CNC MACHINING

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IN THIS ISSUE

Take a Step!

You never get anywhere by standing still. To move forward – in business *and* in life – you first must take a step. Any step. A small step. A big step. A microscopic, barely-perceptible, did-you-move-yet?, itty-bitty step. A paradigm-shifting, industry-changing, quantum-leap-inducing, enormous step. Or even a sideways, change-of-scenery, look-at-things-from-a-different-point-of-view step. Just take a step. Any step. How hard is that?

Well, it's hard! There's a lot of comfort in standing still. It's predictable. It's easy. It's safe. But it doesn't get you anywhere. Doing the same things the same way always gets the same results. Crazy, isn't it?

But what if you want the same results? What if your processes are working? What if you're making money, you've got a steady customer base, you're getting the results you desire? Why change it? Because you're still standing still . . . and more than likely, your competition isn't. They're out there improving processes, reducing costs, investing in new technology, drumming up new customers, developing new products or improving old ones . . . They're out there taking steps. And the next one they take just might be in front of you.

So take a step! Shake things up. Try something new. Take a risk. Conquer your fears.

In this issue of *CNC Machining* you'll find several companies that have done just that. For our cover story, we venture north of the U.S. border to Montreal, Quebec, where a gentleman by the name of Val Ranetkins, upon finding himself out of work, parlayed his passions for diving and photography into a profitable career manufacturing underwater camera housings. His company, Amphibico, is revolutionizing the world of underwater movie making with its AMPHIBICAM® housing for Sony's state-of-the-art, high-definition digital video camera.

From the depths of the deep-blue sea we take you to the "dark forests and terrible swamps" of Germany (it'll make sense when you read the story), where a family-owned engineering company has been serving the mold and die industry for 30 years. Steinkamp is a preferred supplier to such companies as ZF, BASF and Mercedes-Benz, and they didn't get there by standing still. We show you how they're using the latest five-axis technology to machine prototype and development components for some of the world's finest automobiles . . . and we throw in a bit of English history in the process.

Back in the Colonies (English history again), DuHadaway Tool and Die is helping the power industry stay a step ahead of the public's insatiable thirst for electricity. This successful company manufactures components for combustion turbines, which power companies use to generate additional electricity during periods of peak demand. We show you how DuHadaway uses 4th- and 5th-axis rotary tables to step up their production of turbine components to meet the growing demand.

Also here in the States, we visit Gemel Precision Tool Company, a firm that began as a tool & die shop, but stepped into other areas to meet the needs of its customers – in this case, some of the nation's top drug companies. Gemel manufactures tooling for thermoform packaging machines. You know, the machines that put pills into those impenetrable blister packages? Here's the kicker: They not only manufacture tooling to get the pills *into* the packages, they make a machine to get the pills back out! Now that's a step in the right direction.

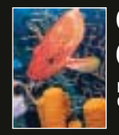
While we're talking about taking steps, one company that definitely doesn't stand still is Haas Automation. Check out our *What to Look for in a VMC* piece to see what we mean. You'll find a then-and-now comparison between the company's original VF-1 and the modern version of that same machine. Then we whip out the inflation factors to show just how much you really get for your money these days.

As always, there's much more. For our education piece, we visit a school in New Jersey that's exposing high-school students to the high-tech world of CNC through hands-on training. You'll also find the latest info on all the Haas-owned and Haas-sponsored race teams in our Race Report, and the Answer Man tackles some interesting machining challenges.

Oh, by the way, if you haven't noticed, this is issue number 25 of *CNC Machining*. Back in 1996, we cobbled together issue number one as a concept piece, a prototype, something to run by upper management to see if it would fly.

Well, it flew. We've taken a lot of steps since then, and we're kind of proud of the results.

So sit back, relax and enjoy!



ON THE COVER

Photo courtesy Getty Images

THE MASTHEAD

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by Denis Dupuis

Survival of the Fittest

In the industry magazines lately, there have been an inordinate number of letters to the editor bemoaning the fact that "all" of the work and parts are going offshore. The authors of these letters, at least many of them, complain that they are losing business to foreign competition, and they generally end their letters by asking what the government is going to, or should, do.

This attitude seems more prevalent in the mold & die arena of late, an industry which, for years, everyone believed immune to foreign intervention. This phenomenon is not unique to the U.S. (with work going to Southeast Asia), but also is prevalent in western Europe (with work going to eastern Europe). We feel their pain – no work means no need for new machines.

