

CNC MACHINING

> C O N T E N T S

> volume 3 > number 9 > spring '99



Coverstory

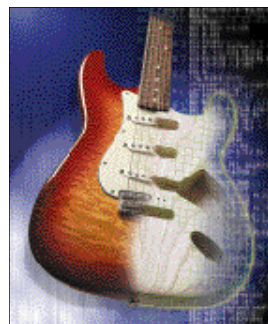
Fender is an American icon, and Fender guitars are known around the world for their characteristic quality, sound and style. With the help of their Haas VMC, the Fender Custom Shop takes these characteristics to another level as they turn customers' musical dreams into reality.

p14.



Coverphoto

Building a dream. Designer Eric Strunk created this issue's stunning cover to illustrate our story on the Fender Custom Shop. Special thanks go out to Byll Williams for the photography, and to Surfcam for their help with the wire frame.



FEATURES

- Grinding Out Profits 4
- Affordable Toys - Getting the Most Bang for Your Buck ... 8
- Maintaining Control With Touch Probes 24
- Application Solutions 33

INDUSTRYNEWS

- Y2K Update 3
- WESTEC Wrap Up 3
- Haas Year End Figures 26
- Trade Show Calendar 31

PRODUCTUPDATE

- Gantry Mill Under Development 30
- High-Speed Software 30

RACINGREPORT

- Gordon Kicks Off Season With Daytona Win 2
- Dan Gurney, Arciero-Wells Join Sponsorship List 26

EDUCATION

- Haas Helps Students Reach for the Stars 12

> IN THIS ISSUE

The term CNC machining usually conjures up visions of machine tools ripping through blocks of steel or aluminum, sending chips of metal slamming against the machine's enclosure. But, according to Webster, machine tools are defined as: power-operated machines used for general cutting and shaping of metal . . . AND other substances. In this issue, our cover story details how Fender uses one of these *other* substances to create musical masterpieces.

Yes, that's a guitar on the cover. And, yes, it's made of wood, as most guitars are. The unique thing is, it was machined at the Fender Custom Shop on a Haas VF-4.

Although wood is a material not usually associated with CNC machining centers, it actually can be harder to work with than metal. Wood changes shape constantly due to moisture variations, and it's more abrasive, because it sucks all kinds of grit up from the soil into its cell structure. As a result, bits and tools don't last as long. In fact, some woods will destroy a tool immediately. Another concern is burning, use the wrong speeds and feeds and a perfect guitar body quickly becomes a useless hunk of firewood.

Getting back to steel, we visit a Canadian grinding shop that increased its bottom line by adding Haas machining centers, and we take a look at controlling processes through the use of touch probes.

In light of the recent influx of "low-cost" machines to the American market, we present some things to consider before signing on the dotted line. And we show just how much "bang for the buck" you get with a Haas.

On the new-product front, we test cut the latest high-speed software for Haas mills, and give you a glimpse of what's on the horizon for the rest of 1999.

THE MASTHEAD

CNC Machining is published by Haas Automation, Inc., 2800 Sturgis Road, Oxnard, CA 93030 • 805-278-1800, Fax 805-988-6918. Postmaster: Return invalid addresses to Haas Automation, 2800 Sturgis Road, Oxnard, CA 93030-8933 postage guaranteed. CNC Machining is distributed free of charge by Haas Automation, Inc., and its authorized distributors. CNC Machining accepts no advertising or reimbursement for this magazine. All contents of CNC Machining are Copyright © 1999 and may not be reproduced without written permission from Haas Automation, Inc. CNC Machining is distributed through a worldwide network of Haas Automation Distributors, and by individual subscription request. Contact Haas Automation headquarters via mail or fax to be added to subscription list. Published quarterly. © Haas Automation, Inc. & CNC Machining Magazine names. Designed and Printed in the U.S.A. www.HaasCNC.com

The 1999 racing season is well underway, and from road courses and ovals to trackless trails through the desert, the Haas logo is making the rounds at some of the most famous racing venues in the world.

While most vehicles competing in motorsports today are equipped with some part or device machined or developed on a Haas, there are a number of race teams which proudly carry the Haas logo into competition.

These racing organizations have entered into a special type of sponsorship agreement with Haas Automation in which the team and Haas become technical partners. Haas provides the teams with CNC machine tools and technical upgrades, while the teams allow Haas to use their shops as working showrooms where prospective clients can see Haas machines at work in an environment that demands absolute perfection.

Teams carrying the Haas logo include:

Hendrick Motorsports

Following an unprecedented fourth straight NASCAR championship title, the three-car Hendrick Motorsports team again is bringing emotions to a boil in 1999. Three-time winner Jeff Gordon ('95, '97 and '98) previewed the season with a forceful move to the front of the pack during Daytona's "Bud



Current NASCAR champion Jeff Gordon strikes a pose next to the Harley J. Earl trophy he won – once again – at this year's Daytona 500.

Shootout." He followed that with a multi-million-dollar win (\$2.1 million, the largest in auto racing history) the following Sunday at NASCAR's big one, the Daytona 500. Gordon also received the "Driver of the Year" award at the annual ESPY awards ceremony the following night.

Teammate and fellow Winston Cup champion ('96) Terry Labonte will again field the #5 car for '99, maintaining the team's reputation as the highest rated stable of racing cars in NASCAR. Wally Dallenbach, Jr. has signed on as driver of the #25 car, following his successful efforts as a substitute driver during the latter part the '98 season when he garnered three top-ten finishes.

In the NASCAR Craftsman Truck Series, Hendrick Motorsports will again campaign the #24 GMAC Chevrolet pickup truck driven by previous series champion Jack Sprague. Sprague missed winning last year's championship by a mere three points, finishing 2nd with 4,069 points. Look for some good racing here.

PacWest Racing Group

The two-car PacWest CART team had a rough year in '98, but things are looking up for '99. The team received Reynard's first 99I chassis in early November, well ahead of all other teams, giving drivers Mark Blundell (#18) and Mauricio Gugelmin (#17) the edge on pre-season setups. Initial

Please see page 26

Racing with Haas:



CART FedEx Championship
 Long Beach, CA April 18
 Nazareth, PA May 2
 Madison, IL May 29
 Milwaukee, WI June 6
 Portland, OR June 20
 Cleveland, OH June 27



NASCAR Winston Cup
 Bristol, TN April 11
 Martinsville, VA April 18
 Talladega, AL April 25
 Fontana, CA May 2
 Richmond, VA May 15
 Charlotte, NC
 "The Winston" May 22
 Charlotte, NC May 30
 Dover Downs, DE June 6
 Brooklyn, MI June 13
 Pocono, PA June 20
 Sonoma, CA June 27



NASCAR Craftsman Truck Series
 Monroe, WA April 3
 Bakersfield, CA April 10
 Martinsville, VA April 17
 Memphis, TN May 8
 Pikes Peak, CO May 16
 Kansas City, MO May 22
 Bristol, TN June 5
 Ft. Worth, TX June 11
 Portland, OR June 19
 Watkins Glen, NY June 26



Haas In The Year 2000

thus are not limited by the year 2000 functions in the software for critical imbedded machine controls. In other words, the year 2000 date problem is not applicable to the Haas operating system.

In addition, Haas machines built prior to 1996, as well as current production brush-type machines (VF-E and VF-EXT), do not use a real time clock. Therefore, there is no year 2000 date problem with these machines.

However, a minor glitch has been discovered when reading the 3.5" floppy drive on machines manufactured

prior to November 1998. In such cases, if the floppy file is dated 00 (meaning 2000), it will cause the file to not be listed when a directory listing is requested using either the LISTPROG F4 method or the Advanced Editor I/O menu FLOPPY DIRECTORY method. This is a very minor problem that can be worked around by loading and saving files to floppy disk using the <filename>F2 and <filename>F3 method. This method works regardless of the date in the control or the dates on the floppy files. [E]

All Haas machines manufactured after November 1998 are fully Y2K compliant.

All Haas CNC controls comply with the year 2000 date requirements. Since Haas began building CNC machines, they have utilized an internal calendar with four places to enumerate the year. Further, Haas controls are not PC-based DOS operating systems, and

New Lathe Brochure Hits the Streets

The all-new Haas SL-Series CNC lathes hit the streets in January, and a new brochure detailing these cutting-edge machines is now available. This new brochure features more than 35 full-color pages packed with photos, specifications and detailed information about the full line of SL-Series turning centers.

Haas SL-Series lathes present a new

level of manufacturing excellence for 1999, and the new brochure provides all the information necessary to select the right machine and high-productivity options to do any job.

To receive your free copy of the new SL brochure, contact Haas Automation at: 800-331-6746, or fill out a literature request form at www.HaasCNC.com on the world wide web. [E]



Haas Sweeps up at Westec '99

By the time you read this, Haas Automation will be reaping the rewards of another successful WESTEC. This year's show was the biggest ever in WESTEC's 36-year history, with more than 750 exhibitors filling 330,000 square feet in three separate halls to demonstrate the best machine tools and metalworking technology in the industry.

As "North America's Largest Annual Metalworking & Manufacturing Exposition," WESTEC is the traditional venue for Haas Automation to unveil new products, and this year was no exception. Haas filled its 5,250-square-

foot booth with 16 machines representing every product line, in addition to an extensive display of rotary products. Haas was also well represented by other companies throughout the rest of the show, with products on display in at least 14 other booths.

Here are some highlights of the exciting new products and options unveiled at WESTEC '99:

CNC Turning Centers:

- The full line of all-new SL-Series lathes

- 7,000-rpm high-speed spindle
- Live tooling w/ fully interpolated C axis
- 4,000-rpm sub spindle with 5" chuck
- Servo-driven B axis
- Servo Bar 300 Automatic Bar Feeder
- 300 psi high-pressure coolant system
- Air-actuated automatic operator door
- Imbedded tool box

Please see page 28

Turning a Daily Grind Into a Cool Mill

Working the daily grind is a noble way to maintain the status quo, but if you really want your business to grow, sometimes you have to take chances and invest in new technologies.

Building a business takes talent and an eye for opportunity. Sometimes it also requires a willingness to spend money to make money, and Jonni Fox, president of Sharp-Rite Technologies in Coquitlam, B.C., has never hesitated to talk to the banks to finance new equipment.

In fact, his company turned a corner a few years ago and shifted its metalworking expertise from grinding to milling. The growth has been so phenomenal, the company finally changed its name to reflect the new, more diverse directions of its metalworking abilities.

GROUND-FLOOR GRINDER

When Jonni Fox immigrated to Canada from Germany in 1966, he had no money and was unable to speak any English. But he was willing to work hard in order to succeed.

Learning the basic skills of the industry as an apprentice tool & die maker, Jonni soon worked his way up to quality control inspector. He eventually went into business for himself in 1979, starting Sharp-Rite Grindings Ltd. in the Vancouver, B.C., area.

The shop specialized in sharpening and grinding tools – and delivering quality work on time. Sharp-Rite Grindings Ltd. soon had a reputation as one of Canada's most sophisticated grinding houses.

Fourth-axis machining proves to be a sure-fire way to increase production output. Parts that used to require multiple operations now are machined in one setup. In addition, Sharp-Rite has reduced misalignment problems to virtually nothing. Here, an HRT 210 is used to position a part for multi-sided milling operations on a VF-3.

TOOLING UPS PRODUCTION

“About three years ago, we investigated the possibility of manufacturing tooling faster on CNC equipment,” says Jonni, “and thanks to the illustrative selling techniques of Chris Morrison of Thomas Skinner & Son Ltd., our local Haas distributor, we bought a Haas VF-3 VMC in January of 1995. Chris took a piece that would normally take me hours to grind and showed me how the Haas could deliver a finished part in 40 minutes.

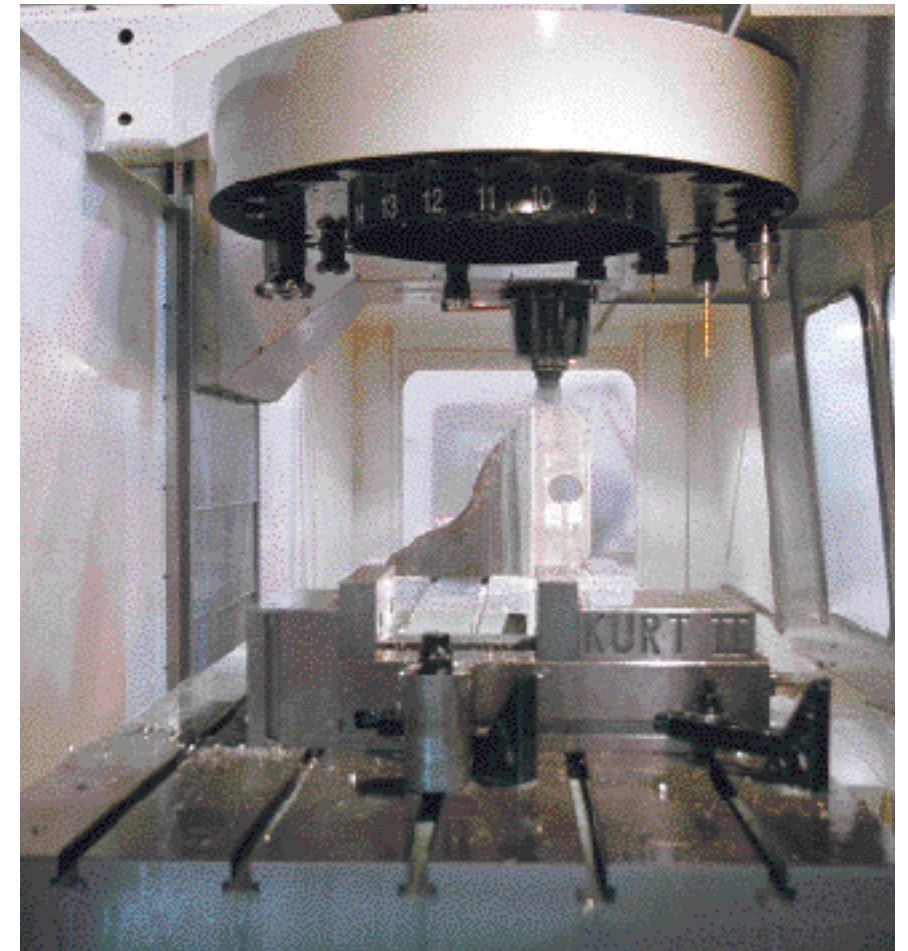
“I was sold, and ordered the CNC machine on the spot. Funny thing is, we never really used the machine to work that part!” says Jonni. “We started accepting some tooling orders, and when people found out about our new capabilities, they started giving us production work. We got another Haas CNC, and it was soon booked to capacity as well! We’ve been milling everything from aluminum to steel on those machines. They just keep on cutting.”

