer '99

coverstory

Hand-Built British Fun

features

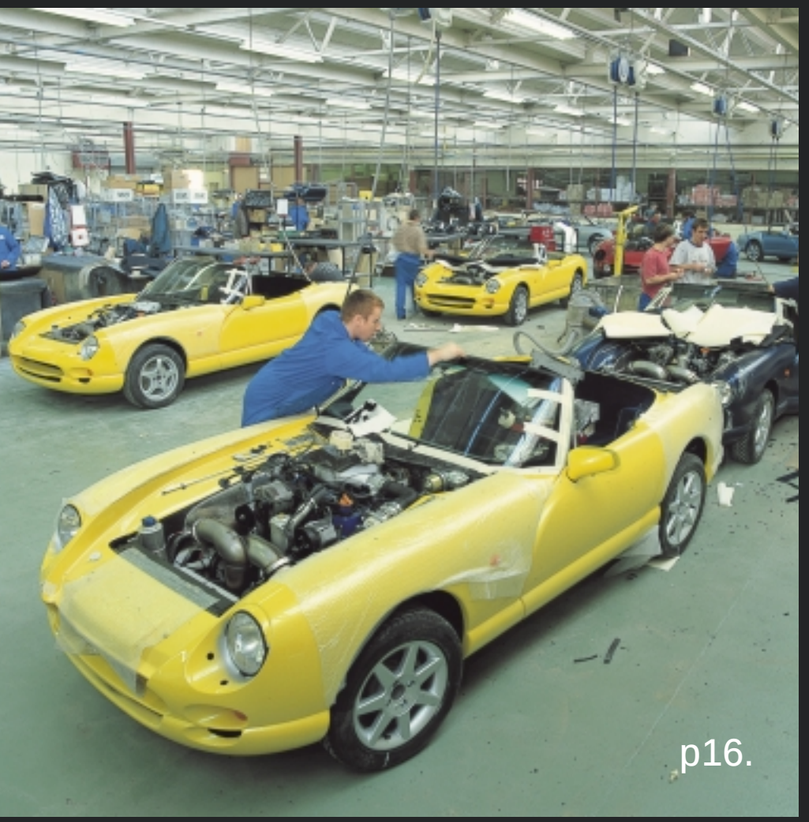
Substrate Review

VB-1 Soars with Eagles

Haas Wins 1999 Renewal Award

CNC MACHINING

coverstory



Gracing our cover this issue are the seductive lines of the TVR Tuscan Speed Six. Powered by a 4.0-litre straight six and weighing less than 1,000 kg, the 360-bhp Tuscan is the embodyment of Gran Turismo motoring. Styled and built entirely by hand, the two-seat covertible is already earmarked as a future classic.

Inset is the 420-bhp Cerbera GT four-seat coupe, a V8 rocketship capable of 0-60 mph in a mere 3.9 seconds and 0-150 mph in a blistering 17 seconds!

p16.

coverphoto Tom Abrams © 1999. Inset and TOC photos courtesy TVR.

THE MASTHEAD

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> volume 3 > number 10 > summer '99

> C O N T E N T S

FEATURES

6 ..... Rad Rides from GT Bikes

10 ..... High-Productivity Horizontals at SKS

14 ..... Substrates for Optimizing Inserts

26 ..... First VB-1 Soars with Eagles at All American Racers

INDUSTRYNEWS

3 ..... Automation Forum Renewal Award

35 ..... Trade Show Calendar

PRODUCTUPDATE

32 ..... Reducing Cycle Times with High-Speed Machining

33 ..... 15,000-rpm Spindle

RACINGREPORT

3 ..... Gordon On Track for Another Championship

3 ..... Haas Puts the Wheels in CART

EDUCATION

31 ..... Gene Haas Engineering Lab at Pierce College

IN THIS ISSUE

Obsessions. We all have them. They occupy our minds and fill our dreams. For some, it's the search for the perfect wave, or finding the fastest line through a decreasing radius corner on a country backroad. For others, it's pushing the envelope of physical endurance, or scouring the stock market for that one magical transaction that will guarantee lifelong financial security.

In this issue of *CNC Machining*, we're obsessed with obsessions. Our cover story comes to us via the United Kingdom, a land obsessed with warm beer, dreary days and some of the finest sports cars in the world. Our European correspondent, Matt Bailey of Haas Automation UK, took on the enviable task of visiting TVR, maker of hand-built motorcars, for a look at their obsession: to build the fastest, most exotic cars in the world. TVR's combination of traditional craftsmanship and twenty-first century technology yields a retro package of classic sports car styling that most of us can only dream of.

But some dreams come with two wheels rather than four. Our piece on GT Bicycles explores their obsession with making bikes, very fast bikes. From stylish cruisers to radical downhill racers, GT takes two-wheeled travel to a higher plain, both on the boardwalk and in competition.

Jerry Keating is a man obsessed with high productivity. Our story about SKS Die Casting & Machining reveals how this one man's vision took an aging machine shop and turned it into a high-tech concern with international connections and some big-name customers.

On the education front, another *Gene Haas Engineering Laboratory* is up and running, with a VF-2 and an HL-2 in place at Los Angeles Pierce College. Students obsessed with learning the latest in CNC technology already are reaping the benefits of the new machines.

For those of you obsessed with choosing the right inserts to fit your machining requirements, there's an informative piece from Valenite on substrates. And if high-speed is your obsession, we detail the latest High-Speed Machining option and 15,000-rpm spindle from Haas.

Also in this issue you'll find some creative solutions from our applications department, and get a preview of the new Haas Factory Outlets and their obsession with total customer satisfaction.

So, sit back, relax and enjoy.

Haas Factory Outlets are Coming

WHY? To provide total customer satisfaction

WHAT? A full service facility in your neighborhood

WHEN? Starting now

HOW?
- Totally dedicated, specially trained sales personnel
- Totally dedicated, specially trained service personnel
- Fully stocked service vans
- 24 / 7 service
- Your customer advocate
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- Consistent quality

Haas Factory Outlet
Torrance, CA

Each HFO must meet the Haas Quality Standards to ensure your complete satisfaction!

You've probably already heard that a Haas Factory Outlet (HFO) is coming to your neighborhood, and you're wondering, "What is an HFO, and what is it going to do for me?"

A Haas Factory Outlet is the same locally owned and operated distributor of Haas products that you're used to dealing with – but with new standards. The HFO will handle Haas products and services exclusively in your area (within a maximum range of two hours from your company). The full-service facilities will include showrooms, training rooms, an area to design engineered solutions, inventory areas for parts storage and a full staff to meet all of your needs – right in your neighborhood.

Each Haas Factory Outlet will handle the full Haas product line and provide all the services and support needed to help make your company profitable. Your local HFO will have a staff of Certified Sales Engineers dedicated exclusively to Haas products, with computers linked through the internet to Haas and the Haas website. They will know the product better than anyone, and have instant access to the latest product information so they can provide the right equipment to meet your manufacturing challenges. The HFO also will have a staff of Applications Engineers specifically trained on Haas equipment who will provide you with better solutions to your manufacturing opportunities. And, to ensure that the sales and installation process always exceeds your expectations, there will be a Customer Advocate you can rely on to work for you.

When you purchase a machine from the HFO, a team of Certified Service Personnel specifically trained on Haas equipment will arrive at your location in a fully stocked service van to provide you with HFO Platinum One Call Service. If your machine does go down for any reason, these Service Technicians will have you back up and running in just one call, more than 90% of the time. With 24-hour-a-day, 7-day-a-week service available, your machine will run any time, all the time. When you only need telephone support, a full team of inside technical personnel will be available to help with any problem.

All of the personnel and services at the Haas Factory Outlets are totally focused on Haas products and must meet the Haas Quality Standards.

What do Haas and the Haas Factory Outlets mean to you? They mean VALUE – the best products, the best prices and the best services.

Haas Automation Wins 1999 Renewal Award

Haas Automation, Inc., has won the 11th Annual Renewal Award as presented by the Automation Forum of Rosslyn, Virginia.

This award recognizes the achievements of North American manufacturers that demonstrate the ability to win substantial global market share through the application of automation and advanced manufacturing technology and modern management practices.

"We are honored to receive this award," said Bob Murray, Operations Manager for Haas Automation. "We're quite pleased to be recognized in the industry for our manufacturing excellence."

Previous winners of the Renewal Award include AT&T, Texas Instruments, Inc., GE Fanuc Automation and Raytheon Aircraft, among others.

The Automation Forum is a diverse group of industry leaders dedicated to advancing the understanding, use and benefits of integrated flexible automation – the broad spectrum of manufacturing technologies, from computer aided design through production and automated warehousing – and the contemporary management systems necessary to run today's businesses. The organization was formed to provide an information exchange forum for senior manufacturing leaders.

With the racing season well underway, Haas-supported teams and drivers are getting the bugs ironed out, or, in some cases, getting their rides rather wrinkled.

Hendrick Motorsports

Jeff Gordon's season as defending NASCAR Winston Cup Champion has been hampered somewhat by a blown engine and a number of ride-wrinkling wrecks, but his #24 ride is still among the top ten in the highly competitive points championship.

Despite four major setbacks in the first ten races of the year – including a broadside hit at Texas that had his car behind the wall for more than 60 laps – Jeff's standing in the overall points championship is on par with last year at this time, largely due to his comeback win at the California 500, a race where all three Hendrick entries finished in the top ten.

PacWest Racing Group

Fate can be a fickle thing when it comes to car racing, PacWest drivers Mark Blundell and Mauricio Gugelmin are fighting to escape the bad luck that has hampered their race results since the start of the season. Sidelined by a debilitating crash during testing at Gateway, Blundell is recovering from a small fracture of the 7th cervical vertebrae. Filling the seat in the interim is Brazilian Roberto Moreno.

PacWest's efforts in the Indy-Lights series find driver Didier André once again in the running for the points championship.

Ilmor Engineering

The Ilmor Technology Center in Plymouth, Michigan, is now on track – literally – and in full-support of the eight cars running the latest Mercedes-Benz IC108E racing engine.

Ilmor engineers now can evaluate and develop strategies trackside in the new Ilmor "Mobile Office," a custom 53-foot trailer built to Ilmor specifications. The high-tech trailer replaces Ilmor's aging engineering rig – itself a ten-year veteran of the CART circuit.

All American Racers (AAR)

Dan Gurney's American-built CART entry (see story on page 26), driven by California-born Alex Barron (#36), is finding reliability and extra horsepower as the season rolls on, recording dramatic performance gains. The Toyota-powered Eagle features body components and other bits and pieces machined on Haas CNCs. Included in the AAR arsenal of Haas CNCs is the first extended-travel vertical bridge mill in the field, the VB-1.

Arciero-Wells Racing

Another pair of CART entries carrying the Haas logo are the two Toyota-powered Reynards driven by Scott Pruett (#24) and 1998 PPG-Dayton Indy Lights champion Cristiano da Matta (#25). In the running for rookie of the year honors, da Matta placed 4th at Nazareth, the highest finish yet for the Toyota racing engine.

C&C Motorsports

Troy Cline, racing partner with Joe Custer, keeps sliding his sprint car into the winner's circle and currently is in contention for top honors in the Sprint Car Racing Association (SCRA) series points race.

Dividing their driving between various race series – the SCRA Sprint Car circuit, NASCAR Winston West sedan racing, and the SCORE off-road racing championships – Troy and Joe are keeping the Haas name out in front in the Southwestern states.

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At Haas, we know that the only way you make money is by making chips, and that means keeping your Haas equipment running in top condition. Our Platinum One-Call policy provides expert service and a dependable, immediate response to keep you making chips. Through our developing nationwide network of Haas Factory Outlets, we're building an elite crew of factory-trained and certified service technicians who focus exclusively on Haas machines. Arriving in fully stocked Haas service vans, our technicians will successfully complete better than 90% of their service calls the first time out.

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800-331-6746 www.HaasCNC.com

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With more than 20,000 units in the field, and 2,500 employees backing up your machine from local HFO headquarters, you'll have the best built, best backed machine tool available anywhere in the world.

Each and every Haas Factory Outlet will provide you, our customers, with the industry's very best:

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- **7-day, 24-hour Platinum One-Call response**
- **Fully stocked service vans**
- **On-shelf replacement parts availability**
- **Local radio dispatch coverage**
- **Inside technical support and coordination**
- **Toll-free technical support**
- **Applications skill training**
- **Full turnkey service**
- **Factory-trained and single-line focused sales staff**
- **Post-sale follow through and support**
- **Haas Customer Advocate represenatitive**

HAAS

From Crude to Rude

GT Bikes Leads the Pack in Rad' Rides

When Gary Turner flashed his TIG welder into action to fuse together a 4130 CroMo alloy motocross frame for his son's racing efforts, he had little idea that he was sparking the start of a bicycle company that would someday carry leading riders to victory after trophy-snatching victory.