More and more, these days, mold & die work is going offshore or to less-expensive countries in an attempt to take advantage of lower labor costs. Classical theorists like Darwin, and economic theorists such as Keynes and Smith, would say: "It is the way it should be." The most-efficient or least-cost producers should get the work . . . and the rest should die or close their doors, making the whole herd stronger over time. That's easy for them to say; it's not their jobs going out the window.

These theorists keep telling us that we (the current industrialized, high-labor-cost countries) must add more value. We must provide our customers with value-added services. Great buzz words, but what do they mean to the average job shop? To me, they mean that we must change the way we do business. We have to figure out how to get the labor out of the work we do. How? Through more automation.

"It's too expensive," you say. Open your eyes! There are some simple and affordable labor-saving devices out there if you look, and CNC machinery is the biggest. Today's machines are immensely faster and more accurate than machines from just 10 years ago. There are inexpensive parts loaders, bar feeders, pallet changers and much more. Over the past 10 years, there has been a revolution in technology that can make the average job shop more competitive. Yet, many of them don't even look at it.

You can't afford to invest in new technology? You can't afford not to! Take a look at some of the Scandinavian countries. Despite very high costs of living, they continue to invest in high technology, create new products and compete quite successfully in the world market. Can you say Nokia?

Another value-added service is to improve your customer service. Provide smaller batch sizes to your customer – they're not going to go overseas for short runs of parts – and shorten your lead times. Customers today want quick turn-around and the ability to make changes on the fly, so give them exactly that. It's something they won't get from suppliers thousands of miles away.

I hear you saying, "Great, but how do I do that?" The simplest way is to upgrade your old equipment. Today's equipment is easier to set up, easier to program and easier to use – and it's faster at all of the above. If you're trying to compete on 20-year-old equipment, you might as well be shooting a one-shot musket against an AK-47: Unless you're a dead aim, you're just dead.

"But what about the government protecting us?" you say. Over the years, I have found that the government can't, and won't, help one particular industry. It has become a government of the lawyers, by the lawyers, for the lawyers. If we, in manufacturing, want something to change, we have to do it ourselves.

"But what about all the jobs that will be lost to this automation." Here is where I agree with the theorists. We must evolve. The jobs that we keep must become the high-tech, high-skilled positions that direct the machines to do the labor-intensive portions of the work. It's the only way we can survive against low-cost labor. Those who cannot adapt should run for office. There seem to be plenty of jobs there with no competition.

We've been written off before, if you recall, in the '70s, the '80s and the '90s. But we rose to the challenge. Each time, we became more productive, built better products and brought better prices to the consumers. We have to rise again in the new millennium.

Complaining didn't get it done in the past . . . we, the people, did.

Quest for Perfection

So, it's been some time since you've visited the Haas Automation website. Well, there's a lot you've been missing. Haas personnel view the website much like they view the company's other products: as an ongoing quest for perfection. So, as you might guess, there's always something new at www.HaasCNC.com. Take a few minutes and check it out.

You'll find that the Haas home page has been completely redesigned. It now features nicely organized drop-down menus for navigation, and an eye-catching flash movie that changes every few weeks. These mini movies, or animated digital billboards, often focus on new machines, new technology or special offers, so it pays to check back often.

Speaking of new machines and technology, roll your cursor over the **news/communications** header at the far right of the upper tool bar, and then select the **new machines & applications** category from the drop-down menu. This area now includes an easy-to-understand interface that is well organized and comprehensive. Select a new machine to explore, and in most cases, you'll find press information, photographs, a specifications data sheet, dimension illustrations and a cutting demonstration video – all for online viewing, or to download.

Now roll your cursor over **Haas products** in the upper tool bar, and drop down to **Rotary Tables & Indexers**. This part of the website was also recently overhauled to offer simple navigation and organized information, making it easy to learn all about the plethora of Haas multi-axis solutions.

As a reader of this publication, you may be interested to know that you can also access every back issue of *CNC Machining* magazine from the Haas website. Just click on the **free magazine** button at the bottom of the Haas home page to go directly to www.CNCMagazine.com, the online home of *CNC Machining*. Here, you can read the latest issue, browse a past issue or search the entire archive by topic or keyword. Use this online resource as your personal mini library of machining information. When you're done, there's a link to take you back to www.HaasCNC.com.