GROWTH BRINGS CHANGE

Sharp-Rite Grindings Ltd. was soon renamed Sharp-Rite Technologies Ltd., and it now occupies two facilities totaling 39,000 square feet. With two shifts a day, and more than 30 employees on staff, Sharp-Rite today specializes in grinding, tooling and, of course, CNC machining.

In the dedicated machine shop area, everything from prototype articles to long-run production pieces takes shape on the Haas machines. “We were given a test program to cut some fuselage tools for a major airplane manufacturer,” says Jonni. “Our attention to quality and on-time delivery so pleased the company that we now have a number of contracts with this manufacturer. And our reputation as a knowledgeable aerospace facility is opening our doors to even more aircraft-related jobs.”

However, many of these aircraft-related jobs involve parts that extend beyond the capabilities of normal job-



shop-sized CNC machines, so Jonni had to make a big decision – either he had to start turning down some of these larger orders . . . or order a larger machine.

BIG TRAVELS FOR BIG JOBS

“We were the first Canadian shop to have a VF-10 delivered,” says Jonni, “and it has been busy ever since. Now we can cut some fairly large pieces, thanks to the machine’s large 120” x 32” x 30” travels.” Sharp-Rite does have a couple of larger mills in-house, but for the majority of the high-quantity production jobs, the Haas machines are called into play.

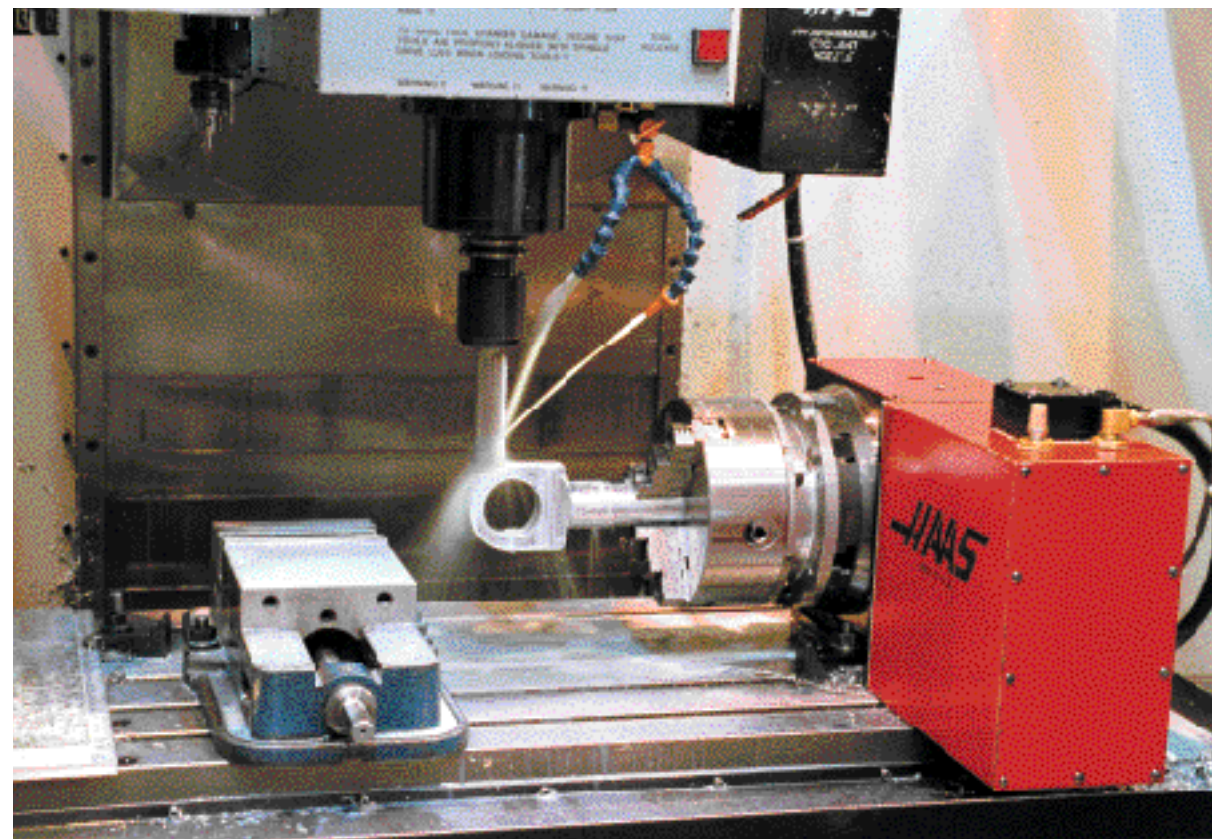
Sharp-Rite realized additional increases in production by using a number of Haas rotary tables for 4th-axis machining. Suju Solanki, CNC programming manager, explains, “Production has increased since we started using our 4th-axis capabilities. We run a full assortment of Haas rotary tables, including the HRT 160, HRT 210 and HRT 310. The use of rotary tables

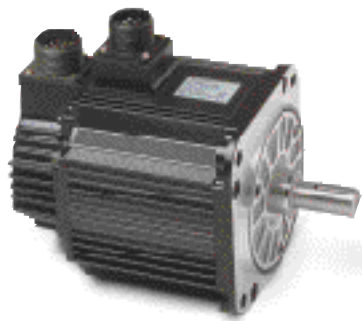
The extensive travels of the VF-10 (120” x 32” x 30”) allow Sharp-Rite to machine large parts or long-duration runs of multiple parts for the local aerospace industries. Sharp-Rite was the first company in Canada to take delivery of the Haas VF-10s, and the VMCs have since been kept busy cutting the majority of the firm’s high-quantity production jobs.

has also increased our tooling accuracy, because by using just one setup operation, misalignment problems are reduced to virtually nothing.

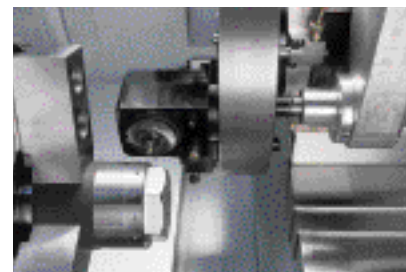
“Since the Haas was our first CNC milling machine,” says Solanki, “I can’t really compare its performance improvements to a predecessor, but we used to spend a lot of time grinding parts, now we mill them for millions.”

Sharp-Rite Technologies
#211 Schoolhouse
Coquitlam, B.C., Canada
604-521-4888





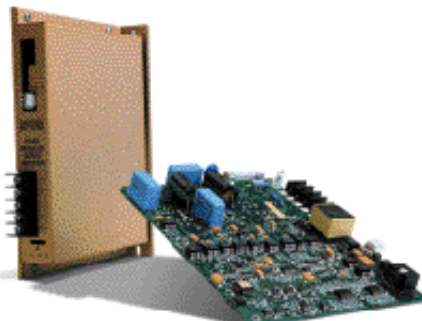
High-Speed Brushless Motors (710-ipm rapids) Brushless motors are superior to brush motors because they can utilize twice the voltage and current, which means higher speeds, faster acceleration and greater power. And, brushless motors don't generate brush dust, which can lead to internal shorts and accelerated brush wear. Plus, the heat producing windings in our brushless motors are attached to the outer shell, which dissipates heat to surrounding air, resulting in higher duty ratings in a more compact housing.



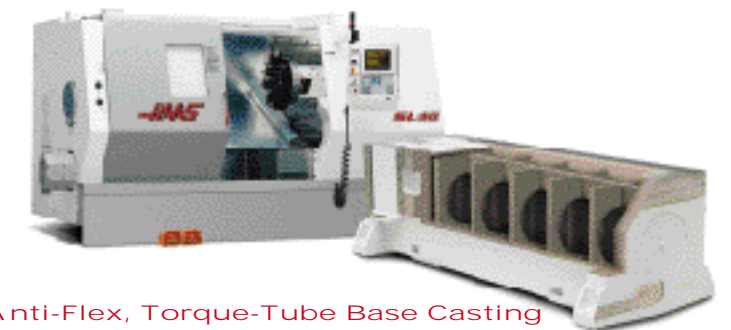
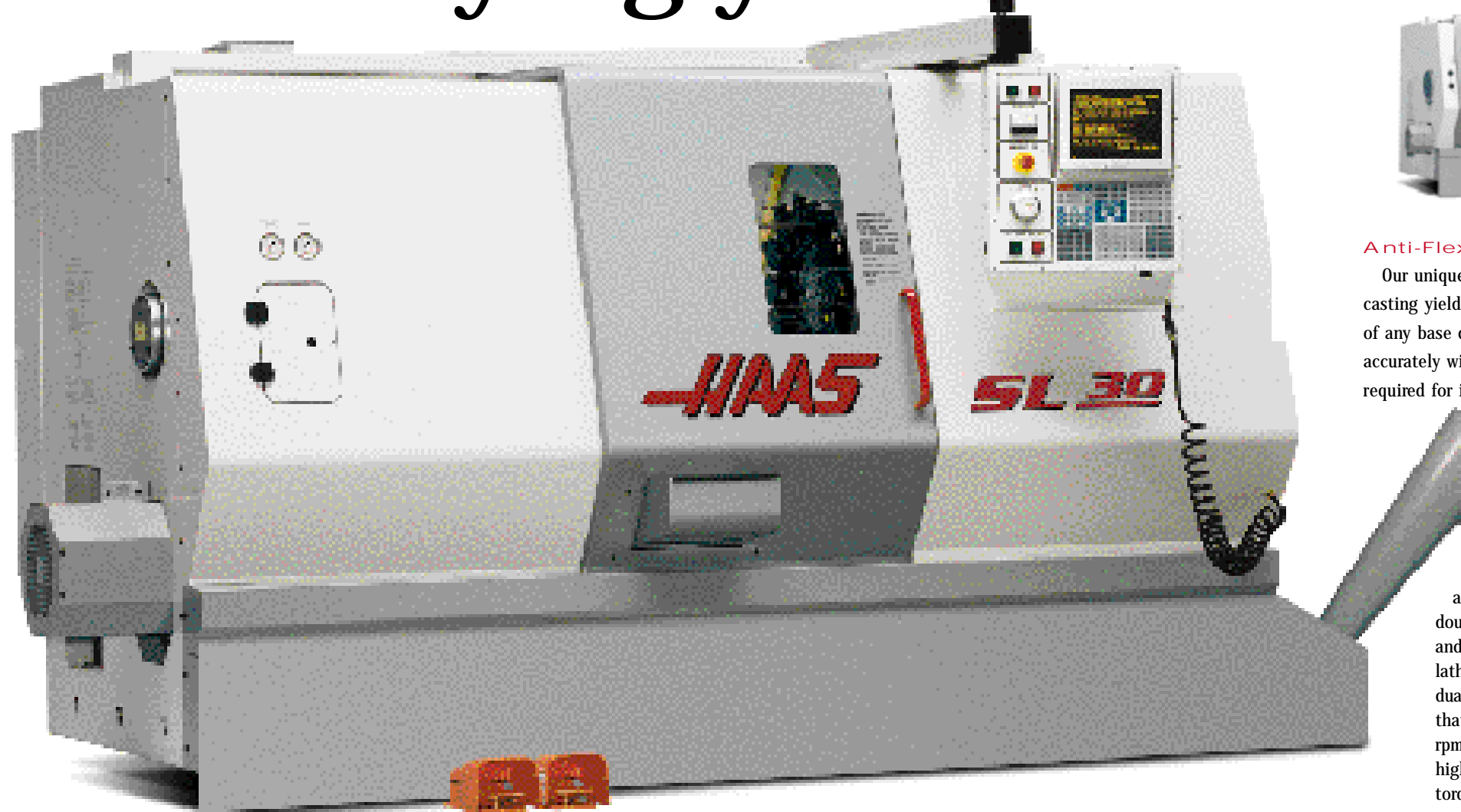
Live Tooling The Haas live tooling option allows you to drive standard VDI axial or radial tools to perform such secondary operations as milling, drilling, slotting or tapping – both on the face of the part and around the diameter. The lathe's main spindle allows synchronous motion for milling flats, hexes and flutes, and is indexable in precise increments for part positioning and repeatability.

Before buying your next CNC Lathe,

Electronic Thermal Compensation When ballscrews rotate they generate heat. Heat causes the ballscrew to expand. With high duty cycles, ballscrew growth can lead to cutting errors. Haas' new ETC algorithm accurately models this heating and cooling effect and electronically compensates for screw position, providing near glass scale accuracy.