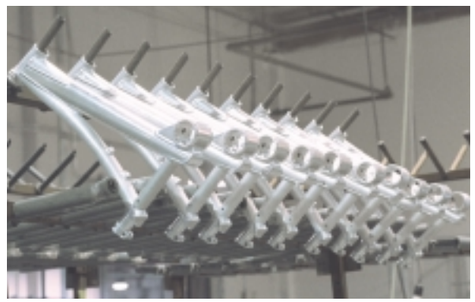
Story & Photos
Preston Gratiot

Bicycle photos courtesy GT Bicycles

Historians agree that cycling's past stretches back some 200 years to the time when crude, two-wheeled "hobby horses" were shuffled about the countryside by the wealthy young men of England. Crude as they were, these wood-framed contraptions soon led to the development of cycles pedaled via a crank attached to the front axle. Incremental advancements in design and style such as this have long been the norm in the world of bicycling.

Today, GT Bicycles, Inc., "pedals" its product in 69 countries around the world, with more than 140 models currently available ranging from bicycle motocross (BMX) bikes to road bikes to mountain bikes.

This rack of 6061 T-6 aluminum frames is destined for use on the flatland freestyle circuit. Featuring CNC machined head tubes and bottom brackets, these frames are ridden by the top riders in the world. Eric Carter (opposite) demonstrates his talents by "grabbing some air" during a downhill race.



Aggressively expanding the bicycle performance envelope with high-tech materials, tradition-breaking designs and advanced construction techniques, GT is a leader in two-wheeled technology. Where the common bicycle once fit the needs of the many, enthusiasts and competitors alike now demand a wide variety of choices at various price points. Some serious riders go so far as to maintain a stable of bikes, one to meet each riding style or event in which they may compete.

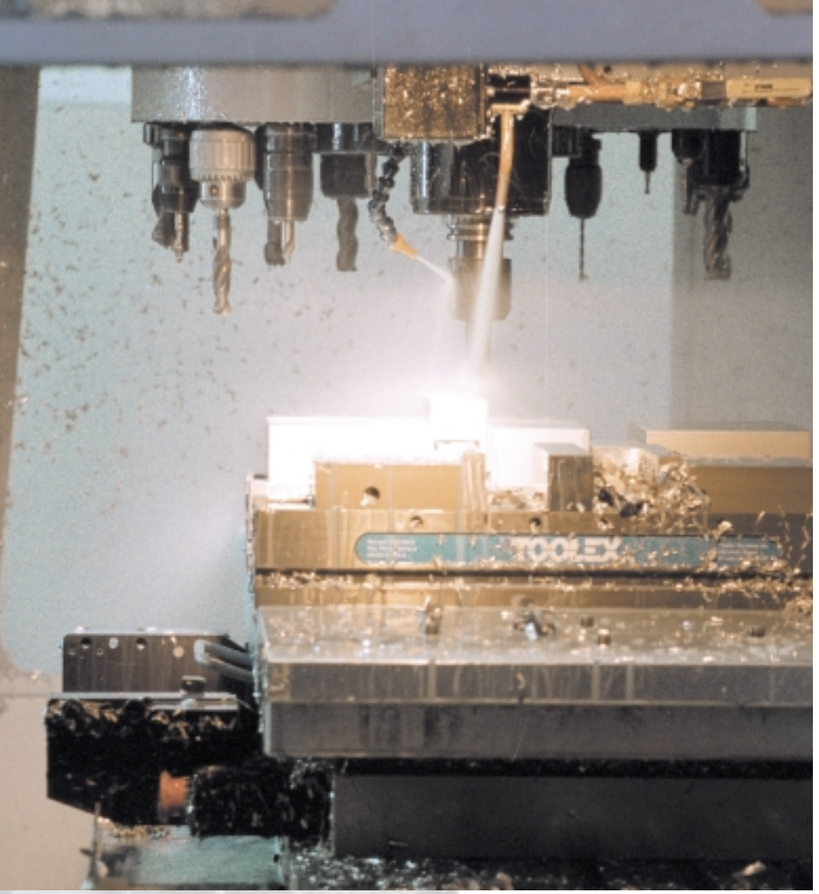
To meet the diverse demands of today's riders, GT modified its manufacturing techniques and responded with bicycle frames made of steel, aluminum and titanium alloys, as well as the latest carbon-fiber composites. Haas CNCs play an important part in this design revolution, with GT using versatile machining centers in both the main plant and off site at Innovative Metal Designs (see CNC Machining, Fall 1998).

Growth & Technology

GT Bicycles has flourished on a policy of heavy participation in competitive events that test the extreme limits of the bicycle. This constant high-profile involvement in competition includes all forms of freestyle aerobatic stunting, BMX racing and downhill events. But to win big – and "Team GT" can claim a string of World Cup victories and championships, in addition to 16 consecutive team titles in BMX competition – advancements in technology must be frequent and fanatically supported by both the designers and members of Team GT itself. But these advancements don't come cheap. In 1997 alone, GT invested more than $2.5 million in research and development.

New Location

GT recently moved to a new facility in Santa Ana, California. "The relocation was necessary to improve our operational efficiencies," says Tom Mason, president and chief executive officer of GT Bicycles. "By consolidating GT's manufacturing, warehouse and product development functions into one site with increased square footage, we have been able to bring more production and assembly functions in-house. These include automated wheel-building and CNC machining. Our goal is to increase the amount of assembled product built in-house by about 50 percent for the 1999 product line."



GT presently runs a VF-4 equipped with a "side-by-side" manual pallet system to mill frame parts such as the bottom bracket crank housings. The operator can load and fixture a pallet of parts while the other pallet is inside the Haas being machined. This increases output significantly, because all non-machining tasks are done outside of the machine cutting area.

Pedals in Suspension

For 1999, GT Bicycles introduced an all-new dual suspension design called the GT i-drive four-bar link system. Though GT is already recognized as the leader in dual suspension – both front and rear wheels feature fully-articulated suspension with up to six inches of travel and shock absorbers to dampen the jarring effects of rough terrain – this revolutionary concept promises to transfer more rider energy to the ground than any other crank model on the market.

Ever since the development of full-suspension mountain bikes, the industry has been challenged by the ever-pervasive problem of pedal-induced "bio-pacing," a jerking motion that occurs throughout the chain while the suspension is active. This results in a disruption of the pedal stroke, forcing the rider to work harder to maintain a steady cadence.

GT's innovative solution revolves around the design of their new i-drive system. The i-drive four-bar link system isolates the crank, and thus the pedals and feet, from the frame's suspension or terrain input, while creating constant, uninterrupted tension throughout the chain. This means the bike can be ridden more aggressively one or even two gears higher than other bikes on any given terrain.

At GT, the goal is to build every part lighter yet stronger. This calls for the ultimate in design and machining skills to achieve these weight cuts without sacrificing structural reliability. Once the perfect balance of mass and design is arrived at, the machinist must be able to duplicate the design time and time again to ensure that part failures do not lead to the dreaded DNF (Did Not Finish), or even worse, a rider injury. This is where the Haas machining center delivers repeatable perfection, the perfection Team GT trusts when racing downhill on the edge of control, the same perfection team riders can depend on while flying through the air and wondering if their bike will survive yet another landing. It's teamwork that delivers perfection, from the designer, to the machinist, to the rider; and the records prove that GT Bicycles is doing it right – consistently!

GT Bicycles
2001 East Dyer
Santa Ana, CA 92705-5709
714-481-7103

Keeping a well-stocked umbrella of tools on hand, the GT Bicycles Haas VMCs are constantly up and running, cutting parts. GT is known throughout the world as a leader when it comes to revolutionary bikes, always on the cutting edge of design and development. Be it advanced designs for downhill competition (i-drive suspension component, below) or radical beach cruisers built purely for style – GT rules.

Custom Cruisers *for the Cool at Heart*

WHILE GT BICYCLES has made an enviable name for itself manufacturing high-tech competition bikes, there are many riders out there who don't care how much "air" they can get or how light their computer-designed, TIG-welded titanium frame is.

They just want to ride, and to ride in style. . .

Dyno Cruisers

GT has a division dedicated to meeting the desires and needs of these riders who tend to frequent local bike paths and coastal cruise zones. The division is called Dyno Brand Fat Tire Bikes, and its motto is, "Just for Fun."

Okay, maybe the designers and engineers have still incorporated some of the trick "tech" elements found on the more aggressively designed offerings from GT, but the focus here is on style – and these fat-tired cruisers are a far cry from the paper-route bikes Wally and the "Beaver" used to peddle around their version of suburbia.

As the Dyno catalog says, these bikes are "More stylish than fuzzy dice, and more fun to play with than a big V-8. Better gas mileage too!"

Trick Touring

However, for those who need high-tech tricks, Dyno offers a number of fat-tired cruisers that embody the look of the vintage middleweight frames popular with today's beach-cruiser set, but without the weight. These lightweight posers feature buffed aluminum frames and 7-speed Shimano Nexus drivetrains guaranteed to bridge the gap between the typical mountain bike and the beach cruiser.

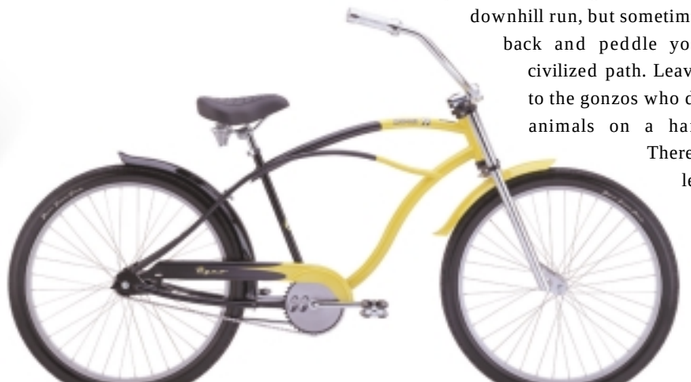
Long, Low and Loaded

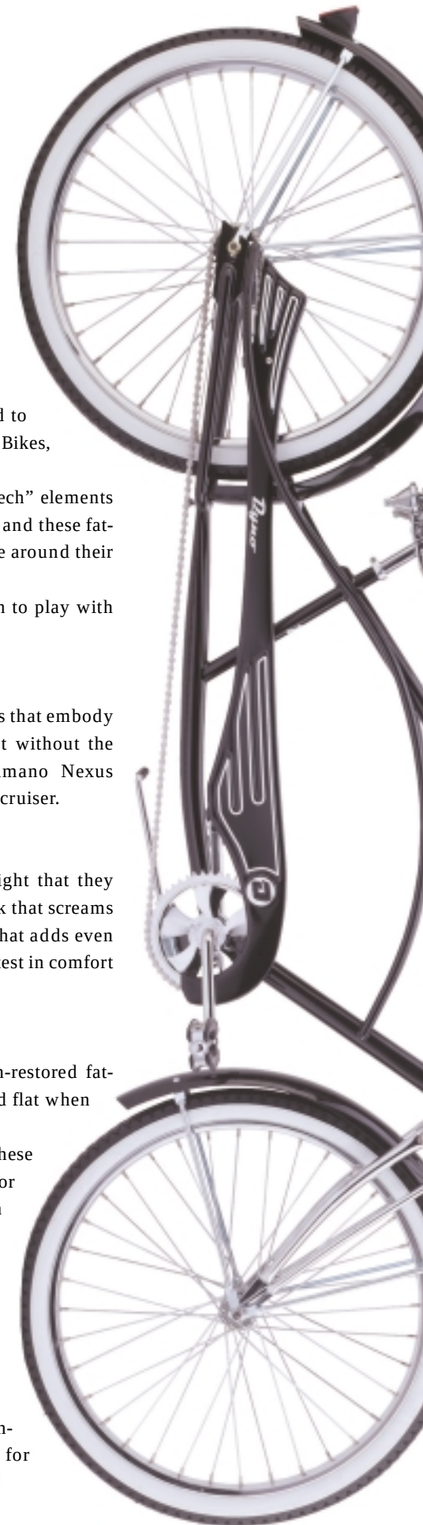
Since Dyno offers hot-rodded versions of the typical beach cruiser, it only seems right that they should also offer a sleek, lowered version as well, with a stretched frame and a springer fork that screams lo-rider style. The Roadster even gets a seat patterned after the "Harley" hardtails of yore that adds even more comfort to the package. And for couples, Dyno builds tandem bikes that deliver the latest in comfort with a choice of 6 to 18 gears.