And there's more planned for the near future. Keep an eye out for changes to the Haas **Build-a-Quote** area under **hassle-free purchasing**. This database-driven repository of specifications allows on-the-fly machine comparisons, personalized machine configuration and much more. It's all part of the never-ending pursuit of perfection.

Affordable Production Solutions Boost Your ROI

If you're looking for high-output machining solutions to boost your bottom line, you won't want to miss Haas Automation's Demo Day 4. On June 11, 2003, Haas Factory Outlets throughout the U.S. and Canada will open their doors to show off affordable production solutions and demonstrate innovative ways to increase your return on investment.

On display during Demo Day 4 will be the latest Haas machines designed to reduce cycle times, increase output and save you money. The event will showcase such machines as the new Super VF-2SS, a high-speed vertical machining center with a 12,000-rpm inline direct-drive spindle, 1400-ipm rapids and an ultra-fast tool changer. Other high-output solutions will include the new Mill Drill Center with high-speed spindle and dual fixture stations, Haas turning centers equipped with automatic bar feeders, and the VF-3APC, a mid-size VMC with built-in automatic pallet changer. Each of these machines can increase your ROI through affordable automation and high-output machining.

If that's not enough to get you out of the shop and into your local HFO, maybe the free food and drink will get you there, or the chance to check out the latest cutting tools, workholding, quick-change tooling, production-enhancing accessories and CAD/CAM software – all shown on the largest and most complete line of Haas CNC machine tools ever.

In addition to the cutting demos, each HFO will present seminars on some of the latest manufacturing trends, including setup-reduction techniques, lights-out production and cost-effective automation. Haas applications engineers, along with representatives from major workholding, tooling and CAD/CAM manufacturers, will be on hand to share their insights and answer questions.

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

And They're Off

In the high-octane world of auto racing, success is all about making adjustments. During a race, the driver and crew chief work closely with the pit crew to improve the speed and handling of the car. Every fraction of a second counts, so changes must be made quickly and decisively. But the off-season gives teams a chance to slow down, to look back at the previous year and see where they can make changes and improvements. While off-season decisions come after more time and reflection than those made in the heat of a race, they often affect the entire season – for better or for worse. And in the fast-paced world of racing, it doesn't take long for teams to see if they made the right choice.

NASCAR Winston Cup

For the Haas CNC Racing team, the winter months brought a number of changes, including a new number and a new body style. The Haas car will wear the No. 0 this season, after sporting the No. 60 in 2002. The new number works well with the team's primary sponsor, NetZero, a company that provides free and low-cost Internet service.

The look of the car is also different for 2003, as the team has switched from the Chevrolet Monte Carlo body style to the new Pontiac Grand Prix body style. The team felt the switch would make them more competitive.

The changes are already paying off, as the Haas CNC Racing team had its best finish ever when Jack Sprague and the No. 0 NetZero Pontiac captured 14th place in the Daytona 500. Sprague was the top rookie in the race, and the No. 0 car was the highest finishing Pontiac in the Winston Cup season opener.

The race was plagued by two rain delays, and Michael Waltrip was declared the winner after only 109 of 200 laps were completed. Fortunately, Sprague was in the lead pack when the second storm hit. NASCAR officials called the race after two hours of rain.

The Haas CNC Racing team next took to the track at the North Carolina Speedway, where the No. 0 NetZero Pontiac rolled to a 34th-place finish in the Subway 400. Sprague was running on the lead lap near the end of the race, but fell three laps behind when NASCAR penalized him for passing on the left before the start/finish line during a restart. "We were better than the finish indicated," said Sprague, who is one of the five drivers competing for the Rookie-of-the-Year award. A 26th-place finish in the UAW-DaimlerChrysler 400 at Las Vegas left Sprague in 26th position in the Winston Cup Series points standings and 3rd in ROY points.

Hendrick Motorsports started the season well, with Jimmie Johnson pacing the five Haas-sponsored teams. Johnson and the Lowe's No. 48 Chevrolet scored two top-10 finishes right off the bat – a 3rd-place finish in the Daytona 500 and an 8th-place finish in the Subway 400 at North Carolina Speedway. Johnson then logged an 11th place finish in Las Vegas.