5 hp from palm-size amplifier The Haas-designed and built brushless servo amplifier, which is only about the size of your hand, packs an amazing 5 hp punch by utilizing state-of-the-art design and manufacturing techniques. It's engineered with robust components and built to deliver dependable, long-life performance.

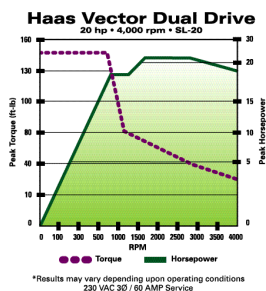


Anti-Flex, Torque-Tube Base Casting

Our unique, specially designed, Haas torque-tube base casting yields superior rigidity and gives the most anti-flexing properties of any base design. It's so stable, in fact, that the machine will cut accurately with one leveling screw removed; and no special foundation is required for installation.

Powerful 20-, 30- and 40-Horsepower Vector Spindle Drives with Wye-Delta Switching

The Haas-designed vector spindle drive uses a true closed-loop system which optimizes the slip angle between the rotor and stator of the spindle motor to double low-speed torque and acceleration, resulting in the fastest and most powerful spindle output ever. In addition, all SL-Series lathes* feature the Haas Dual-Drive system, which consists of a dual-winding motor – Wye and Delta – and an electronic switch that selects the best winding for low rpm cutting, and the best winding for high rpm cutting, yielding higher torque values over a wider rpm range.



*Except 5,000 rpm SL-20

take a close look at what you're getting.

Take a look at a Haas.



Seamless Bar Feeder Setup The Haas servo-driven bar feeder is designed and built exclusively by Haas for our CNC lathes. It runs directly from the Haas control, making it the only "smart" bar feeder on the market. Unique features make setup and operation simple, like a large access door for spindle liner change out, and a single adjustment for setting bar diameter. All bar feed parameters are set at the lathe control.



Haas Automation, Inc.

www.HaasCNC.com

800-331-6746

2800 sturgis road, oxnard, ca 93030

What Do You Want To Be When You Grow Up?

It's been said the only difference between men and boys is the size of their toys. An addendum to that should be: and how much they cost.

Much the same can be said of machine shops. As they get "older," they usually need bigger and better equipment, and more of it. That usually means more money.

Many machine shops start from humble beginnings. Some average Joe has a few pieces of equipment – say a manual lathe and an old knee mill – crammed into his garage so he can make the odd whatsit for his latest hobby. Inevitably, a friend needs something machined for his latest hobby and offers to pay Joe to do the work. Satisfied with the work, the friend tells another. Before long, friends, relatives, and acquaintances are lining up to take advantage of Joe's machines and expertise.

Realizing there might be a career in this machining business, Joe quits his day job and opens Joe's Precision Machining. With perseverance and a little bit of luck – and providing he does good work – the shop will probably succeed and grow.

unless they already have the work. Advances in machine tools over the past decade, however, combined with an increasingly competitive market, have made it much easier for the average Joe to expand his shop and keep it successful. No longer is a million-dollar outlay necessary to get high-quality, reliable machine tools that are accurate and loaded with options. Today, it's possible to get into the biz and equip a substantial shop for less than \$200,000.

JUST WHAT WILL THAT TWO HUNDRED GRAND BUY?

Well, nearly every machine tool manufacturer today offers some sort of "low-cost" machine aimed at the small job shop. Some of these are just stripped-down versions of the company's more expensive machines, with few or no options or features. Others are manufactured offshore using low-cost labor and inexpensive materials. But low cost doesn't necessarily mean low quality. Some manufacturers, like Haas Automation, Inc., keep their prices low by relying on volume sales rather than per-unit profits, and employing the latest technology and automated processes to keep manufacturing costs low.

In the short run, the result is the same: the customer gets an affordable machine tool. In the long run, however, there are other factors to consider when

determining the actual value of a "low-cost" machine.

For example, a stripped-down machine may require the purchase of expensive options and accessories before it can adequately meet the needs of the shop; and the offshore machine may not live up to expected quality standards, or produce the required accuracy. Other important considerations are the cost and availability of repair parts, the availability of service, and the history and reputation of the manufacturer. Saving money up front is pointless if the machine is unreliable, expensive to repair, can't be repaired in a timely manner, or can't be repaired at all.

Obviously, price is an important consideration when making any major purchase. But the overall value of the product being purchased relative to the price, the "bang for the buck," if you will, is much more important.

It's also important to look closely at the manufacturer of the machines you are purchasing. How long have they been in business? How long have they been selling in the United States? Do they offer a complete range of products – VMCs, HMCs, lathes, rotary tables, bar



This is especially important in light of the current shortage of qualified machinists and machine operators in the industry. The expense of hiring an experienced CNC machinist may not be

center and a mid-size lathe will more than fit the bill, and will provide the capacity and capability to handle a wide array of jobs. For more versatility on the VMC, let's add an automatic pallet

Obviously, price is an important consideration when making any major purchase. But the overall value of the product being purchased relative to the price, the "bang for the buck," if you will, is much more important.

in the budget for a start-up shop.

In order to survive, most job shops serve a variety of different customers and take on a wide assortment of work. Reliance on a single customer or a narrow scope of work can often be disastrous. Flexibility is key, and a successful shop must be able to roll with the economic ebb and flow. Keeping profits up means keeping the price-per-part as low as possible, which means reducing setup times and increasing throughput. User-friendly controls and high-productivity options like pallet changers, rotary tables, and bar feeders can help here.

All that said, here's an example of what you can get for \$200,000:

First, let's decide what equipment you need. A mid-size vertical machining

changer; to boost output on the lathe, let's throw in a short bar feeder. Both of these items will boost throughput and reduce setup time, while at the same time allowing unattended machining for further productivity gains. To make programming easier, a good mill/turn CAM package is probably also in order.

The next decision is which brand of equipment to buy. Obviously, this is a very personal choice, usually based on a lot of different variables. Most shop owners do quite a bit of research before making their final decision; but, in essence, there are two basic approaches: buy everything from a single manufacturer, or mix and match different brands.

Mixing and matching can allow you to get exactly the specs and features



Story
Scott
Rathburn

A gearbox will give you the versatility to machine at high speeds for aluminum, graphite, and plastics, while also providing the low-speed torque necessary for harder materials like steel, stainless, and titanium.

you want in each machine, but it may cause headaches down the line. Each machine most likely will have a different control, making operator training more difficult. Plus, sales and especially service also may be more complicated, as you are dealing with different builders, and possibly even different distributors.

On the other hand, going with a single manufacturer for all your machines has definite advantages. For example, the operator only has to learn one CNC system. Having the same user interface for every machine, be it lathe or mill, frees the operator to move from machine to machine with ease, rather than being tethered to the one machine he knows how to run.

Sales and service are also simplified, as the same manufacturer is responsible for all machines. Staying with the same brand as you add more machines in the future also gives you more clout than if every machine is from a different builder. Obviously, every customer is important to a manufacturer, but it's a simple fact that a shop with a stable full of machines from the same builder is likely to get better service than a shop with a single machine.

NOW IT'S TIME TO SPEND MONEY!

Let's start with the mill. Since you'll be running a variety of jobs, the ability to machine different types of materials is important. A gearbox or transmission will give you the versatility to machine at high speeds for aluminum, graphite, and plastics, while also providing the low-speed torque necessary for harder materials like steel, stainless, and titanium.

AHaas VF-3APC VMC (40"x20" x25" travels) with automatic pallet changer, 20-hp vector-drive spindle and two-

speed geared head retails for less than \$95,000. Add another \$6,000 for a package of options that includes a chip auger, programmable coolant nozzle, 1 megabyte of program memory, Quick Code programming system, floppy disk drive, rigid tapping, 4th-axis drive, coordinate rotation, scaling, custom macros and a remote jog handle, and you're looking at lightening your wallet by about \$101,000.

Now let's look at the lathe. Again, you'll be cutting a variety of materials, so versatility and simplicity are key.

AHaas SL-30 CNC lathe (30" swing and 14.5" x 34" turning capacity) with 30-hp vector-drive spindle, wye/delta switching and programmable hydraulic tailstock retails for less than \$66,000. Add around \$8,000 for an option package that includes a tool presetter, an automatic parts catcher, Quick Code programming, a floppy disk drive, a chip auger system, rigid tapping, 1 megabyte of program memory, and custom macros, and your shop fund is down by another \$74,000. Throw in the Haas Servo Bar 300 bar feeder, which runs directly from the lathe's control, for around \$10,000, and you've got a high-productivity turning package for less than \$84,000.

But, wait! There's more. You still have \$15,000 left to spend. How about a CAM system to speed programming and keep your machines pumping out parts? A good mill/turn system will set you back anywhere from about \$1,000 to the-sky's-the-limit. For our purposes here, something in the middle should suffice. Companies such as Mastercam, Surfcam, Teksoft, and others, all offer versatile mill/turn systems for about \$7,500. Before making your choice, however, be sure the software is compatible with your choice of machine

tools. Here, again, is an area where sticking with a single brand could be advantageous, as the post-processing would be the same for all machines.

The remaining \$7,500 should just about cover shipping to most parts of the United States, as well as rigging and any electrical and air modifications necessary to set up the machines.

Keep in mind, these are all retail prices. With the market getting more and more competitive, many manufacturers are offering customer rebates, low-cost lease programs, free option packages, and more as further incentive to buy their product. Obviously, prices for shipping, rigging, and state and local taxes will vary depending on your location.

Now that you have the equipment, what do you do with it? If your \$200,000 expenditure is intended to move you out of the manual age and into the world of CNC, you'll probably need some training. Most machine tool manufacturers, or their distributors, provide some sort of basic operator training, as well as initial setup of the machine, free of charge. Most CAM manufacturers, as well, offer training for a nominal fee. They want you to be happy with your purchase, so they are going to show you how to use the equipment and software.

There you have it. You've just taken Joe's Precision Machining to a whole new level of productivity and versatility for right around \$200,000, something that would have been unheard of a decade ago. This is no low-end shop, either. It's a versatile machine shop with the capacity and capability to service any industry, from aerospace to automotive to medical. After all, that's what success is all about. ■

This may be the most important new feature ever offered with a CNC machine.



Your own Customer Advocate.

At Haas, we know things don't always go exactly the way you planned. To handle any problem you may encounter, we have a national network of locally owned Haas Factory Outlets, each with a full staff of certified service technicians who you can depend on to solve your problem.

Even with all this local attention in place, we still want to make sure you're covered. That's why we developed our new Customer Advocate Program.

If you have an unresolved issue with any Haas machine, we want to hear about it immediately. Please contact your Haas Customer Advocate at 805-988-6980.



Haas Automation, Inc.
800-834-7343

www.HaasCNC.com

Partnership with Haas Benefits College's Machining Tech Program

Story
Gary
Franchi

PUEBLO, CO – A partnership between Haas Automation and Pueblo Community College (PCC) in Pueblo, Colorado, is having a dramatic effect on the school's Machining Technology program. For the first time, students are learning manufacturing production applications that simulate real industry, as well as traditional manual machining skills.

The partnership enables Haas to showcase their machinery, while providing PCC students with the opportunity to acquire the types of technical skills that companies like Haas need to remain productive and competitive.

The partnership kicked off with the acquisition of approximately \$430,000 in Haas machining equipment by PCC's Gorsich Advanced Technology Center (GATC). Included were four CNC machines (HL-2, HS-1RP, VF-1 and VF-3) along with four control simulators. Moncktons Machine Tools of Denver, the local Haas distributor, was instrumental in arranging the purchase and getting the machines up and running.

The new equipment has greatly impacted PCC's Machining Technology program by allowing students to learn true, modern production manufacturing skills. "This equipment is the backbone of our Machining Tech program," noted John Vukich, a member of the PCC team that helped form the agreement with Haas.

George Michel of Moncktons served a vital role in providing the critical link between PCC and Haas. Through his efforts, the final arrangements were developed that led to a "win-win" situation for all three entities.

The partnership is part of an aggressive move by the college to rewrite its curriculum to meet National Institute of Metalworking Skills (NIMS) standards. According to Isadore Ambriz, PCC's Machining Technology instructor, the college is working to become one of only two colleges in the West to have a program



Above: Isadore Ambriz, Pueblo Community College's machining department instructor, explains aspects of the Haas CNC control to a group of students in the Gorsich Advanced Technology Center.

Below: PCC students Joe Albano, left, and Neal Brown use a coordinate measuring machine to check a part machined on the school's Haas machining centers

in which its students can become NIMS-certified.

"We will be able to deliver the caliber of person that companies like Haas would be interested in hiring," said Ambriz, who has taught at PCC the past six years. "This partnership also is a good example of what is happening in the industry today, where a corporation has input into the educational curriculum, and where the program has built-in accountability."

According to Vukich, the Haas equipment at PCC is like none available in a tech center anywhere else. "What we've got might be the best in the country," he stated.

Such partnerships are the crux of the 54,000-square-foot GATC. It is the premier technical training and education center in Colorado for providing access to technology and services to meet the needs of industry. Partnerships such as this not only provide training and education for industry employees, but also provide access to career information for students.



A CASE IN POINT.

Pueblo Community College students, faculty and staff are part of the Colorado Space Grant Consortium (CSGC) that is working on a NASA project through a collaborative partnership between several Colorado colleges and universities.