Classic Cruisin'

While there is a certain amount of class involved in pedaling the beach on the non-restored fat-fendered bike your grandfather delivered groceries with, rusty-retro looks kind of flaky and flat when sitting next to the Dyno Glide Deluxe series.

Basically the equivalents of stripped-down, customized '32 Ford Hi-Boy roadsters, these bikes are the balloon-tired bad-rides that set today's standards for style. It's fun to get the adrenaline pumping on a downhill run, but sometimes you just have to kick back and peddle yourself down a more civilized path. Leave the dirt and danger to the gonzos who dig sweating away like animals on a hamster-wheel Sunday. There's a lot to be said for a leisurely cruise down the boardwalk on a balloon-tired bicycle built for bodacious style.





SKS Does It Their Way!

A long time ago Jerry Keating learned that discovery consisted of seeing what others had seen and thinking what others had not – that's how you become one of the most creative and cost-efficient die casting, machining and finishing corporations extant.

Story
Gary
Brient

Photos
Scott
Rathburn

For Jerry Keating, anything that saves time in machining processes also saves money. His investment in HS-1RP HMCs allowed SKS to machine this part in a single setup rather than three, and shave 11 minutes off the production time. The resultant savings of $14 per part on a 12,000 part run netted a tidy $168,000.

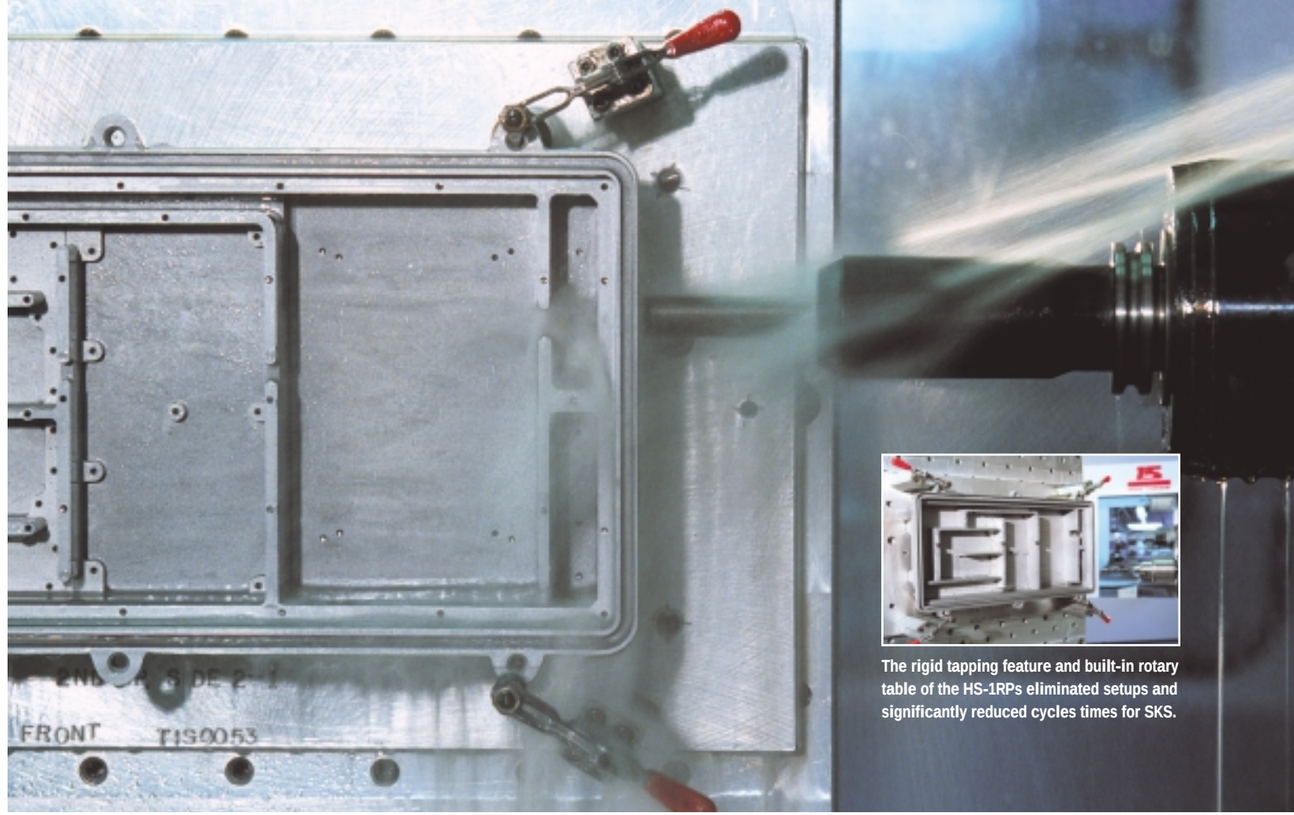
SKS Die Casting & Machining was a leftover from World War II; all the tanks, planes and ancillary materials were history. Yet, three men, Schumacher, Kay and Scott (SKS), had a facility that needed to survive. They struggled through, making ends meet, until 1975, when a "discovery" occurred. Jerome W. Keating, President of Aerojet Manufacturing Corporation, saw SKS as an under-utilized facility, and he thought a progressive future. So what did he do? He bought SKS, and he's never looked back. With a Masters in Science from the Massachusetts Institute of Technology and a manufacturing background in rocket propulsion, chemical manufacturing, space technology, lunar exploration and nuclear reactor componentry, an eclectic future was a promise for SKS with Jerry Keating at the helm.

A quarter of a century later, SKS designs and manufactures parts for the computer, aircraft, medical, automotive and communication industries. The corporate client list reads like the Who's Who of the S&P 500: IBM (a customer for 36 years), Hewlett Packard, Northrop, Titan Information, Xerox, you get the idea. Currently delivering nearly 6 million parts a year to clients, this postwar machine shop is now upgraded to an authentic, progressive manufacturing concern utilizing the latest CNC and CMM technology.

In a word, SKS has a "vision," and that "vision" is enhanced by a corporate leader whose hands-on approach to managing governs 75 employees. SKS produces more than 500 different parts a year that conform to applicable industry standards or customer-specified requirements.

Traditionally, die casting companies do not machine parts. Only 20% of die casters machine parts to a finished quality. Here again the vision of SKS comes to the forefront. Their attitude is, Whadda ya want? – casting, machining, painting, anodizing, plating, powder coating, etc. The client provides the drawing, SKS provides the part.

In the production of parts, Mr. Keating learned a long time ago that machining is labor intensive and costly. Hence, parts are cast then machined. Anything that saves time in machining processes also saves money. A case in point for Keating was when he visited the 1997 Machine Tool Show in San Jose with Sergio Specia, his shop superintendent; Jesus Lavenant, the program setup man; and Jeff Ratto, maintenance supervisor. Dropping by a Haas demonstration, Jerry again could see beyond what others had seen. Currently, he was machining a part that required three different setups. What became blatantly clear at the Haas booth was that the HS-1RP horizontal machining center could be utilized to machine the same part with only one setup – a savings of time and money. Logic dictated that two HMCs would greatly enhance SKS's shop capabilities and increase their capital worth.



The rigid tapping feature and built-in rotary table of the HS-1RPs eliminated setups and significantly reduced cycles times for SKS.

Shortly after the show, two Haas HS-1RP 4-axis horizontal machining centers with pallet changers were purchased and delivered to SKS. The Haas mills commenced a 4000 part production run of a Titan Information Systems enclosure. This aluminum die-cast part necessitates 72 inches of milling and the drilling and tapping of 60 holes – 24 of 8-32 and 36 of 4-40 specifications. When compared to the vertical milling of the part, the Haas horizontal saved 11 minutes out of the total production time. This reduction of machining time provided SKS a $14.00 savings per part. Now, when you stop to consider that the original contract was for 5000 parts, then you add a follow-on contract of 7000 parts, you arrive at the tidy savings of $168,000. This profit was more than sufficient to pay for the Haas HS-1RP . . . no dolts on this team.

According to Jerry, it was the rigid tapping feature and the built-in rotary table that made the difference between the Haas HMC and their old vertical mills. Not only did the Haas save milling time, but it eliminated two setups, and that's an additional savings in labor costs. Or as Jerry puts it, "it significantly decreased the cycle time on parts. We run these machines on two ten-hour shifts. And remember, the art of making money in the machining business is, keep your machines running. Furthermore, the rigid tapping didn't break taps. On our other mill, taps were regularly being broken at significant expense to the company." So, where does this part go? Into a satellite communications module, that's where it goes.

Today, SKS has the technical capability and the capacity to run a number of concurrent die casting development programs involving new alloys, process-control procedures and specialized processing or finishing. Programs of this kind are normally handled on a time-and-material basis, with proposals based on estimated overall costs. For R&D projects, the client bears the costs of required tooling regardless of the outcome of the project.

Over the years, SKS has developed many master holding blocks for use with individual customer insert dies. These insert dies are the property of the customer. Once the quoted price for the initial tooling has been paid, these dies will be returned to the customer without additional costs.

Inquiries and requests for quotations are carefully screened by SKS's engineering and estimation departments; then, detailed cost proposals for individual parts are provided in letter form. To assist clients in obtaining the best possible component with the most economical

Please see page 13

SKS continued from page 11

manufacturing method, they will offer design suggestions at this stage, particularly when slight modifications to parts will improve castability and generate cost savings.

Currently, SKS also realizes that compliance with ISO standards will have a major influence in manufacturing and quality control in the years ahead. SKS is undergoing a rigorous ISO 9002 certification program. Concise and clearly defined procedural guidelines have been established for every operating department. Because of the exacting ISO standards, quality assurance is virtually certain at every level. From employee training programs to various stages of project development, the ISO certification declares a commitment to excellence. The accuracy and repeatability of the Haas HMCs will help SKS meet and maintain these rigorous standards. As of February 5 of 1999, SKS is positioned to fulfill the most imposing demands of client quality requirements with full ISO certification.

Another example of SKS's discovery philosophy is a joint venture in the People's Republic of China (PROC) with Silk Road Enterprises, a corporation specializing in the transfer of technology to PROC. There are now three joint venture plants: the first was opened in 1989 in Zhuhai SEZ near Hong Kong; the second plant in Changqing commenced production in 1990; the third plant is in Qinhuangdao, a city near Beijing. This Asian operation is named Pacific Die Casting and Machining. Pacific will provide high-volume, low-cost production of precision components to the whole of Asia. However, all of the initial tooling is done in the U.S. plant, and the Haas equipment has been instrumental in that production. The First Article Qualification Units are manufactured here in the United States. An initial production run ensures that all tooling, quality and production problems are completely resolved before mass production begins abroad. It is at this time that die cast, machining and inspection tooling, along with the process control and quality assurance programs, are then shipped to the China operation. With their China initiative, SKS feels well-positioned for the new millennium.

SKS runs their Haas HMCs 20 hours a day in two 10-hour shifts. The built-in pallet changer of the HS-1RP allows programmer/machinist Bruce Thompson, above, to load new material, unload finished parts or setup a new job on one pallet while the other is being machined.

Reporter's Notes:

The directness of this man is uniquely beguiling. Well-informed, contemporary, opinionated and knowledgeable – Berkeley should produce as many Jerome W. Keatings as they can. Of course, you don't get many reproductions like this one. Holding his Masters in Science from MIT, he is a registered engineer in the State of California. Mr. Keating also holds a number of patents issued by the U.S. Government for manufacturing processes. In 1989 the American Institute of Aeronautics and Astronautics awarded Mr. Keating its Distinguished Technical Achievement Citation for "tremendous effort displayed in development, design, construction and demonstration of a safe and economical manufacturing process for the continuous production of composite propellants for the Polaris 260-inch Space Booster, Minuteman and ASRM." Not a bad account of a septuagenarian, would you say?

And Mr. Keating has become a fan of his Haas equipment. He delights in having a distributor but a few miles away when a machine burps. "One of our incentives to purchase Haas was the service provided by our local distributor, Selway Machine Tool Incorporated. In the past, we have paid mechanical engineer's round trip airfares and hotel expenses to affect repairs on some of our machines. The cost, delay and lost production can be a significant drag on our bottom line. With the Haas, we know we can have same-day service in an emergency."

Jerry Keating has another major accomplishment, a 49 year marriage to his wife Leonore. Add eight children to the mix and you have a man who has a pure definition of how much time there is in a day. He is a man for all seasons.

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Substrates

A Systems Approach To Insert Selection

Story
Karl Katbi
Valenite, Inc.

Today's worldwide machining requirements are so diverse that cutting tool manufacturers are busy developing new inserts to meet the ever increasing demand. R&D efforts strive to combine an insert's seven critical characteristics (listed below) to satisfy very specific applications. Needless to say, the combinations of insert characteristics can run into the tens of thousands.