Four-time Winston Cup champion Jeff Gordon finished 12th at Daytona, and then placed 15th at North Carolina in the No. 24 DuPont Chevrolet. A stint hosting *Saturday Night Live* in January, and a 2nd place finish in the all-star Budweiser Shootout the week before the Daytona 500, have kept Gordon in the limelight, though. Things were looking up in Las Vegas, with Gordon leading much of the race, until he crashed out on lap 193.

Joe Nemechek and Terry Labonte got off to slow starts in 2003, finishing 22nd and 30th respectively in the Daytona 500, and then 23rd and 27th at North Carolina Speedway. Both drivers had better luck in Vegas, though, with Nemechek finishing 9th and Labonte finishing 16th.

Hendrick Motorsports will also run a fifth team in select Winston Cup races this season. David Green didn't qualify for the Daytona 500 in the No. 60 Haas Automation Chevrolet, but HMS has taken the R&D car back to the shop for improvements, and hopes to get it back on the track later this year.

Busch Series

In addition to racing full time in Winston Cup, Haas CNC Racing will also field a car in the NASCAR Busch Series in 2003. Troy Cline will pilot the No. 00 Haas Chevrolet for five races. "We're looking forward to our Busch Series debut and seeing what Troy can do behind the wheel," said Joe Custer. Rain, however, prevented Cline from qualifying for the Sam's Town 300 at Las Vegas Motor Speedway.

Brian Vickers, 19, made his Busch Series debut for HMS in the No. 5 GMAC Financial Services Chevrolet in the Koolerz 300 at Daytona, but a crash during lap 30 sent him home in 42nd place. Vickers bounced back with an 8th-place finish in the rain-delayed Rockingham 200 – his second career top-10 – and a 13th-place finish at Las Vegas

photo: Scott Weersing

IRL

The Indy Racing League will have a new name in 2003. Instead of IRL, the main series will be called the IndyCar Series, while the League's development races will be part of the Infiniti Pro Series. The name IRL has historically referred to both the sanctioning body and the series, but now will serve solely as the name of the sanctioning body.

To begin 2003, the IndyCar Series traveled around the globe, with races in Florida, Arizona and Japan, as teams work toward the Indianapolis 500. Defending champion Sam Hornish Jr. is seeking an unprecedented third IndyCar Series title, but two-time Indy 500 winner Helio Castroneves and Marlboro/Team Penske teammate and two-time CART champion, Gil de Ferran, are also top contenders for the IndyCar Series title.

NHRA

J&B Motorsports of Aliquippa, Pennsylvania, made several changes in the off-season, including a new driver and a new paint scheme for their NHRA Top Alcohol Funny Car. Paul Lee of Gaithersburg, Maryland, takes over driving duties from Todd Veney, who has piloted the J&B car for the past three years.

"Paul is an experienced driver and brings that experience to the team," said Jeff McGaffic, general manager of J&B Motorsports.

J&B showed off their new paint scheme in March at the Gator Nationals in Gainesville, Florida. The front of the car is painted pearl white, which then darkens to black in the rear. "I think it's one of the best-looking out there," said McGaffic. "We designed it to look like a bullet shooting through the air."

Falcon Cars

In just six months, Falcon Cars has gone from startup to having a complete IRL chassis. The Concord, NC-based company is one of three manufacturers for the new generation of chassis. Falcon Cars unveiled the Falcon Indy 01-A last November, and has been testing the chassis since then.

"We've progressed from the stages of design, aerodynamics, tooling and fabrication, to manufacturing – all in just six months. It's pretty remarkable," said technical director Ken Anderson.

The Falcon chassis is the first car completely designed and manufactured in the United States under IRL 2003 technical specifications.

V=mc²

THE VALUE EQUATION

A look at how machining centers have evolved over the past 20 years, and why today's machines do way more for a lot less than ever before.

Back in the Dark Ages of modern machine tool design – around the early 1970s or so – box ways and heavy castings were considered the mark of a quality machine tool.

Story & Photos **Scott Rathburn**

Sure, some adventuresome companies were experimenting with a new technology called linear guides – a system employing preloaded bearing trucks riding on precision-ground ways – but those "in the know" insisted that box ways were the only way to go. These old-timers maintained that linear guides were a passing fad: They were not rigid and couldn't handle the cutting forces involved in heavy machining.

Fast forward to the new millennium, where the finest – and the most expensive – machine tools in the world use linear guideways. A passing fad they were not. In fact, nearly every machine tool manufacturer today uses linear guides, including many of those same companies who adamantly waved the box-way banner in years past.