The project involves work on a small-scale satellite called Citizen Explorer 1. The mission is designed to provide:

- Environmental and space education for K-12 students.
- Significant experimentation for the scientific community.
- Real-world experience for undergraduate and graduate student engineers, designers, technicians and scientists.

Project leadership is being handled by students at the University of Colorado in Boulder, the headquarters for the project. They interface with consortium members throughout the state to coordinate activities and ensure that the project is on schedule for a December 1999 launch.

The Citizen Explorer 1 spacecraft will piggyback on NASA's EO-1/SAC-C mission and will be a secondary payload on the Delta II launch vehicle that will depart from Vandenberg AFB in



Machining students Rafael Rodriquez, Joe Albano and Bill Hardwick, from left, are part of the group at PCC working on the Citizen Explorer 1 spacecraft, a collaborative effort between several Colorado colleges and universities. PCC has teamed with the University of Southern Colorado as the manufacturing leg of the project and will share responsibilities for producing the primary satellite structure for the spacecraft using advanced manufacturing techniques.

California. The Delta II vehicle is currently being manufactured at The Boeing Co. facility in Pueblo, Colorado. The close proximity of the manufacturing site has enabled students to visit the facility to see first-hand the spacecraft attachment location and gain an understanding of the overall mission.

The Citizen Explorer 1 program is an excellent example of how space technology can benefit life on earth. Students are getting hands-on experience using real data, and the project is igniting their enthusiasm for science while providing a genuine service to the public.

PCC INVOLVEMENT

PCC and the University of Southern Colorado have teamed up as the manufacturing leg of the project by sharing responsibilities for producing the primary satellite structure for the CX-1 spacecraft using advanced manufacturing techniques. The solar-powered satellite is approximately two feet square and weighs 101 pounds. The project brings a realistic perspective to the students in terms of working as a team, meeting schedule commitments, interfacing with customers and applying their technical education to

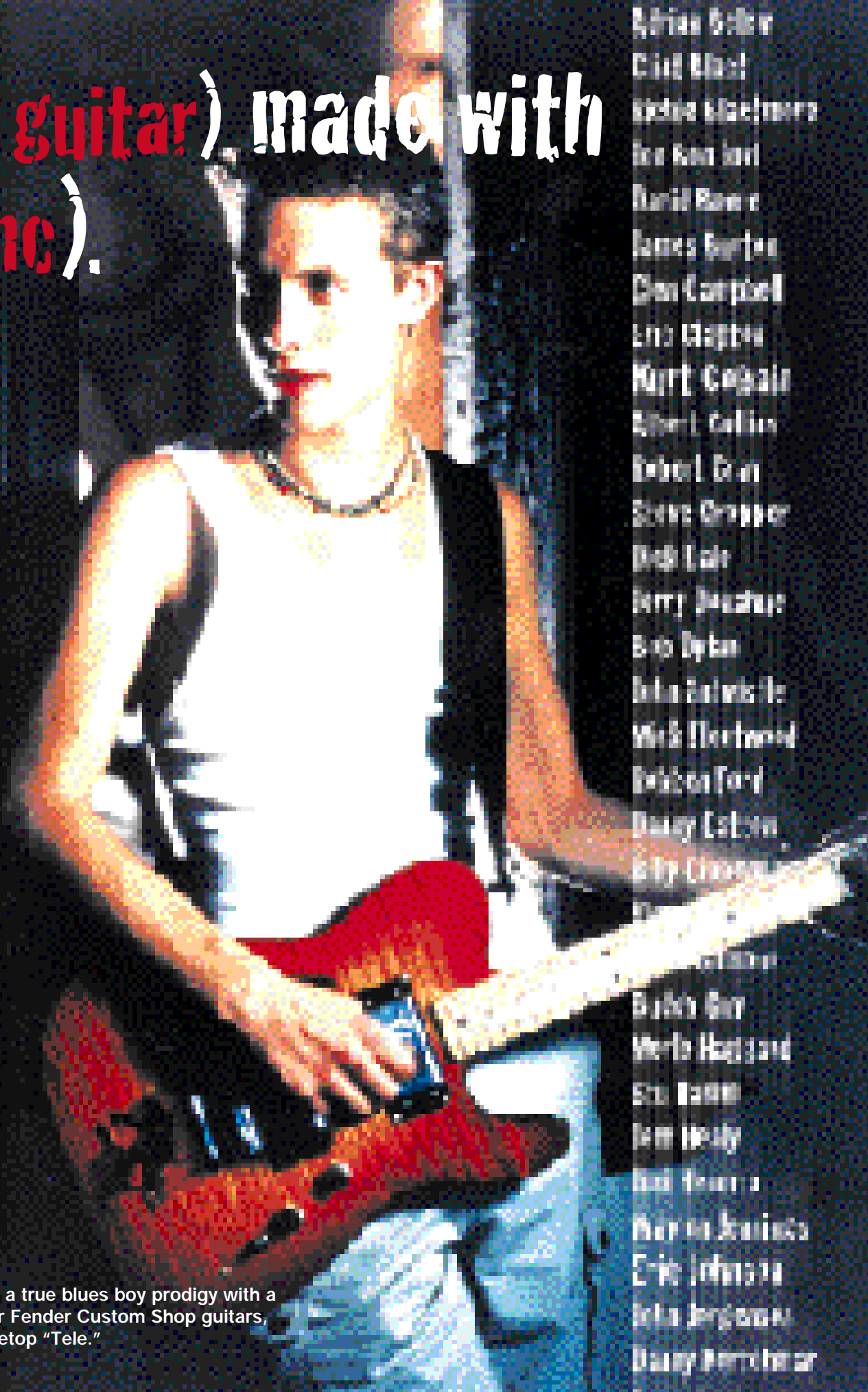
real-life projects that serve a purpose.

PCC is utilizing the capabilities of its Gorsich Advanced Technology Center to produce the close-tolerance parts for the project. Under the direction of John Vukich, GATC Manufacturing and Services Manager, and faculty members Isadore Ambriz and Art Malechek, Machining Technology students at PCC are getting the opportunity to apply design principles, tooling concepts, Computer Numerical Control (CNC) programming and CNC machine setup and operation. The machines being utilized for the project are state-of-the-art CNC machining centers and lathes from Haas Automation, Inc., that are capable of producing high-volume complex metal-fabricated parts. Haas Automation Inc., Moncktons Machine Tools Inc. and PCC have formed a team approach to addressing the need for young people to learn about manufacturing and the long-term benefits associated with a career in a technical field.

For more information about the Pueblo Community College and its technology center, call 719-549-3322. (Gary Franchi is the Communications Specialist at Pueblo Community College.)

An American-made Icon, (the **fender guitar**) made with an American-made Icon (the **haas vnc**).

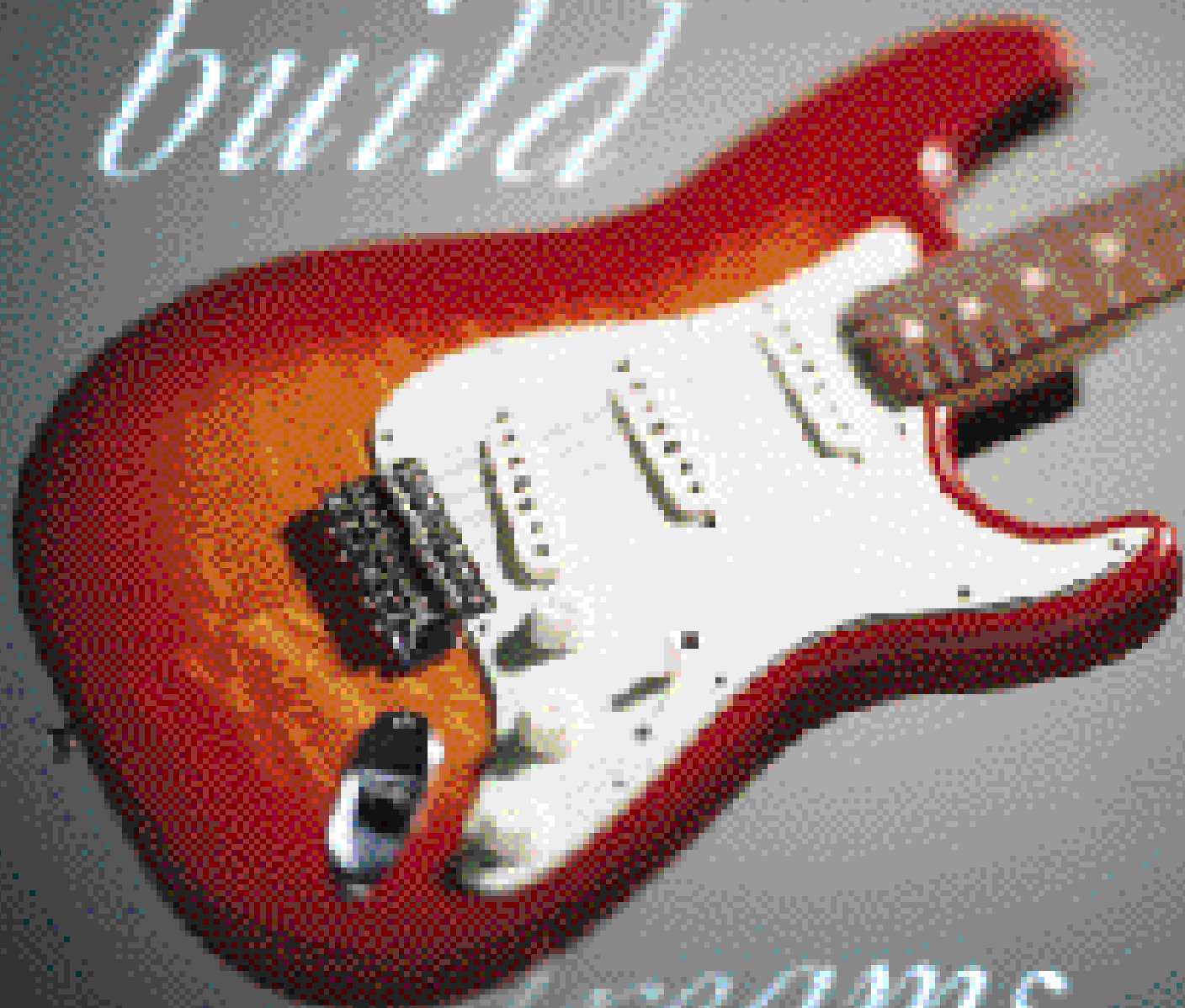
When John Page, co-founder and long-time head of the prestigious Fender Custom Shop was asked how he could consider bringing a computer-controlled milling machine into a shop with a worldwide reputation for building custom, handmade guitars, he answered simply, "When was the last time you chewed down a tree?"



Jonny Lang, a true blues boy prodigy with a penchant for Fender Custom Shop guitars, plays a flametop "Tele."

- Adrian Belew
- Bill Black
- Wanda Jackson
- Tommy Stinson
- David Byrne
- James Burton
- Clayton Kershaw
- Eric Clapton
- Kurt Cobain
- Robert Collins
- Robert Cray
- Steve Cropper
- Neil Dile
- Terry Emmons
- Eric Dylan
- John Fogerty
- Mike Fogarty
- Robert Ford
- Danny Gatson
- John Gorkov
- John Fogarty
- Merle Haggard
- Eric Johnson
- Tom Petty
- Paul Simon
- Mark Knopfler
- Eric Johnson
- John Fogarty
- Danny Perry

*We
build*



FENDERS

The retort by Page was not so much a snide remark as it was a realistic observation illustrating how power

tools actually are a very vital element in the world of today's craftsmen. In order to keep final costs somewhat affordable, today's luthier (guitar builder) is willing to leave the preliminary rough work to more economical, yet accurate, mechanical means.

While the word "handmade" does evoke visions of craftsmen chiseling away in a quaint workshop with barely even an electric light, the Custom Shop wing of Fender Musical Instruments is presently cutting guitar bodies and necks on a Haas VF-4 vertical machining center. Although not normally considered a wood cutting machine, Steve Boulanger, head of Fender Custom Shop Engineering and Tooling, saw the Haas CNC as a valuable addition to the productivity and quality of workmanship produced by this elite shop.

In a highly defined market where professional players and collectors demand specific neck shapes and wood types, the use of an extremely accurate CNC milling machine ensures that the master builders receive parts that are pre-cut to exact specifications with absolute programmed repeatability. It is then that these master builders begin working their skills as some of the best and most imaginative luthiers in the world.

A Look at the Fender Custom Shop

Located in an industrial park on the outskirts of the sleepy bedroom community of Corona, the Fender Custom Shop is just a short drive east of Los Angeles on the Riverside Freeway.

Though you would hardly know it from the outside, hidden behind a non-descript door at the back of the building is the guitar player's idea of a dream factory. A place where – day in and day out – some of the world's finest master craftsmen and guitar builders meticulously craft custom guitars and basses, and on occasion, even amplifiers. And these one-of-a-kind instruments and art

guitars are known worldwide for their incredible tone and beauty.

With recent efforts to consolidate the Corona Fender production facilities under one roof at the new 177,000-square-foot plant, the Fender Custom Shop had to pare down its square footage while maintaining the ability to produce its specialized product on time and to spec. It is here that the new Haas VF-4, installed in February 1998, has helped enhance the production-to-space ratio by providing a versatile milling machine that can effectively cut three bodies or four necks at a time – and cut them rapidly to exact specifications.