Substrates can be tailored to provide the characteristics necessary for specific applications, such as wear and crater resistance, which are the highest priority for turning inserts.

Every successful cutting tool application represents a combination of: 1) substrate, 2) one or more coatings, 3) chipbreaker or "top form" geometry, 4) a specific edge preparation, 5) a specific style and nose radius, 6) toolholder and 7) cutting fluid. This article will provide an overview of substrates and explain their importance in cutting tool performance.

The Substrate

The substrate is the "foundation" for the cutting system in a coated insert, but it never actually comes into contact with the workpiece. This fact permits cutting tool manufacturers to tailor substrate properties over a much broader range than was previously possible with uncoated carbide.

The vast majority of substrates are made from tungsten (WC) carbide which is still the only material available with the hardness and toughness required to handle a broad range of cutting applications. The first substrates were simply traditional straight tungsten grades coated to improve their performance. Many of these combinations proved so successful, they are still used today.

Today, there are different types of basic carbide substrates. The first type is 5-12% cobalt (Co) by weight, with the balance being tungsten (WC). Cobalt is the binder that keeps the carbide together. Cutting tool manufacturers can engineer a substrate by changing the tungsten grain size. Typical tungsten grain size is 1-5 microns. The finer the grain, the more the wear resistant it is; the larger the grain, the tougher it is. Similarly, changing cobalt from 6% to 7% makes the substrate much tougher. End users must decide what they want for their particular metalworking application – toughness or wear resistance.

The second basic carbide substrate is 5-10% cobalt by weight, with the balance being tungsten and other cubic carbides. The addition of cubic carbides to this substrate provide one primary advantage: more wear resistance. In this case, tungsten grain size is 1-4 microns.

Key Properties

There are five key substrate properties that must be considered for any workpiece material. They are: fracture toughness, hardness, traverse rupture strength, compressive strength and thermal shock resistance. An end user must select an insert with the right combination of these properties to satisfy the needs of a particular machining requirement.

• Fracture toughness is the substrate's ability to resist crack-related failures. Interrupted cuts, such as those that occur in milling for example, can cause thermal cracking on the cutting edge. That crack will grow causing either a catastrophic failure of the insert or a loss of size and finish on the part. The crack will go right to the substrate, heating the cobalt binder, deforming it and causing the insert to break.

• Hardness, a second key property, is necessary for abrasive wear resistance. There are two types of abrasive wear: mechanical and chemical. Mechanical wear occurs at lower speeds, chemical wear occurs at higher speeds.

• Traverse Rupture Strength is a measure of body strength or porosity.

• Compressive Strength is a measure of the substrate's deformation resistance. This is closely linked to hardness. The harder the substrate, the more deformation resistance it has.

• Thermal Shock Resistance is the substrate's ability to withstand heat cycling or sudden heating or cooling, as typically occurs in milling.

Alloyed Carbide

Although tungsten with cobalt binder is the basic substrate which provides a unique combination of strength and toughness, others are available.

Cubic carbides (TiC, TaC, NbC, VC and others) can be added as grain growth inhibitors or to strengthen the substrate. Cutting tool manufacturers can engineer a substrate with specific percentages of cobalt, tungsten and cubic carbides to create a product suitable for machining the widest range of workpiece materials. To find the specific combination needed for a particular application, end users should look through a cutting tool manufacturer's application booklet.

Cobalt-Enriched

A whole new class of cobalt-enriched substrates is available today that have tougher edges, without sacrificing bulk hardness. Two types of cobalt-enriched substrates are available: stratified and beta-free. The stratified layer is right below the surface. Other layers are at specific depths from the surface. This cobalt-enriched substrate with TiC and TiN coating is suitable for interrupted cuts.

The second type of cobalt-enriched substrates is beta-free. It can be located anywhere from 5-40 microns below the surface. It has more cobalt, but no cubic carbide. Beta-free is more suitable for high-speed applications, whereas stratified is more suitable for tougher applications.

The point to remember about both stratified and beta-free substrates is their hardness. Their surfaces are much tougher than non cobalt-enriched substrates, and they become more wear resistant at increasing depths into the substrate.

Carbide inserts are loaded into a CVD coating furnace at Valenite Inc., Madison Heights, MI.

Substrate Processing

Substrate processing begins with the mixing of the powder formulation of tungsten (including proper grain size) and cobalt. The mixture is pressed by a mechanical or hydraulic press into the desired insert shape. Newly formed inserts are referred to as being in the "green state." Inserts go directly to the sintering furnace.

There is a specific sintering process for each kind of substrate – straight tungsten, cobalt enriched, etc. Different substrates dictate different temperatures and different lengths of time in the sintering furnace. This is known as the sintering cycle.

Inserts leaving the furnace are smaller and harder than during their green stage. Once cooled, they go to grinding to eliminate the cobalt build-up. The top and bottom, or periphery, is ground for tolerance and to provide a smooth surface. The cutting edge is then honed. Every product line has a different radius and different hone standards. Differences exist because of application driven standards. There are four classes of hones: A, B, C and D, each with their own range. Class A is .001" to .002"; class B is .002" to .003"; Class C is .003" to .005"; and class D is .005" or larger. The vast majority of inserts fall into the A-B range, because this is where the majority of applications are.

From here, the inserts go to surface cleaning where they are dipped in soluble chemicals to remove any cobalt from the surface. This is very important because a coating won't stick to the inserts if a cobalt residue is present. Coating, the next step, is optional. The coating acts as a heat barrier to the substrate to prevent it from deforming and enables the substrate to run at higher speeds. Numerous types of coatings are available. They include:

CVD	PVD
TiN	TiN
TiC	TiCN
TiCN	TiALN
TiC/TiN	
TiCN/AL203	
TiCN/AL203/TiN	

Please see page 34

TVR's Blackpool Works

In the 75 years since Henry Ford first showed the world one way to manufacture an automobile, almost as many alternatives have come and gone. Some have been adopted, most have been discarded ignominiously to the scrap heap of industrial progress. Today, the production line of a typical mainstream manufacturer is the epitome of clinical efficiency, often with its roots firmly in the lean and highly evolved industry benchmark: the Toyota Production System.

Story: Matt Bailey, Haas Automation UK
Photos: Tom Abram © 1999

First time visitors to TVR's factory in Blackpool, Lancashire, can be forgiven for thinking that the company has discovered an all together new way of designing and building a motor car. That's not to say, however, that TVR's are built any less efficiently than the Toyotas of this world, just that where others have evolved, first impressions at TVR indicate more of a . . . proliferation. To understand the company, its cars and their origins, we need to regress.

Imagine, if you will, that you are 12 years old and obsessed with cars (not that difficult for some of us). Frustrated by the bland uniformity and uninspired functionality of modern motor cars, picture the four-wheeled automotive sculpture that you would likely design on the back of your school book. Close your eyes and listen very carefully and you can just about hear the muted cacophony of a highly tuned multi-valve V12 on tick-over. Assuming, in your adolescent daydream, that the family garage is your factory, visualise the many half-forgotten engine and component modifications occupying every available space, each one the manifestation of a nocturnal epiphany, another crazy idea which might just squeeze out more power or speed. Imagine this on an industrial scale, mix in sufficient infrastructure to be simultaneously creative and profitable, and you're not far off today's reality at TVR.

In 1998 the 750 craftsmen and engineers at TVR produced 2,000 hand-built motor cars, every one of which was built to a customer's specification, and every one of which cost less than half as much as the "mass produced" equivalent from Germany or Italy. But don't confuse sticker price with quality. TVR proves that the correlation between these two variables is not necessarily as the Porsches and the Ferrari's of this world would have us believe.

By means of a carefully balanced mix of skill, traditional craftsmanship and advanced manufacturing technology, TVR is able to produce exciting and well built cars which probably would never make it off the drawing board in a company run by accountants. Cars like the new Tuscan Speed Six. With everything designed and built in-house, including body, chassis, 360-hp engine and all the switch gear and dials, these cars are unique, highly desirable and temptingly affordable.

The Early Days

Where most cars designed and built in the 1990s are politically correct understatements, apologetically sipping gas and surreptitiously blending in, TVRs are a shameless celebration of the sports car breed, dressed in the automotive equivalent of Versace and using technology and materials most modern race teams would be familiar with.

But the TVR spirit seems to belong to a different age, a world when roads were quiet and leafy, when a cardiovascular workout could be had by merely "dropping" the clutch, and when drivers of high-powered motor cars were held in the kind of esteem normally reserved for venturesome aviators.

Back in 1947, in an austere postwar Britain, a young and restless engineer by the name of Trevor Wilkinson (TreVoR) built himself a light alloy special based on an Alvis Firebird rolling chassis. Just two years after those early efforts, the very first TVR emerged with its own custom-designed chassis powered by a Ford side-valve engine. Produced in very small numbers, these simple but devastatingly effective sports cars soon built an ardent following of motoring enthusiasts, all looking for power, agility and maximum fun . . . for not a lot of money.

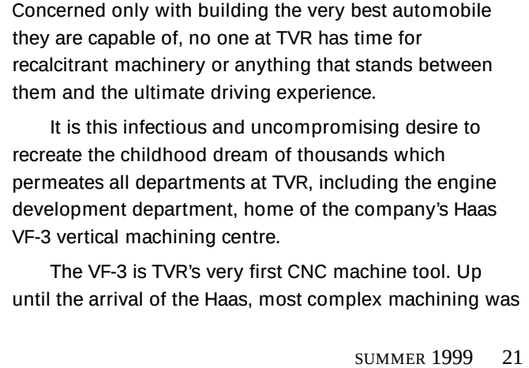
The TVR identity we're familiar with today was formulated in the mid-1950s with the introduction of the Grantura. Fast, agile and good looking, the Grantura used a lightweight body based on a strong tubular steel chassis and was propelled by a powerful big-block engine.

Over the next 30 years, a succession of such cars were created by TVR, all providing the requisite number of "bangs-per-buck" and regularly embarrassing the industry's racing aristocrats: Jaguar and Ferrari. But it was in the late 1980s, with the introduction of the TVR "S," that the company entered the purple patch which continues to this day.

Under the guidance of the new owner and chairman, Peter Wheeler, TVR had been taking the low-cost muscle car concept to new extremes, finally shaking off the unfair and misplaced "kit car" label and the home-built quality connotations that come with it.

Then in early 1992 came the V8-powered Griffith. Launched at the UK motor show of that year, the Griffith bagged an amazing average of an order every eight minutes, and was lauded by the international motoring press as an instant classic.

In the few years since, the uprated 320-bhp Griffith 500 has enhanced the original concept and been joined by the elegant and pragmatic, but no less exciting, Chimera convertible, also available with the 5-litre 320-bhp V8. The mantle of company rocket ship, however, is currently held by the 420-bhp Cerbera GT four-seat coupe capable of 0-60 mph in 3.9 seconds and 0-150 mph in a blistering 17 seconds!



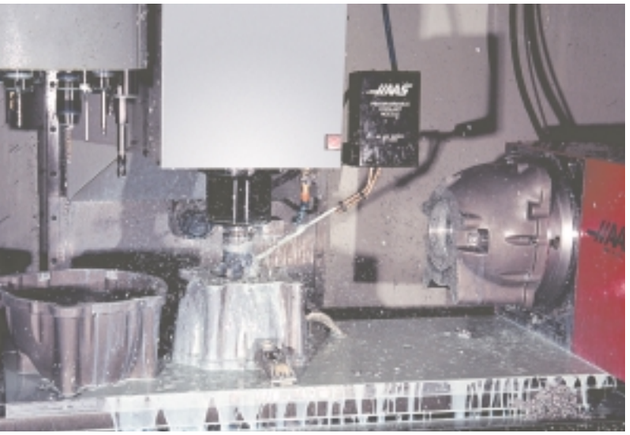
Already earmarked as a future classic is the very latest addition to the TVR lineup. The all-new TVR Tuscan Speed Six is a masterful combination of retrospective styling, classic sports car dynamics and twenty first century technology. Styled and built entirely by hand, the two-seat convertible Tuscan Speed Six looks like a coupe and embodies the very essence of traditional Gran Turismo motoring. Employing a 360-bhp straight six engine and weighing less than 1,000 kg (about 2,200 lb), the eye-catching Tuscan can be a mile-eating continent-crosser or, when the mood takes you, more fun to drive than should ever, some say, be legally allowed.

Engine Development

One could be forgiven for thinking that where others have blood, the men and women at TVR have petroleum. Concerned only with building the very best automobile they are capable of, no one at TVR has time for recalcitrant machinery or anything that stands between them and the ultimate driving experience.

It is this infectious and uncompromising desire to recreate the childhood dream of thousands which permeates all departments at TVR, including the engine development department, home of the company's Haas VF-3 vertical machining centre.