It just goes to show you: You can't judge a machine by its ways.

These days, you also can't judge a machine solely by its price. Competition is stiff in the machine tool industry, with a growing number of manufacturers vying for a piece of the pie, especially from such countries as Korea and Taiwan. Lower labor costs in these countries, combined with favorable exchange rates and America's liberal free-trade policies, allow manufacturers to build machines for less and "dump" them on the U.S. market at prices lower than their U.S. competition.

In an attempt to stay competitive, some manufacturers (U.S. and otherwise) have chosen the "If you can't beat them, join them" approach: taking their manufacturing facilities – or a portion thereof – offshore to reap the benefits of lower labor costs, less stringent environmental regulations and reduced materials costs.

This is all well and good for the corporate big-wigs and company stockholders, whose driving motive is the almighty dollar. But what about the customers? Are they really getting a better product at a lower price? Or are they getting the same product at a lower price? Or worse, are they getting a lower quality product with fewer features and less capability at the same or even a higher price?

Customers are no longer willing to pay top dollar for a machine tool from one manufacturer, when they can get essentially the same machine for less money from another manufacturer. But customers don't just want a machine for less money. They want the same machine, with the same features and the same quality for less money. Or, at the very least, they want to pay the same price for a machine with higher performance, more features and better quality.

So here's the challenge for machine tool builders: to build higher-quality products that outperform last year's models . . . and sell them for less than the competition.

For Haas Automation, Inc., this is nothing new. The company's philosophy has always been to build machines that are bigger, better, faster and less expensive – not only than the competition, but than the machines that rolled off the company's own production lines last year, last month or even last week.

(Haas machines have always been, and still are, manufactured entirely in the United States. All major castings are poured at U.S. foundries, and all major components are manufactured in-house to control quality, cost and delivery.)

A simple comparison of the first Haas VMC, the VF-1, to the modern version of that same machine proves the point.

When Haas introduced the VF-1 in 1988 at IMTS in Chicago, the suggested retail price was $49,950. Adjusting for inflation, that's equivalent to about $76,100 in 2002 dollars.* The machine featured 20" x 16" x 20" travels, a 7.5-hp (peak) brush-style spindle motor, a two-speed geared head, speeds to 5000 rpm, brush-style servo motors on all axes, 480-ipm rapids, a 16-tool ATC and the Haas CNC control, which featured a whopping 128 K of program memory and a maximum processing speed of 20 blocks per second. Additional options were essentially non-existent.

Today's VF-1 is easily 10 times the machine tool its 1988 namesake was, yet the base price for a machine with a two-speed geared head is only $45,895, or about $30,100 in 1988 dollars. The VF-1 still has travels of 20" x 16" x 20", but now features a 20-hp (peak) brushless spindle with a high-performance vector drive, speeds to 7500 rpm standard, brushless servos on all axes, 1000-ipm rapids, a 20-tool ATC and the Haas control, which now features 1 MB of program memory (nearly 8 times the 1988 figure) and provides processing speeds up to 1000 blocks per second (or 50 times faster than in 1988). And that's the base model machine. The list of options is extensive:

- **10, 000-, 15,000- or 30,000-rpm spindles**
- **1200-ipm rapids**
- **Automatic chip auger system**
- **24-pocket side-mount tool changer**
- **Through-spindle coolant**
- **Remote jog handle**
- **Linear scales**
- **4th- and 5th-axis capabilities**
- **High-speed machining software with full look-ahead**
- **Visual Quick Code conversational programming system**
- **Ethernet connectivity**
- **Floppy disk and Zip drive interfaces**
- **Memory upgrades to 16 MB (that's 1000 times more than in 1988!)**
- **User-definable macros**
- **Work and tool probe systems**
- **and much more**

A fully optioned VF-1 with a 30-hp (peak), high-torque 10K spindle, through-spindle coolant, 4th-axis drive, side-mount tool changer, programmable coolant nozzle, chip auger and loaded with control options can be had for less than $69,000 – or about $45,250 in 1988 dollars. That's a lot of bang for your buck!

And that's exactly what buyers are, and should be, looking for: the most bang for their machine tool buck.

Today's vertical machining centers come in all shapes, sizes and price ranges. Models range from bare-bones 3-axis machines not much larger than a refrigerator, through 5-axis behemoths that can fill a goodly portion of an entire building. What the average shop owner is looking for, however, probably lies somewhere in between. And for most, a C-frame VMC probably fits the bill.