“The Custom Shop needed its own production ability for small-quantity, high-quality guitar and bass guitar wood components, as well as plastic components,” explains Boulanger. “We also make virtually all of our own unique tooling and fixturing. After looking at the CNCs available on the market, we found that the Haas VF-4 had the perfect combination of high-quality and low-price, plus machine size, ease of use and special features.” He also noted that the way covers seal the ways and ballscrews from wood dust contamination far better than the competitive brands.

It was this economy of space, time and operation, in addition to the unlimited versatility the machine offered in allowing for rapid changes in final cut design – that helped to seal the deal with the Haas sales reps at Machining Time Savers (MTS).

How Much Wood?

When putting together the order for their wood-cutting VF-4 – which was chosen to match the table size with the ability to machine a certain number of guitar bodies or necks in the same setup – the Custom Shop opted for the 10,000-rpm, 20-horsepower vector drive spindle, 1,000-block-per-second processing, macros, Quick Code programming, 3.5" floppy disc, 4 MB expanded memory, rigid tapping, chip auger, programmable coolant nozzle, remote jog handle, 4th-axis capability, coordinate rotation and scaling, and an Ampro aluminum tooling plate.

“The macro option is a must-have option,” says Boulanger. “When we first got the machine, I must admit that I was a bit baffled by macro programming, but once I understood it, I don't know how I ever got along without it. The possibilities of macro programming are endless. I am currently re-writing all existing programs to use macros.

“Machining wood to $\pm .005$ " tolerances has its own unique difficulties,” explains Boulanger. “The main problem is that wood swells or shrinks depending on the humidity, causing fit problems day to day. Of course, we try to minimize this by maintaining the shop environment as close to optimum as we can, but different woods absorb and expel moisture at different rates, and the last time I counted we were using 11 or more different species in the construction of our guitars.”

This susceptibility to changes in temperature and humidity has been addressed at the new Corona facility. A sophisticated climate control system maintains temperature within one degree Fahrenheit and humidity within two percentage points, no matter what the conditions are outside. A good way to test this attention to accurate cuts is to try to slide a business card between the side of the guitar neck and the body. On a Fender Custom Shop guitar, it won't fit. Some cheap guitars have such a large gap that they will accommodate a typical plastic charge card. Do not use your charge card to buy one of these low-quality guitars!

“With the Haas, we have cut our tolerances in half while increasing our output by 400%,” says Boulanger. “The stoutness of the VF-4 and the 10K spindle have allowed us to increase our feed rate from 25-30 inches-per-minute to 150-200 inches-per-minute.

“In addition, due to the 21-tool capacity (20 tools in the changer and one specialized tool mounted to the VMC's table), we have incorporated many secondary operations, such as fret-slot sawing and face-dot drilling, into the machining cycle, thereby eliminating them in the down-stream process.”

Like the versatile guitar that carries the Fender name – the Stratocaster – the VF-4 was a solution to a set of technical problems, and as such opens new avenues for expansive improvements in design and imagination.



The Fender Custom Shop builds a line of “Relic” guitars, above, that duplicate the look, feel and tone of the desirable pre-’65 Strats. With worn necks and artfully replicated nicks and wear marks, these “aged axes” are the choice of today’s professional players.

A rack of set-neck Telecasters, left, are ready for the protective finish coat.

The Birth of the Custom Shop

Although the Fender Custom Shop didn't officially exist until 1987, the idea surfaced many years earlier. However, the dream did not become a reality until current-day CEO Bill Schultz – who saw the merit of the custom shop concept – selected Page and Texas guitar builder Michael Stevens as the first custom builders. They started small, in an 850-square-foot space near the Corona factory, expecting to build only a handful of instruments a month.

However, when word of the first guitars hit the streets, new orders came pouring in – in numbers far beyond anything the two original builders could handle. It was obvious that the company had tapped into a previously untapped consumer need. In fact, today almost every major guitar manufacturer has a version of a custom shop to satisfy the needs of the elite buyers. But the Fender Custom Shop is still recognized as a leader when it comes to playability and innovation.

Page, who just recently accepted a new assignment as Executive Director of the Fender Museum of Music and the Arts, explains, “We just grabbed a share of the market that I don't think even we were aware existed, and that's the market share that wanted the kind of details not available on our production-line guitars at that time, whether it was custom pickguard materials,

humbuckers (pickups) or neck shapes.” The Custom Shop grew quickly in space and in personnel, and today boasts more than 60 employees, including the master builders. The Custom Shop is also the location of Fender's West Coast Artist Relations.

A Hive of Activity

Despite its industrial park surroundings, the Fender Custom Shop today is a veritable hive of craftsmen busily hand-building a wide range of guitars; experimenting with colors, finishes and electronics; and carefully measuring and fine-tuning dimensions. It is here that the Haas VMC has earned a place in a world usually reserved for those long trained in the art of guitar making.

At one workbench, master builder Stephen Stern meticulously shapes the ebony tailpiece of a Fender D'Aquisto archtop guitar. In another alcove, master artisan/woodcarver George Amicay is at work carving on a Stratocaster called “The Roots of Rock,” which is

Please see page 22

Steve Boulanger selected the VF-4 because of its versatile cutting abilities and attention to cost and quality. Contrary to popular opinion, Boulanger says cutter speeds need to vary greatly depending on type of wood and rate of feed — a feature provided by the Haas.



Leo's Legacy

During the mid-1940s, Leo Fender, owner of a small-town electronics/radio shop in Fullerton, California, saw the need for a decent, portable amplifier specifically designed for use with musical instruments. The success of this amp caught the eye of local country music groups, and Fender soon found himself manufacturing electronically amplified lap (steel) guitars, as well, in partnership with fellow entrepreneur “Doc” Kauffman.

Marketed under the “K&F” name, these lap steel guitars established the Fender name in the music industry. It wasn't long before Leo, while not a true musician by his own account, introduced the first mass-produced, solid-body electric Spanish-style guitar, the single-pickup Fender Esquire.

By all standards at that time, the Esquire was a bare-bones model, and Leo decided to upgrade immediately with the addition of a neck-stiffening truss rod and a second pickup.

In the rush to get this guitar into production, Fender neglected to sufficiently research the new “Broadcaster” name (chosen to capitalize on the popularity of the radio and the new-fangled television). He soon was told by Gretsch Musical Instruments that they already had an instrument in production with that name — a drum set called the Broadkaster. Although the spelling was different, Leo chose to back down, and the guitar was soon re-released in 1951 as the Telecaster.

While other guitar manufacturers of the time had electrically amplified guitars on the market, they were basically just archtop acoustic guitars

with pickups bolted in place. They proved to be very prone to feedback and thus were limited in volume. Fender's solid-body guitar, however – while laughed at as a weird California creation totally devoid of the design and craftsmanship commonly found on previous hollowbody designs – was a simple, but pure, design that minimized feedback and maximized sustain. The “Tele,” as it is known in the trades, is still in production today.

This guitar was designed to be played, and to survive the hardships of life on the road. Where most guitars of the time had glued-in “set necks,” Leo elected to make his guitar a modular creation with a bolt-on neck, because guitars exposed to the rigors of baggage handlers and other forms of rough treatment often suffer broken necks or snapped heads. With a “set-neck” guitar, repairs require a trip to the luthier's shop and at least a couple days without that guitar. With Leo's bolt-on necks, a player simply bolted on a replacement neck and tuned-up the guitar again – a gig-saving 5-minute fix if you had a spare neck and a screwdriver on hand!

The Fender reputation continued to grow as Leo's company introduced the first nationally-sold production bass guitar with a fretted neck: the Precision Bass. This new bass guitar was followed in 1954 with the introduction of the most popular and most copied guitar in the world . . . the Stratocaster.

Here was a guitar that was ridiculed by the purists, yet revered by the young at heart. The modernistic styling captured the attention of such revolutionary artists

as Buddy Holly, the Beach Boys and Dick Dale — a.k.a. the “King of the Surf Guitar.” The contemporary yet well-balanced and comfortable-to-play guitar enjoyed a long run of popularity.

But the late 1960s found the California creation finally fading into obscurity until a young master of electronic rock whipped the Stratocaster back into the spotlight with flaming solos bellowing and screaming into the night. . . his name was Jimi Hendrix.

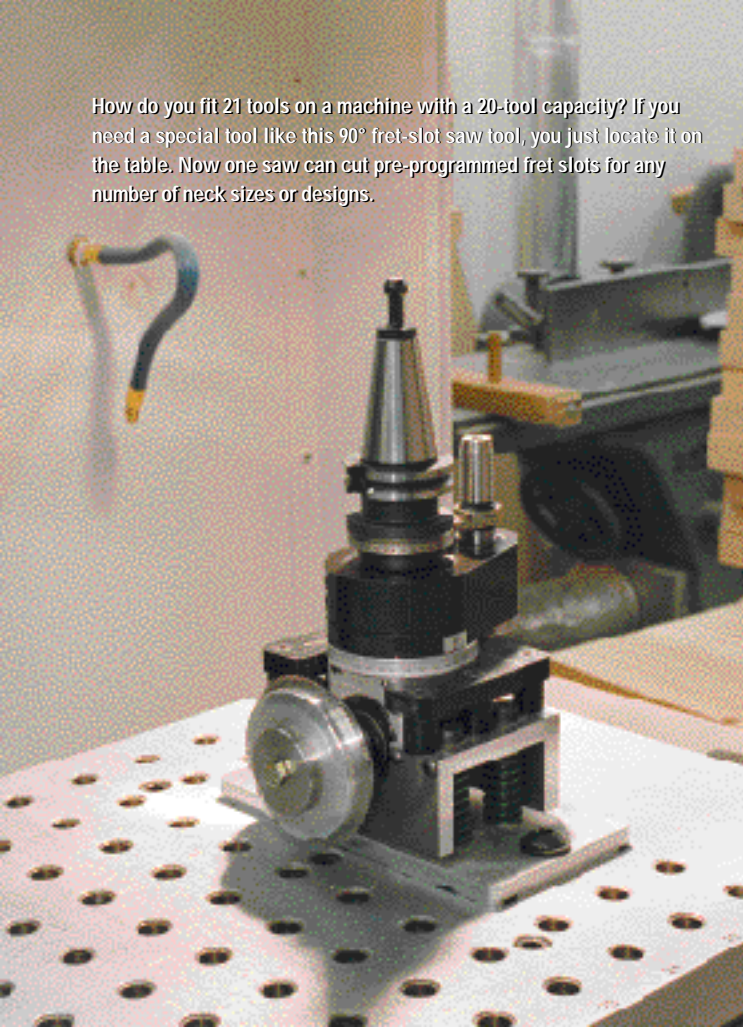
Today, the list of recording stars associated with Fender Musical Instruments includes such luminaries as Eric Clapton, Stevie Ray Vaughan, Bonnie Raitt, Leroy Pernell, Bob Dylan, Bruce Springsteen, Jeff Beck, Beck and even blues great Buddy Guy. The Stratocaster was the guitar of the future, and there is little doubt that its popularity will continue well into the next century. The Stratocaster may be in its 45th year of production, but it's far from growing old.

In fact, today's Stratocaster can be ordered in more than 20 production models, and that's without going into the rainbow of optional colors or the choice between rosewood or maple necks. Then there are the Custom Shop production models – designs that have proven so popular that many are now “team-built” in order to satisfy the demands of the buying public.

The “Relic” series is a good example of this trend. With vintage Strats (1965 and earlier) now valued in the four- to five-figure price range,

Please see page 32

How do you fit 21 tools on a machine with a 20-tool capacity? If you need a special tool like this 90° fret-slot saw tool, you just locate it on the table. Now one saw can cut pre-programmed fret slots for any number of neck sizes or designs.



imbedded with 100 etched stones – each carrying the name of one of the greats of rock and roll. In still another corner, master builder Alan Hamel fine-tunes a radical guitar and amp combo he calls “The Hot Rod Set,” a custom pearl-blue Stratocaster with remote-controls that allow the player to tweak the amplifier settings while playing elsewhere on stage. The antennae on both the guitar and amplifier are electronically raised and lowered on command. In keeping with the hot-rod theme, the guitar’s pickups are hidden underneath a louvered pickguard!

This holistic approach to guitar building is a large part of what makes a Custom Shop guitar so special. It also helps explain why the Custom Shop has been so successful over the last 12 years.

The Master Builders

While many different kinds of guitars are built in the Dream Factory – including a full line of Custom Shop “production guitars” – the heart and soul of the Custom Shop concept is the Master Builder Program.

The Master Builder Program not only involves recruiting first-rate guitar builders and inviting them to contribute their unique skills to the co-op environment, but, more importantly, it provides Custom Shop patrons

the opportunity to speak directly with the builder, ensuring that the guitar the customer receives is the instrument he or she wanted.

“Look,” says John Grunder, the Shop’s head of sales, “when a customer opens the case of a Custom Shop guitar he’s waited a year and paid his hard-earned money for, we want his expectations to be exceeded.”

The Master Builder Program’s focus on communication and teamwork ensures the highest level of customer satisfaction. “It really makes the difference,” adds Page, “between just being guitar builders and actually being a team with the customer.”

Two Types of Guitars

Custom “one-off” orders run the gamut from high-dollar works of art (last year’s Catalina Island Blues Festival commemorative Stratocaster was auctioned off for \$50,000) to slightly modified versions of standard production models. Within that range, there are “set necks,” semi-hollow bodies, exotic finishes, special woods, custom hardware set-ups, you name it.

“Basically,” says Grunder, “we make two types of guitars – player guitars and art guitars. There are a lot of people who buy guitars because they want to put them on the wall. They want something really unique, and they’re not necessarily going to take it out and play it in a club. And then we do a lot of guitars for players who just want a really unique or personalized guitar that they can take out and play.”