The VF-3 is TVR's very first CNC machine tool. Up until the arrival of the Haas, most complex machining was



The aluminium bell housings for TVR's 4.0-litre straight six are machined on a three stage fixture incorporating two static stages and one using an HRT 310 rotary table.

outsourced to local subcontractors, with more simple work being carried out on the company's manual knee-type mills.

Presiding over the VF-3, and instrumental in the company's decision to purchase the machine, is Gavin Beach. As a development engineer for his previous employer, Oxfordshire-based Reynard Racing Cars, Beach was also a key player in Reynard's decision to buy three Haas machines. "We knew exactly what we were looking for when we decided to buy a CNC mill," says Beach. "I was very impressed with the Haas machines at Reynard, I knew what the machines were capable of and I knew what it would enable us to do at TVR."

Beach's enthusiasm for the Haas wasn't lost on the holders of the company purse strings. "Because there was no need to consider other machines, we saved a lot of time. It was just a question of talking through our needs with Haas Automation UK, and choosing the right machine and rotary," he claims. "Being the company's first CNC machine tool, I think there was some concern that we might not fully exploit the machine, that it might be a little surplus to our requirements. That couldn't be further from the truth. Since the machine arrived we've kept it very busy, and we have plenty of ideas for keeping it even busier in the future."

In keeping with the philosophy of enthusiasts building cars for enthusiasts, there are no job titles at TVR. So, although everyone has a broad remit according to their skills base and experience, there are no internal barriers stopping employees from one department getting involved in almost any activity in another.

"Since installing the VF-3 a queue of people has appeared," says Beach, "all either with components which they'd like to be machined on the Haas, or just keen to learn what it's capable of."

The VF-3 currently spends most of its time machining components and housings for TVR's homegrown straight six engine, but what little free time is available has so far been spent redesigning chassis and suspension components for the company's GT race car.

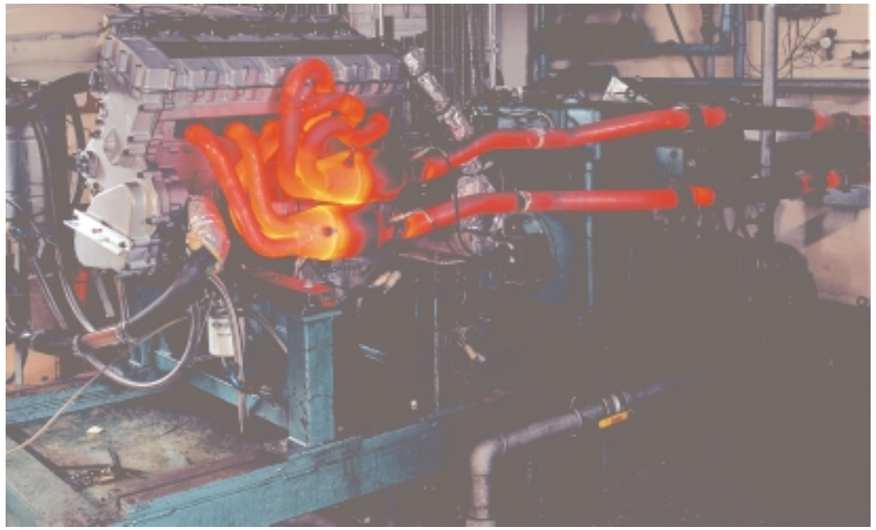
"Many of the parts we are doing for the GT car will be very short run, perhaps only 6-12 examples of each in the course of a season," says Beach. "However, where in the past we've used fabricated components, we can now use the Haas to machine them from solid, simultaneously increasing strength and reducing weight."

Straight Six

Those automobile manufacturers that can afford it often invest hundreds of millions of dollars to develop and build new power plants for their production vehicles. To avoid these crippling costs, TVR is bound to using engines from other companies, and for some time the cars have been synonymous with the tried and tested Rover V8 unit, available in either 4.0, 4.2, 4.5 or 5.0 configuration.

Keen to offer the customer a choice, TVR has taken an expensive chance and designed and built its own 4.0 litre straight six engine. Offered as an alternative to the V8 in the Cerbera, the 360-bhp straight six will also be the standard power unit for the forthcoming Tuscan, the car TVR hopes will continue its run of good fortune into the 21st century.

Using the Haas VF-3, the engine development department is currently machining 20 crankshafts per week for the straight six power unit. Cast in austempered ductile iron, the crank is held between a tailstock and a Haas HRT 310 rotary table. A tipped mill with a flat underside is brought down to machine a flat surface on the first of the crank's main bearings. The HRT is then



To provide a choice for their customers, TVR has taken an expensive chance and developed their own 4.0-litre straight six engine as an alternative to the venerable Rover V-8. The 360-bhp straight six, shown being tested above, will be the standard power unit for the company's forthcoming Tuscan Speed Six.

indexed 4.8 degrees and another flat is machined. This process continues for each main bearing until all four have 75 flat sides each. Through this process the maximum amount of material can be removed, minimising the total time necessary to grind the bearings to the correct tolerance.

Having such a high unit value, machining the crankshaft right the first time is extremely important, and TVR have been very careful to make the metal removal process as quick and accurate as possible. "Production of the crankshaft has only just begun," says Beach. "But so far, I'm happy to say, the machine and the rotary table have worked perfectly. No problems and no scrap."

Before the arrival of the Haas, the crankshafts were sent out to have the excess metal removed. Apart from the extra work involved in shipping and receiving the cranks, the actual cutting cycle per component was approximately six times slower than the current in-house arrangement.

The Bell Housing

The aluminium bell housing for TVR's straight six has been given the Haas treatment from start to finish, concept to working example. Where the previous version was made by hand, the pattern for the new cast bell housing was designed on the company's HyperMill CAD software and drip fed directly to the Haas, which then machined the mould pattern from model board. Beach found the whole process particularly impressive. "Although the cutting forces involved were low, it was quite something watching the Haas produce the mould pattern from a solid block of model board so quickly and so accurately. It was a perfect reproduction of the 3D CAD drawing."

Once cast, the unmachined bell housings are mounted on the VF-3 on a three stage fixture incorporating two static stages and one using the HRT 310.

Mounted on its back, the first stage uses a Renishaw probe to locate a datum on the bell housing. The mounting surface is then machined flat, the mounting

TVR's Paul Howser (programmer/setter) machines a differential carrier plate for the company's Speed Twelve GT race car. The combination of the Haas VF-3 and HyperMill CAD software has allowed TVR to redesign many of their race components to improve strength and reduce weight.

holes are drilled and tapped and three locating dowels are machined. For the second stage, the housing is turned upside down and several mounting surfaces for ancillary components are machined. The third position uses the HRT 310 to rotate the bell housing through ±135 degrees to machine mounting points and hydraulic oil ways which would otherwise be inaccessible.

The bell housing fixture makes maximum use of the VF-3's 48" table and has a production cadence of one finished bell housing every 30 minutes.

According to Beach, the finished article produced from the handmade mould was a pretty inaccurate affair. "Although the mounting holes were in the right position, the casting wall thickness varied greatly. With the new Haas-machined version, we have much greater control over the wall thickness and the positions of the strengthening ribs. They're exactly the dimensions and positions we programmed at the design stage, allowing us to produce a much lighter component."

Racing

As with many of its industry compatriots, the reputation and enigma surrounding the TVR name was established on the race track and is currently maintained by a GT works team and an army of weekend amateurs.

TVR made its first serious motorsport mark when it entered a three Grantura works effort in the 1962 Le Mans 24 hours. Throughout the 1960s, the 1970s and into the 1980s the marque was an ever present front runner in a number of series, both at the professional level and the club level. In the '70s there were frequent works-supported entries in the Prodsports championship, with notable successes in the 1979 and 1980 seasons: a 3000M winning every race it entered in the latter.

The company's series domination continued unabated in the 1980s, until in 1986 the works 420SEAC was banned from competing for being too fast and too far ahead of the competition!

Sidelined by the governing body, TVR had become a victim of its own success. Race circuits around the UK had been the company's shop window, its medium for delivering the TVR message to the growing number of enthusiasts. Not to be out done, TVR launched the Tuscan Challenge, a one-make series aimed at the professional and the amateur alike.

A race-going TVR Tuscan weighs just 800 kilograms (approximately 1,760 pounds) and develops more than 450 bhp. With considerably more grunt than grip, these true "hairy-chested" sports cars exploit a concept as old as motor racing itself, giving race fans the drama and close finishes often lacking from the high financed upper echelons of modern motor sport.

Now in its tenth season, the TVR challenge has built up a worldwide following thanks to regular screenings on satellite and cable TV. Grids have set new records for this level of motor racing, with two and sometimes three races being scheduled to accommodate all of the entries.

Always with its eye on the big prize, TVR has continued to develop its GT race entry in the shape of a heavily modified Cerbera competing in the 1998 British GT series and the British rounds of the FIA GT series. The striking looking Cerbera GT scored its first outright win in the 1998 BRDC GT race at Donnington Park, England.

The TVR Speed Twelve GT race car is an evolution of everything learnt in the 1998 season and before. Powered by the company's own 7.7 litre V12 engine, the 800-hp Speed Twelve GT is available in road or race trim, making it the most powerful production road car in the world. It is also the company's most serious assault to date on the FIA GT series, and is the car TVR hopes will lead to eventual victory at the prestigious 24 hour Le Mans.

"Since installing the VF-3," says Beach, "we've started to think more carefully about the way we make certain components for the Speed Twelve. The fabricated suspension wishbones, for example, have recently undergone a complete redesign to improve strength and reduce weight. What we have now is a component which is designed on the CAD system and machined from solid aircraft-grade aluminium alloy." Beach stresses that components such as the wishbone are still very much at the experimental stage; but others, such as the car's differential carrier plate, are already better than the original and will be fitted to the car at the beginning of the season. "The differential carrier was another special project for the race car. We won't make that many during the season, but, as with other components, it means that we won't be as dependent on subcontractors."

Another example Beach is keen to cite is that of the scavenge pump fitted to the V12. "There are seven pump elements per engine, previously needing half a day just to fit the machined component parts together. The finish and accuracy of the Haas-machined pumps allows for instant assembly, no fitting and smoother running."

Continuing the tradition of those race cars which could be driven to the circuit, raced and driven home, the Speed Twelve is the car that most of us 12-year-olds dreamt of during those interminable history lessons on damp Wednesday afternoons. It represents the pinnacle of TVR's art and, just as importantly, the future of the company as a globally respected manufacturer of high-quality and very-high-performance super cars.








First VB-1 Helps the Eagles Fly

Story & Photos
Preston Gratiot

All American Racers (AAR) has been in the racing business since 1965, when Dan Gurney and Carroll Shelby joined forces to establish a race car company in Santa Ana, California. The cars AAR designed and built for the Indy and Grand Prix racing circuits were called Eagles.

Eagles soon became very popular on both sides of the Atlantic. Driven by hot drivers of the era like Mark Donohue, Ritchie Ginther, Bruce McLaren, Denny Hulme, Swede Savage, Bobby & Al Unser, Gordon Johncock and many more, Eagles let the racing world know that American builders could compete on an international basis – and win.

The crowning achievement in Formula 1 was Dan Gurney's victory at the Grand Prix of Belgium in 1967. It was the first victory by an American driver in an American car since 1921, and it remains the only one in modern Grand Prix history.

Racing Diversity/Domination

Apart from fielding Formula 1 and Indy Car racing teams, AAR at various times also entered the Trans-Am, Can-Am, Formula A and Formula 5000 series, as well as IMSA championships, with GTU and GTO Toyota Celicas, and GTP with Toyota Eagles.

From its inception, AAR built cars for its own racing teams, and also for sale to customers. AAR teams went on to win eight championships through the years, gathering 78 overall victories, including 82 pole positions. Eagle customers did equally well, winning championships in Indycars, Formula Ford and Formula A categories. In fact, in 1973 twenty one of the 33 cars on the grid at Indianapolis were Eagles.

In 1970, upon retiring from driving, Dan bought out Carroll Shelby, and he has been sole owner, CEO and Chairman of All American Racers ever since. Under his guidance, AAR has been continuously modernized and expanded.

Well known for carrying the Stars and Stripes into four-wheeled battle, All American Racers, led by AAR owner/former racer Dan Gurney, is in the thick of the international '99 CART series running the new Eagle 997-Toyota. Driven by Alex Barron (#36), the car is clawing its way up in the standings, upholding the AAR tradition for putting the "Eagle Eye" on – and in – the winner's circle.

AAR & Haas Join Forces

At the start of this year, Haas Automation joined forces with Dan Gurney's All American Racers. AAR became a Haas shop with the installation of the first Haas VB-1, a large travel, 5-axis vertical bridge mill. Also included in AAR's arsenal of Haas machines are two VF-1 vertical machining centers and an HL-2 turning center.