Because of their versatility, VMCs have become the tool of choice for most job shops and contract manufacturers. This same flexibility makes them quite suitable for almost any industry. Today's consumer products change so rapidly that manufacturers must be able to change designs mid-stream and retool quickly to stay competitive. Purpose-built machines designed to spit

out millions of identical parts are becoming a thing of the past; and even the automotive suppliers, once the bastion of dedicated transfer lines, are going the way of the VMC and other CNC machine tools.

So, what should a shop owner look for in a VMC? First off, a few questions are in order. What is the reason for buying a machine? Is it a first machine for a start-up shop, or a first step into CNC? Is the machine needed to expand the company's capacity, or is more capability needed to take on new jobs? These questions and more must be answered in order to select an appropriate new machine.

Here are some of the primary things to look at:

CAPACITY

How big a machine do you need? Do you need a 40-taper or 50-taper spindle? What's the largest part you will be running? How much room do you have in your shop for a machine?

CAPABILITY

What materials will you be cutting? Do you need 4th- and/or 5th-axis capabilities? Will you be doing high-speed machining, or heavy hogging?

AVAILABILITY/DELIVERY

Is the machine you want available? Can it be delivered in a reasonable time frame, or will you have to wait months, or longer, for delivery?

SERVICE AND SUPPORT

Is there an authorized distributor nearby to set up, service and support your new machine? Can they provide applications assistance? Are repair/service parts readily available and affordable? Is training readily available for your operators?

PRICE

In today's economic climate, price is becoming a major consideration more and more. Obviously, getting the most machine for the money is the primary goal. But it is also important to consider the long-term cost of a machine, not just the initial sticker price. Such things as the reliability of the machine, the availability and speed of service, the availability and cost of spare parts – and much more – must be taken into consideration.

OPTIONS

Are options available to increase the performance of the machine or tailor it to better suit your applications? If so, are they reasonably priced? Does the manufacturer offer packages of options at reduced prices, or must they be purchased separately?

Here are some useful options to consider when purchasing a new VMC:

Programmable coolant nozzle – automatically directs coolant to the proper height for each cutting tool via the G-code program, eliminating the need to stop the machine and readjust coolant lines at each tool change.

Chip auger system – automatically removes chips from the machine and discharges them into a barrel or chip bucket. The Haas chip auger system compresses chips and wrings out the coolant as swarf is removed from the enclosure.

4th- and 5th-axis rotary tables – allow multi-sided machining or machining of complex geometries in a single setup. Boosts production, reduces cycle times and cuts down the number of tool changes.

Side-mount tool changer – provides additional pockets for more tools, and frees up the work enclosure for unobstructed machining. Provides faster tool changes to reduce cycle times.

High-speed machining software with block look-ahead – allows faster programmed cutting feedrates without distortion to the programmed path. Provides smoother machine motion and better surface finishes, and reduces cycle times on complex geometries.

Expanded program memory – allows large files to be stored in the control, rather than having to DNC. Also allows a large number of programs to be stored on the machine for repetitive parts, and provides a buffer when running large programs through DNC.

As you can see, there's a lot to consider these days when purchasing a machine tool. And with recent events in the industry – bankruptcies, mergers and several major players going by the wayside – it's becoming increasingly important to make the right choice.

***Dollar equivalents calculated using published inflation conversion factors.**

Steinkamp

Werkzeug-und Formenbau

On a visit to a Haas user in Northern Germany, *CNC Machining's* roving reporter Matt Bailey not only learnt something about the history of the English monarchy, but also saw how a family-owned engineering company is using American technology to maintain its lead in the mold and die industry.

Story & Photos Matt Bailey

"DARK FORESTS" AND "TERRIBLE SWAMPS"

These were the lasting impressions made by the area of Neidersachsen on the Roman historian Tacitus, as noted in his publication *Germania.*

Perhaps his foreboding description helped to perpetuate doubts amongst the leaders of Rome's imperialist army, partly explaining why the marauding legions never managed to conquer the territory during their march across Europe. Instead, they retreated back beyond the Rhine and Danube rivers and contented themselves to trade with, rather than fight, the inhabitants of this seemingly impenetrable land.