These personalized guitars can require any number of modifications to make them fit the desires of their future owners. These deviations from the norm can include major construction changes, from woods used, to hollow chambers being carved into the body to reduce weight. In one case, a client requested the installation of LEDs in the fingerboard underneath carved-pearl stars to facilitate late-night visibility. Whether this was to make it easier for the player to see where he was on the neck, or just to make it easier for the audience to see him, remains a mystery!

Soon, macro programs will be written for the VF-4 for cutting intricate fretboard patterns, which will allow this type of ornate inlay work to be accomplished in a fraction of the time it now takes to do by hand.

Guitars as Collectable Art

The art/show guitars the Custom Shop has created have been some of the most dazzling musical instruments ever made. One needs only to flip through the Fender Custom Shop Guitar Gallery, published by Fender and Hal Leonard, to get a taste of the beauty and variety of which the Custom Shop is capable. From the

Harley-Davidson Stratocaster, with its etched-aluminum body and gold hardware, to the one-of-a-kind “Disney 75th Anniversary Hand-Carved Stratocaster” by staff artisan George Amicay, the possibilities seem endless.

But, no matter how breath-taking these art guitars are, for the guys in the Custom Shop – all players themselves – it’s the player guitars that really excite them.

“Art guitars are real guitars – they play and sound great – but they’re still art guitars,” says Page. “From the guitar player side of it, the most exciting thing for me is when a customer who is not a famous musician – you know, just a regular guy – sends a letter that says, ‘I just got the 1959 Strat I ordered, and it’s the most amazing thing I’ve ever played. It brought tears to my eyes.’ And we get letters like that all the time, from players who got the guitar of their dreams.”

The Future of the Custom Shop

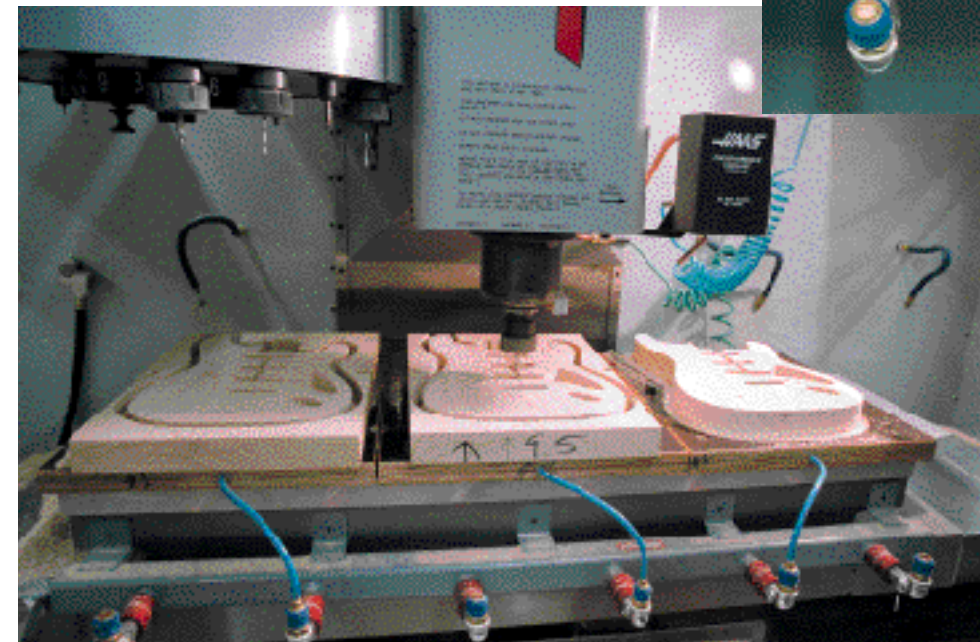
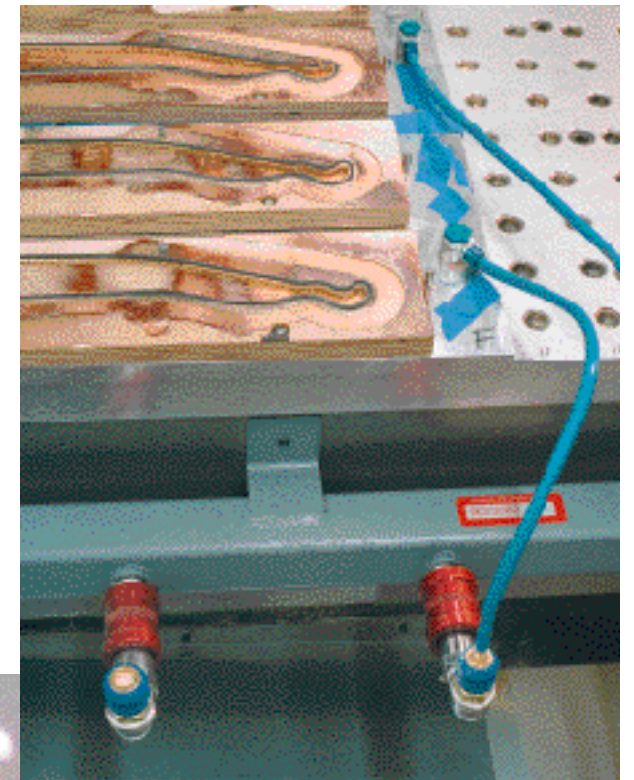
Over the years, the Custom Shop has exceeded all expectations, and as an added benefit, the Shop has positively affected regular production.

“By keeping its ‘finger on the pulse’ of the needs of players, the Custom Shop has been able to stay on top of trends,” says Boulanger, “and the knowledge the Shop has gained from interacting with musicians has trickled down into regular Fender production in many ways, improving the quality and variety of the Fender guitar line.”

A lot of what gets passed on to the regular production lines are subtle details like peghead shapes, fret sizes, certain finishes and hardware specs. The wide choice of guitars now available from the regular production factory has freed the Custom Shop to focus a

little more on its mission. Where Custom Shop builders had previously been bogged down in large batch orders of specific models, the regular production factory now is taking over some of this load, leaving the Custom Shop craftsmen more time to recenter their efforts on projects more demanding of their specialized skills.

With the current backlog of custom-order guitars, Boulanger says the ability of a CNC to save time will be appreciated. “The speed and accuracy of the Haas enables a much faster turnaround time for product; and the dependability, coupled with excellent and timely service, means an extremely low amount of down time. Once again, the Haas VF-4 has cut our cycle time by 75% – it was the perfect choice.”



The 50" x 20" x 25" travels of the VF-4 allow for three bodies or four necks to be cut per setup. Boulanger designed and built the vacuum fixture that holds the workpieces in place. Production has increased by 400% while tolerances have been cut in half.

Touch Probes: A Good Choice For Closed-Loop Process Control

Today's CNC machining capabilities, together with advanced insert cutting grades and materials, offer metalcutting manufacturers unprecedented new production potential.

That potential has allowed many high-production facilities to begin replacing dedicated transfer systems with more flexible CNC machining centers, and many small job shops to compete on equal terms with far larger OEM and supplier plants. At both levels, modern CNC machines offer the potential to make parts faster and to better tolerances.

Still, potential is the key word. Both large and small manufacturers are quickly learning that, even though the CNC machine is capable of making parts faster and to tighter tolerances, it often can't do so consistently without the help of some means of process control. This is because of the many variables that affect the metalcutting process. These commonly stem from inconsistencies in the part material, insert quality or machine stability. Another primary source is the machine operator himself, who can easily over-control or under-control the process, and make tool-compensation decisions that are necessarily subjective. Such decisions will be different from those made by other operators running the same operation on other shifts.

CLOSED-LOOP PROCESS CONTROL OFFERS A SOLUTION

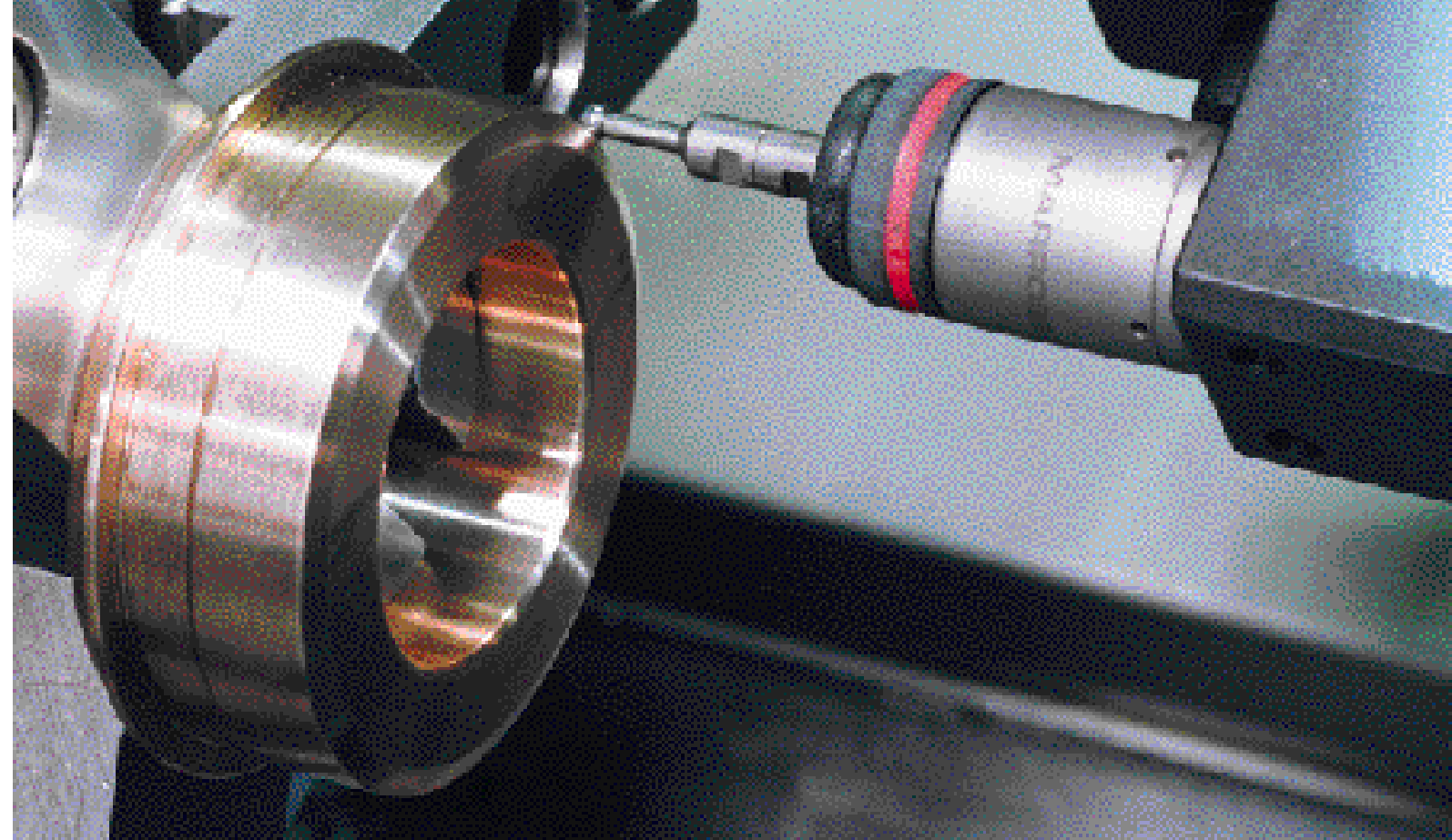
An effective way to eliminate process variables is to invest in a system of closed-loop process control. Such systems provide continuous control of part size through automatic feedback of gauged information directly to the machine tool's CNC. When the gauged information falls outside pre-set limits, the CNC activates tool offsets needed to maintain in-tolerance parts production.

An important advantage of closed-loop process control is its predictability. Unlike human machine operators, the system makes compensation decisions the same way every time, allowing production



management to target the machining process to narrow tolerance bands. If the process represents an early stage of manufacturing, the narrow tolerances maintained can pay huge dividends down the line by making it easier and far less costly to maintain quality in later stages of manufacturing.

Closed-loop process control can be achieved through feedback of gauged information either before, during or after the machining cycle. Pre-process control, in which measurements are made to establish correct setup and/or depths of cut before the part is machined, is most effectively used for cast parts, gang fixtures and pallet machines. In-process control, which is effective for all types of machines and parts, is achieved by measuring the part prior to finishing cuts in order to determine the tool offsets needed to keep finish dimensions within tolerance. Post-process control, which is used most effectively on CNC lathes, is achieved by measuring the part after it is machined to determine where each dimension falls within programmed statistically-based process limits. Based on these findings, the machine CNC calculates and activates necessary tool-size offsets.



TOUCH PROBES CAN BE AN EXCELLENT FIT

Although part measurements for closed-loop process control can be made by a device as simple as a hand-held gauge, or as complex as a multi-dimensional gauging fixture, the most cost-effective solution can often be a machine-mounted touch probe system.

Unfortunately, this highly practical measurement technology is often rejected out of hand by Quality Control managers, since it relies on the coordinate feedback system of the machine to produce its measurement reading. Many QC people just can't buy the concept of measuring a part on the same machine that is making it. And they have a point - if you're thinking along the lines of taking a measurement, plotting the data on a chart and doing an SPC analysis. The probe is not recommended for applications where size data must be extremely precise, since its measurements can be no more accurate than the machine tool's positional accuracy.