The 75,000-square-foot AAR complex includes five buildings which span the length of the block. These buildings house a state-of-the-art CAD design department, quality assurance, vehicle dynamics, data acquisition and analysis department, a development team and race shop, CNC machine shop, fabrication shop, 40%-scale wind tunnel, water tunnel, an 800 degree / 200 psi electrically heated TEC autoclave and a complete composite material department where all AAR race car bodies and chassis are built.

Teaming with Toyota

In 1983, AAR entered into a long term relationship with Toyota. The team first entered the GTU category of IMSA Sports Car Championship, winning 10 races and progressing from there to the GTO class, capturing the Drivers Championship and the Manufacturers Championship in 1987.

AAR then designed and built the GTP Toyota Eagle, a car which became legendary for its speed, reliability and impressive winning streaks: 17 consecutive victories during 1992 and 1993, two Drivers Championships and two Manufacturers Championships, as well as impressive wins in the endurance classics at Daytona and Sebring.

In 1996, after two years of preliminary development work, AAR re-entered the CART PPG Cup Championship after a 10-year hiatus from the circuit. AAR currently fields an Eagle-Toyota in the 1999 CART FedEx Championship Series with Alex Barron doing the driving.

All-American Tradition

Throughout its 35-year history, AAR has occupied a special niche among race car companies. Not only does the company provide a link to the "glory days" of racing, but at the same time, it manages to be on the cutting edge of technology. The combination of Dan Gurney's experience as a driver and owner, and his perseverance in building his own race cars, often against great odds (for years, Eagles were the only American-made race car on the scene), has won Dan Gurney many loyal fans around the world for two generations.

Many of the engineers, mechanics, designers and team managers now on the CART circuit went through the AAR "university" when they were young and starting out – a tradition which continues to this day.

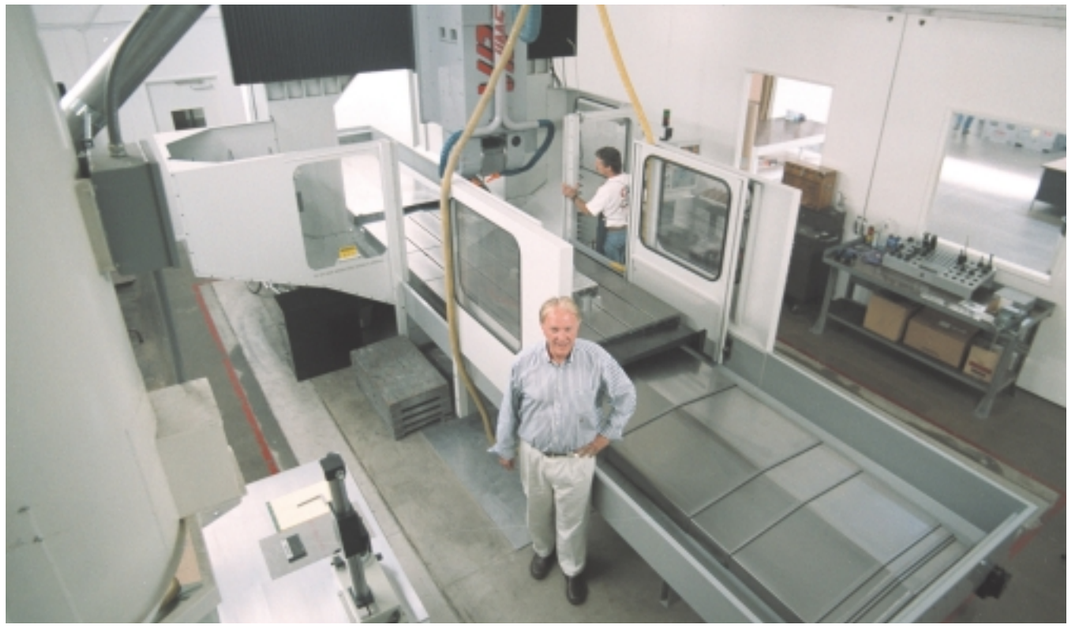
This tradition depends on the constant search for the latest edge in technology, and the absolute repeatability that allows for the analysis of the minute modifications that can shave tenths of a second off a lap time. In a racing world where a field of 30 CART cars can qualify within two seconds a lap, a mere tenth of a second can mean the difference between Victory Circle and just another – albeit very expensive – Sunday drive.

Selecting a Prototype

This search for the competitive edge focused on Haas when the prototype VB-1 was introduced at in Chicago at IMTS '98. By far the largest Haas machine ever displayed, with travels of 200" x 66" x 40", the VB-1 was seen by AAR as the perfect 5-axis machine for cutting the molds and forms used to lay up the carbon fiber body panels for their present CART Eagle.

Unfortunately, at that time, the VB-1 was just a prototype machine, with plans for production only if there proved to be sufficient customer interest. AAR was interested, and the discussions that led to the eventual delivery of that same prototype machine began. The machine was delivered in mid-January.

Dan Gurney and the latest weapon in the All American Racers' arsenal, the Haas VB-1 vertical bridge mill. The prototype machine (now in production-Ed) features full 5-axis articulation and travels large enough to machine the molds used for the carbon-fiber body components of the new Eagle 997 CART racer.



The full 5-axis spindle of the VB-1 is not only used to machine the molds for laying up the carbon-fiber body parts of the Eagle CART entry, but for final machining of the finished parts, as well.

Out with the Old

AAR was already using an existing in-house 5-axis machine before considering the VB-1, but it was seriously outdated and unreliable. Representatives from AAR had looked at competitor's 5-axis machines, but they proved not only to be much more expensive ($1.5 million and up), but they also required much more floor space to do the same size of work. As it was, AAR still had to extend the room for the VB-1 by about three feet and modify the sliding door assembly to allow for machine move in and loading of parts on the table with a forklift.

The original outdated 5-axis machine now is in pieces on the concrete floor of the museum/storage building.

Because of the wide variety of materials cut on the VB-1 – various metals, mold materials and carbon fibers – a dual-nozzle vacuum system has been fabricated and installed on the center column of the machine to remove dust and related materials. This allows the operator to run the machine without having to resort to wearing extra breathing or filtration gear.

"We use the VB-1 to cut the original molds and to do the finish work as well," explains Jim Becker, machinist/operator. In addition to machining parts for use on the actual racers, the VB-1 is also put to use making 40-percent components used for testing in the AAR in-house wind tunnel. These same programs can be scaled up (using the scaling option of the Haas control) to cut full-size versions of the parts once the designs have passed testing and are ready to hit the track.

Because the variation in size is a simple program command, these changes can be made with absolute repeatability of the design parameters. In addition, if the wind tunnel engineers request a minute change in the surface curvature, the program can be duplicated and modified, saving the original program as a baseline should the modification prove ineffective.

While the prototype VB-1 at AAR has travels of 200" x 66" x 40", the new production model offers larger travels (200" x 84" x 40" with 72" between the columns) and increased travels on the integrated-motor spindle head(±120° on the B-axis and ±220° on the C-axis as compared to the prototype's ±180° on the C-axis). The production 126" x 59.5" table allows for machining off the ends of the table, or a large subplate can be mounted to machine larger workpieces.

Additional Haas CNCs Delivered

In direct contrast to the massive usable workspace available on the VB-1, the table on the VF-1 is, well, a little small. However, AAR has found the diminutive machining center perfect for manufacturing the many smaller components that are used in the CART Eagle racers.

AAR presently is using two VF-1s, one in the main machine shop and one in the motorcycle R&D shop. The VF-1 in the main machine shop is used primarily to machine such parts as pedal assemblies, suspension components and various proprietary items AAR uses on the Toyota engine/transaxle assembly.

"We do a lot of parts on the VF-1 out of all kinds of material," says Frank Keiser, who operates the VF-1. "You don't know from one minute to the next what it is going to be: aluminum, steel, almost any kind of metal or mold making material you can imagine."

Frank likes the file storage ability of the VF-1 and the fact that it is easy to program and modify. He was drilling starter holes for the EDM wire used to cut the exhaust flanges for the CART Toyota engine. The material used is a very hard steel and he could only get about three holes drilled (through four .25" plates spot-welded together) before having to resharpen the bit. He noted that he is pleased with the way the Haas control allows for rapid tool offsets and rapid return to work.

"Of course, you get into a job like this (exhaust header flanges) and nothing goes fast. The metal I'm cutting for the flanges is H 250, it's very hard. The Haas just keeps on working though, it's the bits that I have to keep replacing. I can't get but about $3\frac{1}{2}$ holes with this drill . . . and that's with cobalt drills. They're about the only thing you can use to get through this. It is very, very tough stuff to drill."

In the case of the exhaust flanges, eight are used per engine. But numerous header designs are built for research and development in addition to adapting engine torque curves to fit the various tracks.

Frank, also noted that the VF-1 is a very stiff machine, much stiffer and more stable than the Fadals they had been using. He also commended the control features, saying that, "I can set this machine up in about half the time it takes me to set up the others.

"I also like the way you can return to a partially completed program, like when I have to take out one of my cobalt drill bits for resharpening . . . I know which hole I'm on, so I just go to that hole, press "Start" and the Haas control

Please see page 34

The All American Racer

By the time AAR team owner Dan Gurney retired from active driving in 1970, he had raced 25 different makes of cars in 20 countries and won 48 major races. Among them, seven Formula One races, seven Indy Car races, five NASCAR Stock Car races (all 500 mile road races at Riverside Raceway in California) and a number of wins in Trans-Am, Can-Am and Sports Car races, including endurance races at Le Mans, Sebring and Daytona. This versatile record of wins made Gurney the first driver ever to win races in the four major categories of motorsports: Grand Prix, Indy Car, NASCAR and Sports Car. To this day, he is one of only two drivers in history ever to have accomplished this monumental feat.

A Shaper of Things to Come

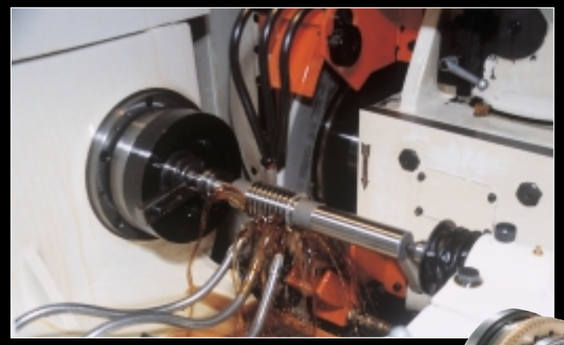
During the years that followed, Gurney continued his interests in racing, even helping to change the face of racing in America, if not the world, with his "White Paper" on the state of championship car racing in the late 70s. His treatise led to the formation of CART, the Championship Auto Racing Teams, a name that Gurney coined in this report. His visionary plan has helped make auto racing the most widely viewed sporting event in the world.

Trendsetter Meets Toyota

His long-running relationship with Toyota (which continues today with his AAR-sponsored CART program) began in 1982, when Dan did a few TV commercials for the company. This union has resulted in three Drivers Championships and three Manufacturers Championships for the automaker.

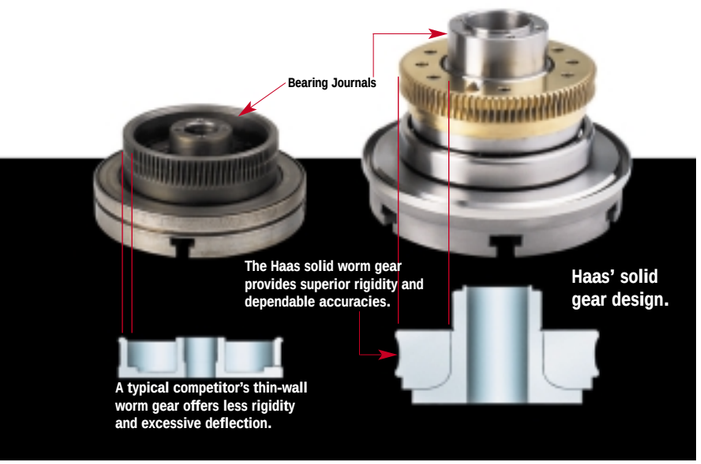
Now the Gurney name is back behind the wheel with his son Alex running a Swift 008.a in the Toyota Atlantic Championship. Driving for Team KOOL Green and co-sponsored by AAR, Alex is looking to make his mark during this, his rookie season.

How We Build A Way Better Table.



This is a Haas aluminum-bronze worm gear before the teeth are cut – it's a key part of our rotary tables. The gear blank is mounted to the spindle before the teeth are cut. Then, each unit is hand-trammed while in position to a runout of less than .0001 of an inch.