To the modern, English-speaking world, the Federal State of Neidersachsen is Lower Saxony, the area of Germany around and including the city of Hanover. Of course, Hanover is best known to anyone in the precision engineering and machine tool industries as the venue for the biennial machine tool and manufacturing technology exhibition, EMO. But to my English compatriots and me, Hanover has a more regal significance. A quick explanation is in order:

If your knowledge of history is anything like mine, it may surprise you to know that the blood of the English and Hanoverian monarchies is forever mixed, thanks, indirectly, to the tyranny of Henry VIII. Unfortunately, even for those with an interest in the genealogy of the English crown, there isn't sufficient space here to give a full explanation of how a German became King of England. Suffice it to say that due to a marital link between the two royal families, protestant Hanoverian Georg Ludwig was, in accordance with the Act of Settlement, 52nd in line to the English throne, and although he spoke no English, his blue-blooded status and his suitable religious colors enabled him to leapfrog many more legitimate candidates to take his place on the English throne as George I, the House of Hanover's first King.

Fascinating, I'm sure you'll agree, but not the intended subject of this report.

THE HOUSE OF STEINKAMP

Fortunately, during my visit to the small town of Espelkamp, home of Steinkamp Werkzeug-und Formenbau, I didn't come across too many dark forests or terrible swamps. Nor did I knowingly bump into any ex-members of the Hanoverian royal family. What I did come across was a very warm welcome from a company that's fighting for its corner in the mold and die industry with as much vigour as its ancient ancestors mustered against the invading Romans.

Steinkamp Werkzeug-und Formenbau was established in 1970 in Espelkamp, Germany, by Ingolf Steinkamp, a toolmaker and engineer who remains today as the company CEO. Steinkamp's founding premise was to machine and manufacture three-dimensional dies for blow molding, injection molding and foam molding operations. Although the company's activities have diversified, its original remit still constitutes its core business today, more than 30 years later.

These days, the Steinkamp operation has a staff of 140, including some 120 skilled machinists and precision engineers. Although the Germany-based operation is by far the largest, the company also maintains a successful presence in the USA, based in Erlanger, Kentucky.

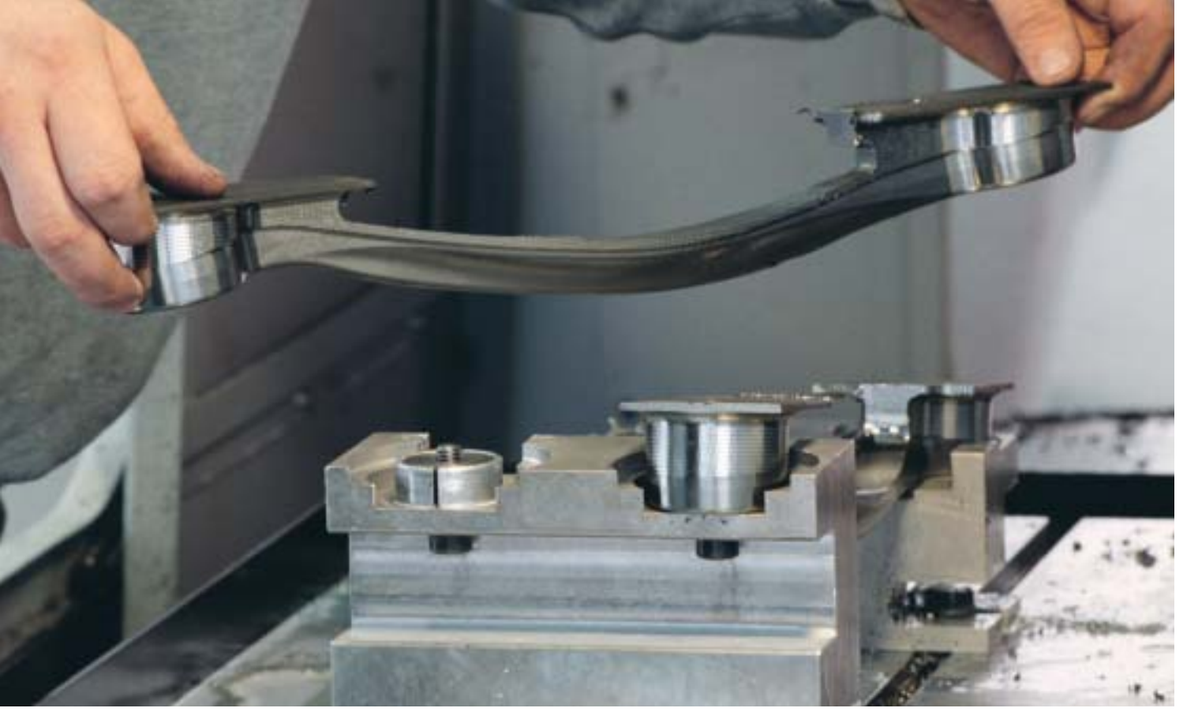
Thirty years is a long time building molds and dies. The company's prodigious experience is obviously highly regarded, as evidenced by its list of blue-chip manufacturing customers, including Johnson Controls, Mannesmann Automotive, Lemforder and Mollerplast.