However, if your purpose is simply

In a high-production atmosphere like Haas Automation, accuracy is critical, and consistency from part to part is essential. The use of touch probes for closed-loop process control provides automatic feedback of gauged information directly to the machine tool's CNC for continuous control of part size. At left, Ricardo Gutierrez loads a gear blank for the Haas two-speed gearbox onto a hobber for machining. The use of post-process control ensures that every blank is exactly to spec. In-process control, above, measures the part prior to finishing cuts to determine the tool offsets needed to keep finish dimensions within tolerance.

to control the machining process, the touch probe can meet your needs at far lower cost than alternative hard gauging systems. With a locational repeatability of better than 40 millionths, it will successfully control any process where the dimensional tolerances to be maintained are 0.001" or greater. What's more, when programmed correctly, the touch probe system offers as much flexibility as the CNC machining center or lathe on which it is used. Generally, the system will provide process control for any parts you can cut within the machine tool's work envelope.

APPLICATION VERSATILITY

In addition to cost-effectiveness and flexibility, touch probing systems

provide the versatility for a wide range of closed-loop process control functions. This is especially evident in pre-process applications. On pallet machines, for example, the probe will allow you both to confirm the correct part, and confirm or correct for a good part load. If your setup is a load of parts on a gang fixture, you can use the probe to set an individual workshift for each part. For cast parts, which often introduce the variables of foundry flash and thermal drift, the touch probe will determine the right amount of material to remove.

The touch probe is no less effective in in-process applications, where it is used to measure parts prior to finishing

Please see page 28

Story
Tom
Stewart

Photos
Scott
Rathburn

RACE REPORT Continued from page 2

testing at Sebring found Gugelmin running nearly two seconds faster than his best lap in a '98 car.

In addition, the new version of the Ilmor/Mercedes-Benz IC108E "Phase Three" engine producing even more horsepower for 1999. While testing at Sebring, Blundell trimmed more than a second a lap off last year's times.

PacWest's efforts in the '98 Indy-Lights series earned a 2nd-place finish in final points standings for driver Didier André. André amassed his points by driving his V-6 powered Lola T97/20 to a first-place finish at Laguna Seca, logging several top-five finishes, earning two pole positions (fastest qualifier) and completing more race miles than any other driver.

Ilmor Engineering

The new Ilmor Technology Center in Plymouth, Michigan is fully operational and using a pair of Haas CNCs, an HS-1 and a VF-4, to produce the latest "Phase Three" version of the ultra-compact Mercedes-Benz IC108E racing engine. This diminutive V-8, the

smallest engine now running in the international CART FedEx series, put the competition back on the trailer during Spring Training at Homestead, Florida. Patrick Carpentier dominated the timing charts, turning in the first sub 25-second lap, followed by teammate Greg Moore, also in a Mercedes-powered Reynard.

"The results are significant because the engines that were fastest both days were some of the first engines built in our new Plymouth facility," said Paul Ray, Ilmor Vice President. The new Ilmor-Mercedes powerplant is used in seven of the 1999 CART entries, including the PacWest cars driven by Blundell and Gugelmin.

All American Racers (AAR)

Dan Gurney's American-built CART entry, driven by California-born Alex Barron (#36), carries the Haas logo on both sides of the driver's compartment. Body components, along with numerous other bits and pieces on the Toyota-powered Eagle, are being machined on Haas CNCs. AAR recently took delivery of the first Haas VB-1 Five-Axis Bridge Mill and is making use of


the VB-1's extensive travels to fashion molds used to make composite body panels for the Gurney Eagle chassis.

Arciero-Wells Racing

Additional 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). Arciero-Wells also fields two cars in the Indy Lights series competition.

Off-road enthusiasts will also recognize the Haas logo on the Arciero-Wells-sponsored race truck driven by "Iron Man" Ivan Stewart. Known for his consistent, and very persistent, driving style, the "Iron Man" is a real attention getter when he takes to the dirt.

C&C Motorsports

This growing team campaigns entries in the SCRA series, SCORE off-road racing, and is now running in the NASCAR Winston West Series. The team's SCORE Ford Ranger is starring in a national advertising campaign, and also will be featured in a build-up article for Four Wheeler Magazine. 

Haas Announces Year-End Figures

OXNARD, CALIFORNIA - Haas Automation, Inc. recently announced sales totals for 1998, and according to Denis Dupuis, general manager, "1998 was another good year for Haas with sales of \$326 million." Mr. Dupuis went on to explain, "Although that total is on par with our figures for 1997, the extreme efficiency of our new Oxnard facility (recently expanded to 620,000 square feet), combined with lower production costs, resulted in a slightly stronger bottom line."


According to Dupuis, Haas is well positioned for further growth in the

coming year, despite a marked slowdown in the entire industry during late 1998 and early 1999. "With the recent release of our new SL-Series turning centers, and several new entries in the five-axis and large-capability categories," Dupuis said, "Haas is uniquely positioned to attract a whole new category of customers."

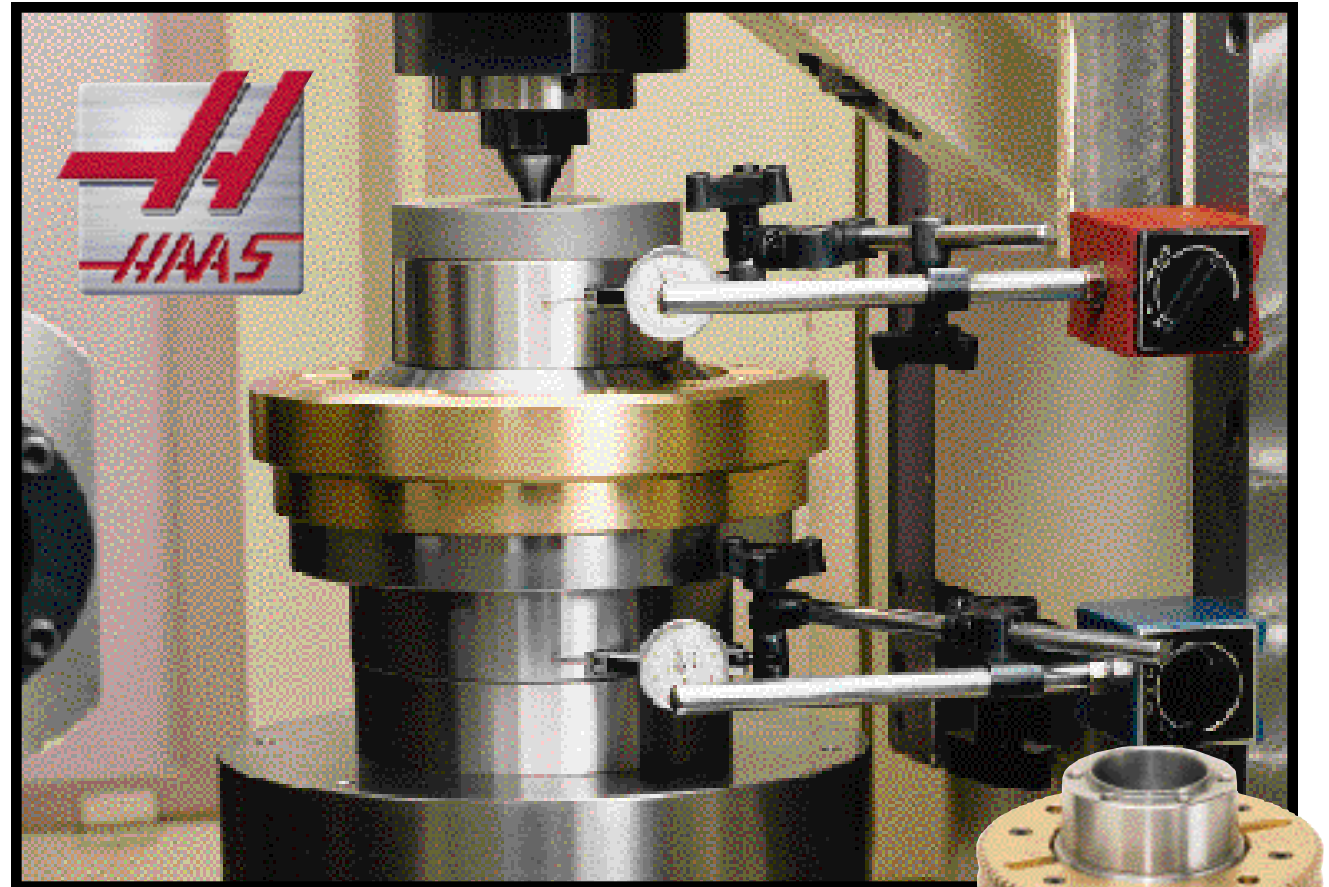
The growing markets opened by these new machines, combined with a solid existing customer base for their shop-proven VMC line, truly leave Haas poised for real growth in 1999. In fact, the company expects to return to

the traditional 40-70% annual growth rates that marked most of the company's previous years.

"Right now, Haas Automation is an extremely healthy company, both financially and mentally," Dupuis said. "We are looking at the current industry slowdown as an opportunity to improve our operations and manufacturing processes well beyond all expectations."

For 1999, Dupuis said Haas customers can look forward to "new machines, expanded features and options, continued polished engineering and more productivity solutions from America's best selling CNC machine tool company." 

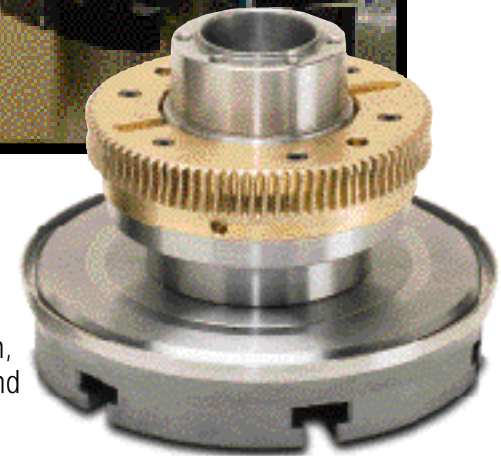
BUILT TO LAST



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.

By mounting the worm gear blank to the spindle before cutting the teeth, we're able to maintain superior overall concentricity. Each gear is then hand mated to one of our ultra-precision worms to produce a highly-accurate worm gear set for dependable, precise operation.

Each and every part machined by Haas at our state-of-the-art facility gets this much attention. It's the only way we achieve superior quality with years



Contact us for complete details about our full line of rotary tables and indexers - including dual, triple and quad-head models.



www.HaasCNC.com



Haas Automation, Inc.
2800 Sturgis Road,
Oxnard, CA 93030
800-331-6746
fax 805-278-2240

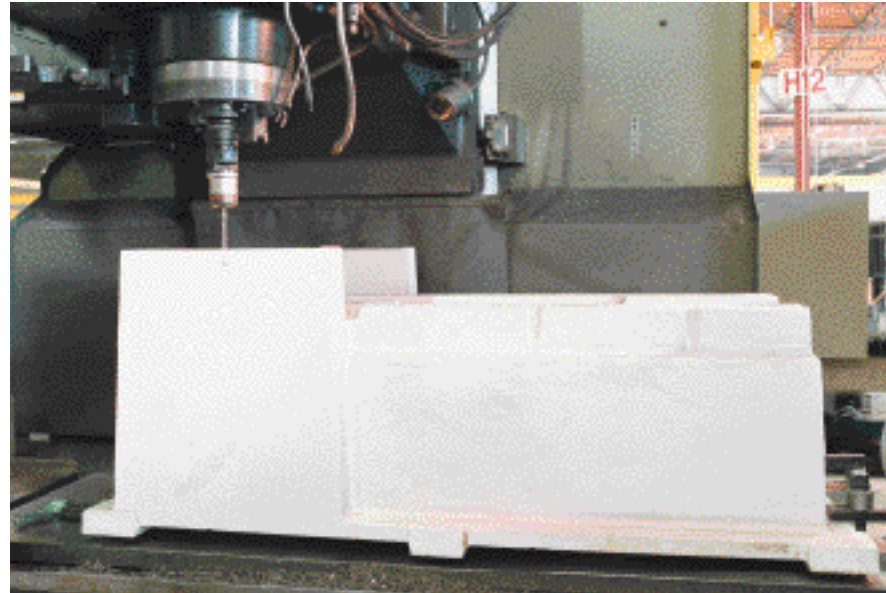
MARPOSS Continued from page 25

cuts, or in post-process applications, where it will measure a part after it is machined to determine where each dimension falls within programmed statistically-based process limits.

For all parts that it can measure, the touch probe system, if correctly programmed, will pay for itself rapidly by maintaining continuous in-tolerance parts production. There may be some dimensions on some parts that a probe cannot reach to measure – for instance, a groove inside a casting. But such cases are relatively rare. Overall, a probing system offers outstanding return on investment. It may cover only 75% of all possible application requirements, but it will probably solve up to 90% of any shop's closed-loop gauging needs.

USER-FRIENDLY APPLICATION SOFTWARE

One of the only real problems with today's touch probe technology is the extent to which acquired probes go unused. In some cases, a customer will receive the probe in a box, discover he has trouble getting it to work, and put it back in the box under a workbench. Larger manufacturers will often



Closed-loop probe systems, when used for pre-process control, can be used to make measurements to establish correct setup and/or depths of cut before the part is machined. This type of system is most effectively used for cast parts, gang fixtures and pallet machines.

purchase a machine equipped with a probe, but stop using it when the workpart changes and the probe needs reprogramming.