The indexing accuracy of any rotary table is determined by the precision of the worm and worm gear set. The secret to Haas' indexing accuracy is grinding an ultra-precision worm, in-house on a 1995 Mitsui Seiki GSE50A thread grinder, specially purchased for this operation.



One example of how Haas builds the most accurate rotary tables in the industry is our worm gear design. Many of our competitors use a thin-wall design – placing the bearings inside the worm gear. Haas employs a solid worm gear design, with extra-heavy-duty bearings mounted on each side of a solid worm gear. Hobbed from aluminum-bronze alloy, the Haas worm gear offers superior rigidity compared to the hat-shaped worm gear used by our competitors.

This is the front bearing used on a Haas HRT 310 rotary table. It has a 25,000 lb load rating. Does Haas make heavy-duty rotary tables that are built to last? We'll let our parts speak for themselves.

Pierce College Dedicates Gene Haas Engineering Laboratory

Learning the latest technologies in machine tool operation requires "hands-on" training you can only get by actually using today's modern machines. To this end, Haas Automation has in place various programs designed to help teaching facilities place Haas CNC machining centers in classrooms across the nation.

Ron Smetzer, Professor of Industrial Technology at Los Angeles Pierce College, says that the new Haas CNC machines in the college's recently christened *Gene Haas Engineering Laboratory* have opened the door to a higher level of instruction and learning for his students.

"The educational alliances Haas has set up are a fabulous thing," says Smetzer. "It's really been a spark here. We have a student chapter of the Society of Manufacturing Engineers, and each year we enter the Manufacturing Challenge Competition at WESTEC. We've been doing this for 13 years, and now, with the Haas equipment, we are able to do much more sophisticated projects than we've had the capability for in the past. I think our quality of work is going to escalate by leaps and bounds from this point."

Haas Lab Opens Doors

The opening of the *Gene Haas Engineering Laboratory* has generated considerable interest among students, and among the companies in the San Fernando Valley. "It's been rather remarkable," says Smetzer. "I've had a number of former students interested in enrolling again in the Fall."

The college, which has an extensive industrial arts program, has taught numerical control technology for years, but their equipment was well past retirement age. "The machines didn't give us the capability that we now have with the Haas machines. Now, I can teach current material in an atmosphere where the students get hands-on experience."

The new equipment has opened other doors as well. "You know, when you're in the limelight, everybody else wants to step into the limelight with you," explains Smetzer. "For instance, I needed some more water-soluble coolant, and coolant for the Haas machines. I called around and I got a donation. I'm sure it came about in part because we have this new Haas Lab and these new machines." Smetzer admits he is

Please see page 35

New Haas High-Speed Machining Option Drastically Reduces Cycle Times

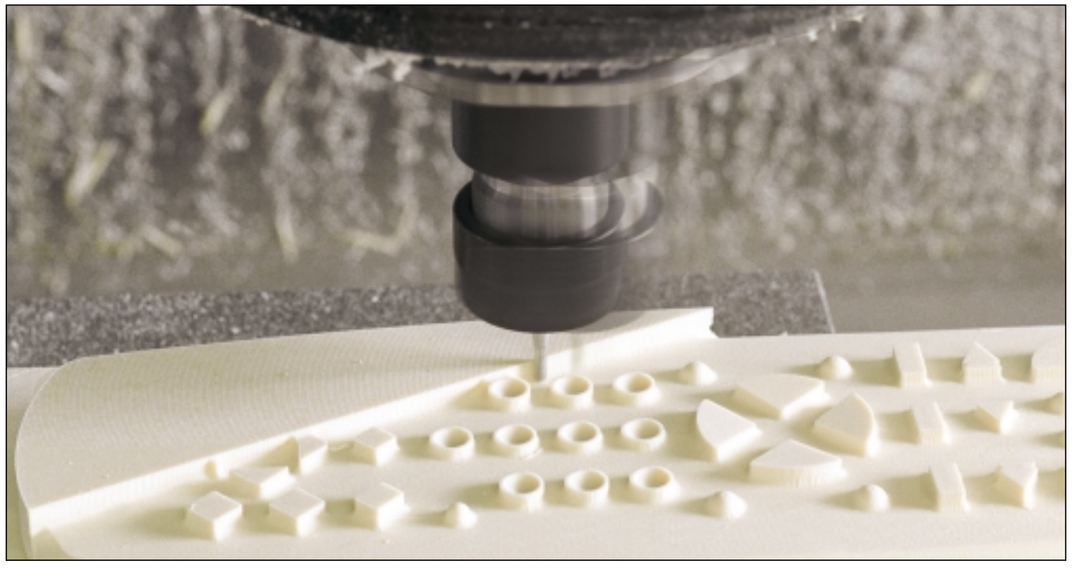
The new High-Speed Machining option for Haas vertical and horizontal machining centers provides a powerful tool for reducing cycle times and improving accuracy for many applications, including tool & die, molds, patterns, electrodes, aircraft components and other 3-, 4- and 5-axis parts. Testing on complex mold applications has shown a reduction in cycle time of nearly two-thirds while providing improved accuracy and smoother motion.

Using a motion algorithm called "acceleration before interpolation" combined with full look-ahead of up to 80 blocks, the new High-Speed Machining option provides very high feedrates – up to 500 inches per minute– without risk of distortion to the programmed path. All programmed motions are accelerated before interpolation, which ensures that the movement of each axis does not exceed the acceleration capability of that axis. The look-ahead algorithm determines the fastest feedrate at which one stroke can be blended into another without stopping. The result is higher accuracy, smoother motion and a higher actual feedrate – even with complex geometry.

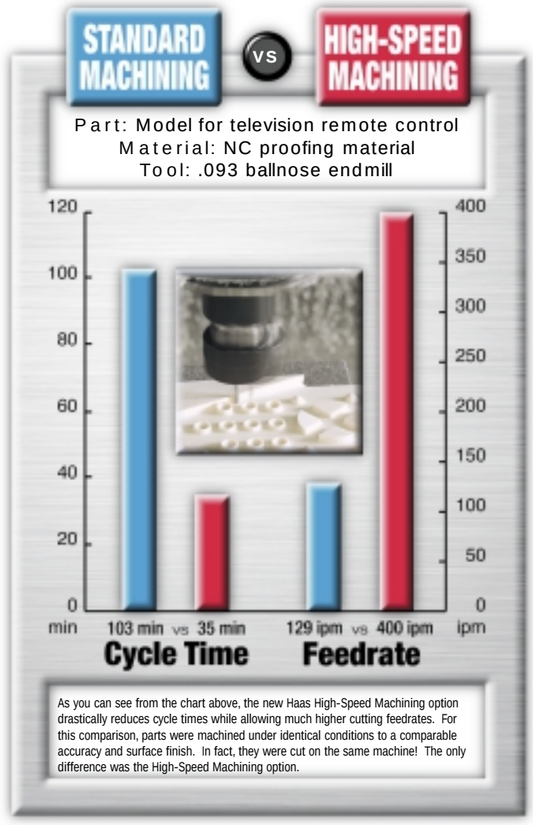
The new Haas High-Speed CNC software controls machine motion for both low and high feedrates by building a queue of motion strokes from axis motion data found in the G-code program. The look-ahead function then determines the maximum velocity that can be maintained at each stroke junction. Junctions of linear strokes with very shallow blending angles, or circular strokes which are tangent to the velocity vector, require no reduction in velocity and can be negotiated at the maximum programmed feedrate. Stroke junctions with greater angles are negotiated at lesser velocities.

For very fast feedrates up to 500 ipm, and very short command block stroke lengths, the High-Speed Machining option looks ahead as many as 80 blocks to find where velocity must begin deceleration to be slow enough for a sharp corner or exact stop.

At low feedrates, or when executing long command block stroke lengths, the look-ahead distance may only need to be



Combining the new High-Speed Machining option with the Haas 15,000-rpm spindle makes quick work of such applications as precision moldmaking, graphite electrodes, tool & die and aircraft components, among others.



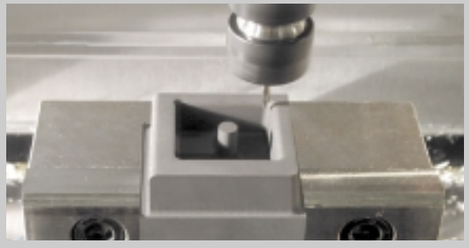
one or two blocks. Part accuracy is specified through a setting or the G-code program using the Haas Contour Accuracy Control feature. This allows the user to define an accuracy value for the overall part, as well as higher accuracies for specific areas of the cutting path. Significant improvements in cycle time are possible with the control planning the acceleration profile over many motion blocks instead of dealing with individual blocks. Accuracy is also greatly improved because the abrupt changes in direction are visible far enough ahead of time to compute the required acceleration necessary to bring velocity down to a value appropriate for the direction change.

Many of today's "high-speed" controls are either very expensive or require a pre-processing mode or special post, which is time consuming and alters the G-code program. The Haas High-Speed Machining option accepts ISO standard G-code from all major CAM systems.

The 15k Spindle Advantage

When it comes to high-speed machining, the ability to control the machine tool accurately at high cutting feeds is only part of the equation. Another key element is a spindle fast enough to maintain the proper chip load during those fast feeds. The latest high-speed spindle from Haas Automation provides 15,000 rpm of cutting speed to take full advantage of the time savings and increased accuracy possible with today's high-speed machining.

- High-precision ABEC class 7 ceramic bearings
- Bearings carefully matched to spindle shafts and housings for accuracy
- Air/oil-mist injection system for long life and cool operation
- Dynamically balanced for smooth, accurate operation
- Haas-built Vector Dual-Drive system with wye-delta switching
- Bores and ODs finished in one operation for concentricity
- Advanced four-bearing design for high axial thrust capability
- Available on VF-0, VF-0E, VF-3D and VF-4D VMCs



SUBSTRATES Continued from page 15

TiN, TiCN are the most popular coatings. In addition, coating thicknesses vary, adding to the already wide variety of coatings. Coatings are much harder than the substrate, providing the insert with additional wear resistance.

Turning versus Milling

Why are there so many choices for substrates? Consider the different requirements for turning and milling. The highest priority for turning inserts is wear and crater resistance. Typically, there is a thick, multi-layer CVD coating for steel, cast iron and some stainless steels. Then there is a thinner PVD coating for high-temp alloys, stainless steels and the like.

In milling, on the other hand, toughness is the most important criteria because of the interrupted cuts that occur. Usually, milling inserts have high cobalt grades that are resistant to thermal cracking, chipping and, to a lesser extent, wear resistance (which was the highest priority for turning). This wide divergence between turning and milling points out the necessity for the widest array of possible substrates.

Toughness is the most important criteria for milling because of the interrupted cuts that occur. Milling inserts usually have high cobalt grades that are resistant to thermal cracking, chipping and wear.

What happens when the wrong substrate is selected? Premature failure occurs. That leads to the production of bad parts, increased scrap, downtime and wasted productivity. The substrate is one of seven elements that must be carefully selected if the machining application is to work successfully. By selecting the right substrate, along with the right coating, chipbreaker, edge preparation, a specific style and nose radius, toolholder and cutting fluid, the end user is assured of improved productivity, increased uptime, better surface finish and maximum insert usage.

Substrates are often considered "simple" but, in fact, they are a science. They play a critical role in an insert's performance.

AAR Continued from page 30

picks up all of my offsets and everything and I'm back to work."

Frank says he also appreciates the programmable coolant option. "It really helps when you're using a number of different tools, because you don't have to keep re-aiming the nozzle by hand every time you change to a new tool. This is especially true if you have any skin problems reacting to the coolant or constant wetness. Nobody wants to mess with unnecessary rashes or chafing.

"The Haas machine's also easy to clean out," he continues. "The only thing I've noticed is that if the chip tube were just a little bit longer, it could spit the chips directly into the Fadal . . . (laughter). We ordered the auger chip conveyor because it makes it a lot easier to clean out. This machine is real nice to keep clean.

"I also like the memory that's in it, 'cause I can store a lot of programs, especially when we're doing lots of bit parts like this. We also have the floppy drive, so we can keep even more programs on file and ready to load within a matter of minutes."

Frank said that the VF-1 arrived ready to work. "When the guys put it on the floor, we came in, hooked it up and started cutting. The first chip was when it hit the concrete, the second was when we turned it on! It's done real good."

Turning Cycle Parts

Over in the motorcycle R&D shop, the AAR team has access to the second VF-1 vertical machining center and a Haas HL-2 CNC turning center.

Presently working on a new, closely-guarded, and very revolutionary motorcycle design, the R&D team is using the Haas machines primarily to machine one-off parts (a long run might be as little as only six parts!) for testing on one of the low-slung developmental bikes. While the operators are in agreement that their next Haas turning center will have the Big Bore option, the short runs of developmental parts are said to be the reason for not ordering the lathe with a bar feeder or live tooling.

Having seen one of the bikes fully-clothed in carbon-fiber cowl and fenders, it is evident that All American Racers is on the verge of making yet another major mark in the competitive world of motorsports. And you can just bet that this bike has been designed to be very competitive in one, if not many, international motorcycle racing classes. Time will tell, be we have definitely seen the future.

PIERCE Continued from page 31

not opposed to donations if they help keep his program working right, and it has become easier.

Alliance Breeds Interaction

"I've developed visions of wonderful things to do here in the next few years that I wouldn't have considered previously." These plans include developing a network of contacts with other schools that have Haas equipment, and establishing a mutual arrangement to share curriculum, share projects and enhance the overall success of the industrial arts learning process.

"I've already made contact around the country with other community college instructors who have access to Haas equipment. It's amazing how many of these colleges I stumble across in my interaction with other instructors. I'm sure that some of the instructors in isolated areas would benefit from this type of connection, even if it were only through e-mail, a letter or a downloaded project program."

As far as students are concerned, Smetzer says he doesn't have the usual 18- or 19-year-olds found in the typical Pierce College English or history class.

But he says an interesting thing has occurred recently. "I've been teaching here for 18 years, and I can count on two hands the number of students who came into my class directly from high school. Now I've got four students who graduated from high school just last year. And, it looks like I'm going to have another flock of them coming in. This is a complete turnaround!"

Smetzer explains that he now has alliances with several of the local high schools, "and there just wasn't any connection there previously. Having this equipment has had a great impact on that. It's definitely the cornerstone for making things like this happen."

Haas representatives join school officials in the ceremonial ribbon cutting signifying the grand opening of the latest Gene Haas Engineering Laboratory at the Los Angeles Pierce College Industrial Arts complex. The new HL-2 turning center and VF-2 VMC are visible in the background.

1999 TradeShow Calendar

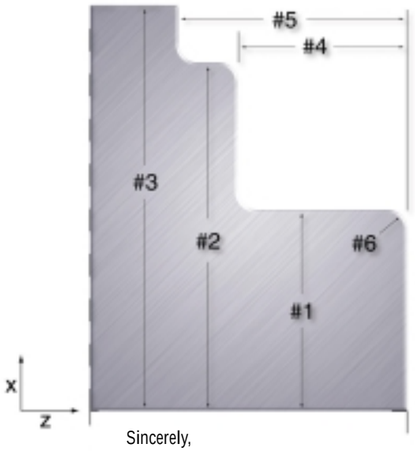
Show Name	Dates	Info
Detroit, APEX Detroit, MI	Sept. 14-16	With the auto industry accounting for more than 60 percent of all machine tool sales, this show is one of the Midwest's largest.
Rochester MTS Rochester, NY	Sept. 21-23	Haas Products will be displayed in the Nymat Machine Tool booth #700. The show is expected to draw over 350 exhibitors and 7,000 attendees from the upstate New York Area.
Mid-Atlantic MTS Fort Washington, PA	Sept. 28-30	The Mid-Atlantic Machine Tool Show, which attracts 5,000 attendees and 150 exhibitors, will be at the Fort Washington Exposition Center.
Wisconsin Tool Expo Milwaukee, WI	Sept. 28-30	Haas products will be located in booth #1006 in the North Hall at the Wisconsin State Fair Park. This show attracts over 10,000 attendees and 150 exhibitors.
Haas Open House Oxnard, CA	October 6-7	Haas Automation opens its doors for the annual presentation of new products and demonstrations of the entire product line.

From The Solutions Department

This column is designed to help you and your business perform better. It is a standard feature in *CNC Machining*. Readers are welcome to submit machining and programming questions to Haas. Haas Applications Engineers will answer each of your questions promptly. Select questions are published with answers in this column.

Dear Applications,

I own a small machine shop with two Haas HL-2 lathes. I manufacture plugs for the medical industry. Many of my products are members of large families (each having the same shape, but with variable dimensions). I don't want to write a separate program for each part because the control is limited to 200 programs in memory. Is there a way to write a single parametric program for an entire family of parts? Are parametric macro variables compatible with G71? I have enclosed a drawing of a typical part.



Sincerely,
Jack Hall

Jack,

Haas recently released an upgrade to lathe control software that allows use of macro variables in G71 and G70 canned cycles. Only one program is required per family. In the example below, the operator simply changes the values for #1 to #6.

```
%
O00001 (G71 G70 PARAMETRIC EXAMPLE)
(FANUC COORDINATE)
#1= 3.25
#2= 5.45
#3= 6.
#4= -1.25
#5= -1.5
#6= 0.05 (CORNER BRK + TOOL NOSE
     RADIUS)
G20 (INCH)
G00 G54 G40
G50 S5000
G96 S1000 M03
T101 M08
X [ #3 + 0.05 ] Z0.01
G71 P1 Q2 D0.2 U0.02 W0.005 I0.03 K0.002
F0.015
N1 G00 X0
G01 Z0 F0.005
X [ #1 - [ #6 * 2 ] ]
G03 X#1 Z - #6 K - [ #6 ]
G01 Z [ #4 + #6 ]
G02 X [ #1 + [ #6 * 2 ] ] Z#4 R#6
G01 X [ #2 - [ #6 * 2 ] ]
G03 X#2 Z [ #4 - #6 ] R#6
G01 Z#5
G01 X[#3 + 0.1]
N2
G70 P1 Q2
G28
M30
%
```

Note to all lathe users: This programming method may not be compatible with your lathe's current control software. However, your machine may be easily upgraded. Please contact your dealer for more information. Control software upgrades currently are available for $995.00 plus dealer labor and travel. (Parts extra)

Sincerely,
Haas Applications

Dear Applications,

I'm having a problem with chatter while finish boring a deep 2" diameter bore on my new CNC mill. It would seem to me that this job is not too much to ask of a CNC as I have done this type of operation in the past without incident on my manual mills, just not as deep. The bore extends 10" into the work piece. The material is cast iron. The steel boring bar that I'm using is micro-adjustable and the insert has a small nose radius. I've used a bar extension just long enough to allow the insert to reach the bottom of the bore without interference from the spindle. Shouldn't a new CNC machine be able to bore deeper than a 20-year-old manual? I'm looking for a solution and your recommendations would be appreciated.

Sincerely,
Mike Owens

Mike,

Machinists familiar with manual machines often feel that a new CNC should offer more performance than a manual machine. In many ways they do, however, a modern machine tool is not a manual machine with a control added.

CNC machine tools rely on different operating parameters than manual machines. This difference is necessary to maximize performance of the servo system. For example, no manual machine can tolerate 710 in/min rapids and they are not asked to follow 3D surfaces. While CNC machines do not amount to a compromise, it is not always correct to duplicate setups from manual machines on a CNC. With a CNC machine tool, performance is always linked to tooling performance. Tooling has advanced in step with modern CNC machine tools and we highly recommend that advanced tooling be used in challenging applications such has deep-hole boring. Steel boring bars should not be extended greater than 4 times its diameter on any machine. You may be able to nurse such a tool on a manual machine, but not likely with a CNC. Luckily, with high technology machines, comes high technology tooling designed to out perform their ancestors. Carbide bars can be used to bore holes up to 5 times the diameter in depth and heavy metal (tungsten) or De-vibe brand bars can bore up to 10 times their diameter, which in your case will be more than enough and should fix your chatter problem.

Sincerely,
Haas Applications

Dear Applications,

I recently purchased an HS-1RP and really like how the machine runs. I have several older horizontals on the floor and they use a M65 command which in turn commands G17, G40, G49, G64, G80, and G98. I was wondering if the Haas has this feature? Program compatibility between different controls is a must for our operation.

Sincerely,
Carl Wilton

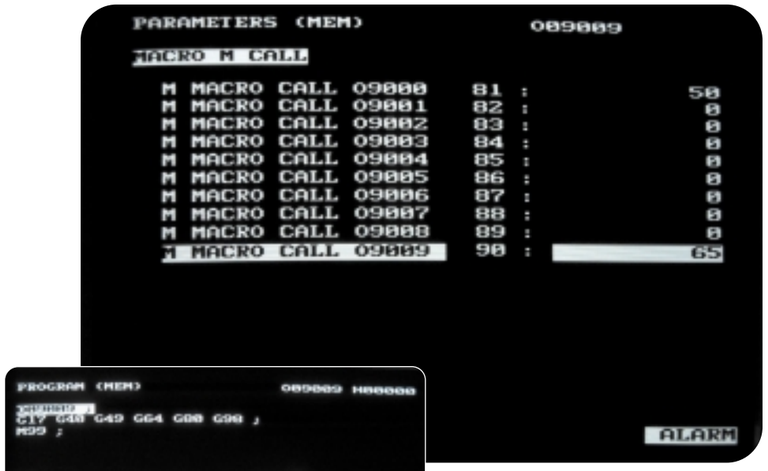
Carl,

While your Haas was shipped without M65, it is possible to define your own M65 with an M-code alias. Haas Automation has macro call parameters for both M and G codes. Parameters 81 through 100 are used for user-defined M and G codes. To set up M65 to work like your other machines follow these steps: (See screen shots on next page)

1. Press the emergency stop button
2. Turn Setting 7 (Parameter Lock) OFF
3. Change Parameter 90 (M Macro Call O9009) from 0 to 65 (as in M65) (Call Haas if Parameter 90 was not found to be set to 0)
4. Create the following program:

```
%
O9009
G17 G40 G49 G64 G80 G98
M99
%
```

5. Turn Setting 7 ON
6. Reset the emergency stop
7. You can now use M65 just as you would in your other machines and every time the machine reads a M65 it will call and run program O9009.



Note: M and G macro calls override the normal definition of a M or G code, so be sure not to use an M or G code that is already being used by the machine!

Sincerely,
Haas Applications

Dear Applications,

I am interested in using a macro statement to test the tool life variables to see if my inserts need to be changed. When the tool can only make one more part, I want to sound a siren to let the operator know he has to attend to the machine and change tooling.

Sincerely,
Carlos Garcia

Carlos,

Variable #5701 is the tool usage counter, which will accumulate each time Tool #1 is called and used in a program. Variable #5601 is the tool life usage alarm limit that can be set by the operator. The following macro program will accomplish what you want:

```
%
…
T1 M06
G103 P1
(BLANK LINE)
#1 = #5601 - #5701 (this is setting what you
want #1 to represent.)
IF[#1 LT 2] GOTO2 (program will advance to N2
when you have one usage left)

N1 (Main program)
G55 G90 G00 X6.215 Y-4.
G103
Program continues…
…
M30

N2
(This sub routine is going to activate an M
function relay that could be wired to a siren)
IF[#1 LT 2] THEN #1126 = 1 (#1126 is a spare
M function in the machine control.)
M00
M99 P1
%
```

Sincerely,
Haas Applications

Dear Applications,

We have a VF-9 in our shop. I find that we cannot run faster than 80 IPM on a 3D contour without losing shape. I have called regarding this and was told that the size of the table was the reason, which makes sense. I have tried to run the feedrate faster only to have the machine start jumping to get to the points in the program. I was reading about the new High Speed Software in the "CNC Machining" for Spring and wonder if this would help our situation?

Thank you,
Steve

Steve,

Yes, your VF-9 running a 3D contouring application could benefit from our High Speed Machining option.

The size of a machine tool does limit its ability to accelerate and decelerate. 3D contouring often requires many sharp changes in direction and velocity. At high feedrates these changes demand rapid acceleration and deceleration. When the programmed feedrate exceeds the machine's ability to accelerate or decelerate, "jumping" may result. This rough motion occurs when acceleration and deceleration occur so rapidly, a shock is created. The new High Speed Machining option utilizes up to 80 blocks of look-ahead to determine when the machine can safely and smoothly accelerate to a high feedrate. The control will only accelerate to a high feedrate if the programmed path allows enough time and distance to decelerate for the next major change in direction without straying from the programmed path. The High Speed Machining option ensures that you are always traveling at the highest possible feedrate without sacrificing accuracy on any size machine.

Sincerely,
Haas Applications

If you have a question regarding the operation of your Haas machine or the running of a program (including rotary tables), please fax your request to 805-278-0861, att: Applications, and a Haas Applications Engineer will follow up and get back to you. If we feel your problem would help others, we will publish it in the following issue of CNC Machining. Or you can send your questions to Haas Automation, 2800 Sturgis Road, Oxnard, CA 93030 • Att: Applications Dept. You can also e-mail your questions to: askhaas@hotmail.com

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