The solution to this problem is in the application software – the component that makes the probe do what it does. Correct application programming is essential to productive probe performance. User-friendly

application software and easy-to-follow programming instructions – such as those provided with the Marposs Mida® Touch Probe – liberate the potential of touch probes for cost effective process control. ☐

Tom Stewart is the Sales & Marketing Manager, Standard Products Division of Marposs Corp. (Auburn Hills, MI)

WESTEC Continued from page 3

Machining Centers:

- VB-1 Vertical Bridge Mill with 200" x 84" x 40" travels, full 5-axis head and 15,000-rpm spindle
- Prototype VS-3 extra-long travel VMC with 5,000-rpm, 50-taper spindle, fully supported 150-inch X-axis travel and 15,000 lb table capacity
- 15,000-rpm high-speed spindle
- High-speed control software with full look ahead and 400 ipm cutting rate
- Haas-built 40- and 50-taper side-mount tool changers

Rotary Products:

- HRT 210 SHS super-high-speed rotary table with 360°/sec rapids and 270°/sec feedrate
- Look for these exciting new products and options to reach production in the near future. ☐

GOT CHIPS?

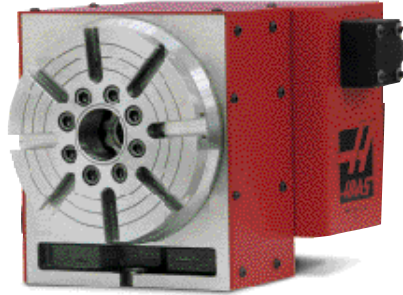


Haas Tool Holders



New Products In The Works

Never content to sit back and enjoy the rewards of success, Haas Automation engineers are always designing new products or thinking up ways to improve the existing ones. While some new products are variations on existing themes, others break entirely new ground. Here are a few examples of what's in the works at Haas:



HRT 210 SHS Rotary Table

The latest variation on the Haas rotary theme is the new super-high-speed HRT 210 SHS rotary table. Designed for rapid indexing and high-speed simultaneous milling, the HRT 210 SHS is perfect for drill and tap machines or increasing production on multi-sided 4th-axis setups. With a platter speed of 360° per second, the SHS is six times faster than the standard HRT 210. Like all Haas rotary products, the HRT 210 SHS is easy to program and interfaces easily with Haas and other CNC machines.

High-Pressure Coolant

A high-pressure coolant system is now available on all new SL-Series lathes. This new system provides 300 psi of coolant to the cutting edge for deep-hole drilling, heavy cuts, faster feed rates and better surface finishes.

Activated by an M code in the part program, this dual coolant system provides both high- (300 psi) and low- (30 psi) pressure coolant via the same delivery system, either through the

tool or through standard coolant nozzles. The result is high productivity and reduced cycle times.

High Speed Control

The latest High Speed control software for Haas mills 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.

Using a motion algorithm called "acceleration before interpolation," combined with full look-ahead of up to 80 blocks, the new High Speed software provides very high feedrates with little risk of distortion to the programmed path. All programmed motions are accelerated before interpolation, which ensures that the movement of each axis will not exceed the acceleration capability of that axis. The look-ahead algorithm determines the 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.

Here's How It Works


The new High Speed CNC software controls machine motion exactly the same at low feed rates as it does at high feed rates. A queue of motion strokes is built from axis motion data found in the G-code command program, and a look-ahead function 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

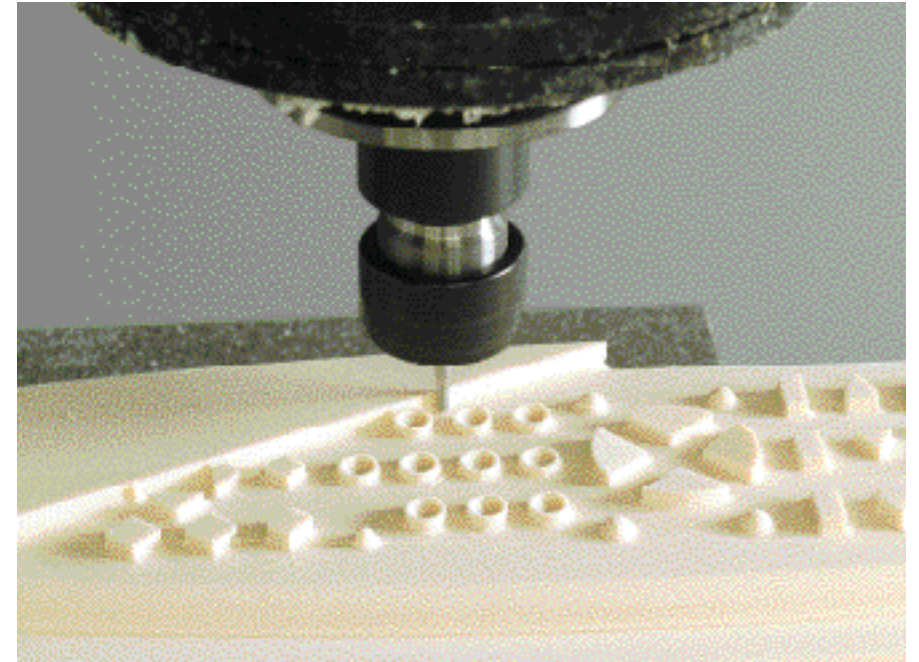
negotiated at lesser velocities down to zero at the greatest angles.

For very fast feedrates up to 400 ipm, and very short command block stroke lengths, the look-ahead function can look 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 one or two blocks.

Significant improvements in cycle time are possible with the control planning the acceleration profile over

many motion blocks instead of dealing with blocks independently. 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. 



The model of a television remote control, right, was machined in 35 minutes and 24 seconds using the new Haas High Speed software (version 10.6), versus a time of 1 hour, 43 minutes and 25 seconds using previous software version 9.61.

1999 TradeShow Calendar

Show Name	Dates	Info
Twin Cities, APEX Minneapolis, MN	May 4-6	More than 8,000 buyers are expected at the Minneapolis Convention Center. Booth #301
EMO '99 Paris, France	May 5-12	More than 2,000 exhibitors from all five continents will be showing their products at the Paris-Norde Villepinte Exhibitions Centre in France during this biennial show. Haas products will be displayed in Hall 6, F-68. Additional Haas machines bearing the Mikron label may be seen in the Mikron booth, as well.
FEIMAFE '99 Sao Paulo, Brazil	May 24-29	International Machine Tools and Integrated Manufacturing Systems trade fair. The major fair for the Southern Hemisphere, Feimafe expects more than 1,000 exhibitors and 33,000 attendees.
EASTEC '99, APEX West Springfield, MA	May 25-27	EASTEC has been the East Coast's largest annual manufacturing systems trade fair since 1981. 625 manufacturers and distributors are expected to attract more than 20,000 attendees to the show. Booth #2448.
Technology '99 Tel-Aviv, Israel	June 21-24	The Israel Trade Fairs and Convention Center in Tel-Aviv is the site of this biennial trade show and conference. Haas CNCs will be on display in the TekTeam Ltd. Booth #3205.

FENDER Continued from page 21

it just isn't economically sound to take such a rare, irreplaceable instrument on the road where it could be damaged or stolen. However, with one of the Custom Shop Relics, an artist can have an instrument that emulates all of the positive aspects of the true vintage guitar, while playing a production – and comparatively affordable – model that can be replaced with a simple trip to the local authorized Fender dealer.

While these radical departures from the norm set the standard for the world, there are those whose instruments must meet no standard except their own. For these discriminating artists, the only avenue is the Fender Custom Shop. While it might take as long as a year or more to finally take delivery of a Custom Shop creation, at least the new owner will know that the guitar has literally been in the hands of the craftsmen who give the kind of "hands on" attention to detail that makes each instrument a work of art.



Introducing, Haas SHOP-X-CHANGE.



What: An electronic posting area at www.HAASCNC.COM where Haas-equipped shops can post classified messages, want ads and other business-related messages.

Why: Perhaps you have too much work and need to job some of your longer runs out to another shop. Or, maybe your business specializes in a particular type of work and you could use over-runs from other shops. Or. . .

How: Submit your classified-style posting via e-mail to clortie@HaasCNC.com. We'll review the content and post your message in the X-CHANGE area of the Haas home page.

To view message postings, go to HaasCNC.com and click the X-CHANGE button on our home page.

We reserve the right to edit or disqualify all submissions.

www.HaasCNC.com

Simplify.

Discover how easy and user-friendly CNCA financing can be.

We build a leasing or financing plan to fit your needs.

It's that simple.



Call us toll-free
888-350-4CNC

Specializing in Haas equipment.

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 the Haas Applications Department. Haas applications engineers will answer each of your questions promptly, and the best questions will be published with answers in this column.

Dear Applications,

Last month I took delivery of my very first CNC machine, a brand new Haas VF-4 VMC. The control is great! My only problem is that I've been unable to get the control to communicate with HyperTerminal on my PC. I've been struggling for weeks with different software settings and cables. HELP!!!

Sincerely,
Dennis Kernighan

Dear Dennis,
Over the years, Haas CNC machine tools have been successfully interfaced via RS-232 to thousands of computers. However, due to a flood of inquiries from customers having difficulties getting Windows-based computers to communicate with a Haas control, now is a good time to set the record straight about using HyperTerminal.

While HyperTerminal can work, it is very unreliable for this application. In addition, it does not seem to work at all within NT (NT itself is not at fault here). As stated in the Haas Operators Manual, general-purpose Windows-based communications programs, like HyperTerminal, will not work reliably with the Haas control. DOS-based programs work much better; however, user resistance to DOS-based programs is growing, and many will not run on NT.

The solution is to use a Windows-based program written especially for CNC machines. Haas Automation does not provide software; however, we know of several third-party vendors selling a wide range of products which work well with a Haas. Try looking in your monthly trade magazine for a compatible program, or search the Internet for "DNC software."

One last thing, it is not always necessary to make your own RS-232 cables. Radio Shack stocks excellent cables that work very well. Call the Applications Department (ext. 7342) to obtain correct Radio Shack catalog numbers for your application.

Sincerely,
Haas Applications

HyperTerminal is a product of Hilgraeve, Inc. Windows and NT are trademarks of Microsoft, Inc.

Dear Applications,

I own a small job shop with two Haas VF-1 machines. Since I mainly do short runs of any given part, I change setups and work offsets often. I recently nearly crashed my machine because I accidentally called up the wrong work offset. Since then, I always erase any work offsets I am not using to eliminate the chance of calling up the wrong offset and crashing the machine. The problem is that it takes some time to select and erase every individual offset. Is there an easy way to clear all work offsets?

Sincerely,
Brian Channing

Dear Brian,
You could write a simple program using G10 preparatory functions to automatically zero all of your work offsets. It may take a little time to write the program, but it certainly will save time in the future. G10 is usually used to alter offsets within a program, but it also can be used to set offsets to zero. See the programming example below:

```
Set G52-G59 work offsets to zero:
G10 L2 P0 G90 X0 Y0 Z0 A0 (repeat, changing
the value of P, for P0 through P6)
G10 L2 P1 G90 X0 Y0 Z0 A0
" " " " " " " "
G10 L2 P6 G90 X0 Y0 Z0 A0
```

```
Set G110-G129 work offsets to zero:
G10 L20 P1 G90 X0 Y0 Z0 A0 (repeat,
changing the value of P, for P1 through P20)
G10 L20 P2 G90 X0 Y0 Z0 A0
" " " " " " " "
G10 L20 P20 G90 X0 Y0 Z0 A0
```

This could be expanded to set tool offsets to zero by altering the L and P codes. L10-L13 references the geometry and wear columns of length and diameter offsets and P1-P100 reference the tool number offsets.

Sincerely,
Haas Applications

A Handy Macro

McClain Tool & Technology, Inc., the Haas distributor in St. Louis Missouri, recently sent us this handy macro program which can be used to thread mill just about any size of thread with any size tool. We liked it, so we decided to pass it on to you.

```
%
O0001
...
G00 G40 G54 X0 Y0
T1 M06
S1000 M03
G90 G43 H01 Z0.5 M08
G65 P1234 D1.98 C0.5 E0.0556 Z-0.75 F15. M2
G65 P1234 D2.0 C0.5 E0.0556 Z-0.75 F15. M2
G00 Z1.
M05
...
M30
```

```
O01234
(MACRO - ID RIGHT HAND STRAIGHT)
(THREAD MILLING WITH MULTI-POINT)
(TOOL)
(C=#3 CUTTER DIA)
(D=#7 PASS DIA)
(E=#8 LEAD)
(Z=#26 Z DEPTH)
(M=#13 Z LEAD UP LOOPS)
G103 P1 (HALT LOOK AHEAD)
(BLANK LINE)
(BLANK LINE)
IF [#13 EQ #0] THEN #13=1
G01 Z[#26]F20. (FEED TO BOTTOM)
#32=[#7-#3]/2 (CALC CUTTER PATH)
#9=[#9*[#32]/[#7/2]] (CALC FEED RATE
CENTER OF CUTTER)
G03 X#32 I[#32/2]J0 F#9 (APPROACH)
WHILE [#30 LT #13] DO1
#30 = #30 + 1
G03 I[-#32]J0 Z[#26+[#8 * #30]]
(THREAD MILL UP)
END1
G03 X0 I[-#32/2]J0 (ESCAPE)
G103 (RESUME LOOK AHEAD)
M99
%
```

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

Coming Soon to your local area.



Platinum One-Call Service.

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 nation-wide 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.



Haas Automation, Inc.
800 331 6746

www.HaasCNC.com



Haas Automation Inc.
2800 Sturgis Road
Oxnard, CA 93030
Tel: 805-278-1800, 800-331-6746
Fax: 805-278-8540