"We also have many customers within the ZF group, and we do a lot of work for BASF," says Lars Steinkamp, son of Ingolf. "In fact, ZF and BASF combined account for roughly 50% of our current business."

Many of Steinkamp's customers are automotive OEMs and first-tier suppliers. As anyone familiar with the high standards of world-class auto companies will tell you, achieving and keeping a place as a preferred supplier is no mean feat. Over time, Steinkamp has capitalised on its hard-earned goodwill, becoming involved in machining prototype and development components for new models of prestige automobiles.

One of the company's latest projects is supplying essential mold components for the active suspension system of the new Mercedes Benz CL, including blow molds for the bellows, rubber- and metal-injection molds for the vibration dampers and foam molds for the suspension support struts.


photo courtesy Mercedes-Benz



"Over the years we've expanded our machining capability," says Steinkamp, "but mold and die is our priority. The largest die we make is 20,000 pounds; the smallest is just 20 pounds."

Lars Steinkamp is the product manager of the family-owned business. As such, he is closely involved with the design and manufacturing operations, as well as having a significant say in what constitutes the company's machine shop. With obvious pride he lists the current armoury:

"We have more than 40 CNC machining centres, nine conventional milling machines, 11 four-axis machines, four five-axis machines, four high-speed machining centres, some nine CNC turning centres, 10 EDM machines, six grinding machines and 22 CAD/CAM workstations."

Included amongst this formidable array are 15 Haas-built CNC machines, 12 in Germany and three at the company's U.S. plant.

"We were the very first company in Germany to buy Haas machines," states Steinkamp. "Every time we are in the market for a machine we look at all the alternatives. There are a number of reasons why we keep buying Haas, including the cost/performance relationship and, just as importantly, the ease of use.

"One of the reasons why the Haas machines are so simple to use is because the control is easy to learn. This is very important here in Germany. Like all around the world, it's becoming increasingly difficult to find skilled people. Many of the features of the Haas control enable new or inexperienced operators to learn programming very quickly."

However, as anyone machining molds and dies will know, some of the machining operations necessary for achieving complex 3D surfaces are almost impossible to program at the control, even a Haas control. To eliminate the mind-blowing complexities of the problem, Steinkamp has a software armoury that's almost as impressive as its array of machine tool hardware.

"We have seven seats of CATIA," says Steinkamp. "We also have two Pro/ENGINEER workstations, 13 seats of Mastercam and one seat of AutoCAD. Consequently, we can either design the component from scratch and generate the CNC program, or we can accept the drawing file from the customer and take it from there."

5-AXIS VERTICAL

The latest arrival in Steinkamp's Espelkamp machine shop is a new Haas VF-6TR (trunnion) vertical machining centre, purchased and installed early last year.

"We needed a new, large 5-axis machining centre for some of the heavier mold and die jobs. We chose the Haas VF-6TR for its capabilities, but also because we were very familiar with Haas machines, and we were very happy with their capabilities," says Steinkamp. "Also, the price and the specifications of the machine are much better than the alternatives available."

As the name suggests, the Haas VF-6TR is based on the very successful Haas VF-6 vertical machining centre platform. The standard table has been replaced with a dual-axis trunnion table enabling full, simultaneous five-axis machining or the incremental positioning of a part to almost any angle – ideal for machining the complex shapes and surfaces found in mold and die work.

However, during my visit, Steinkamp's VF-6TR wasn't machining mold and die work. Instead, it was busy machining a run of components for a prototype motorcar suspension system being built by ZF Fahrwerktechnik.

"As I said before, ZF is a very important customer for us," says Steinkamp. "The VF-6TR is a very capable steel-cutting machine, so we're using it to turn out this short-run prototype job."

Two solid blocks of 42 CrMo 4V steel are loaded simultaneously on opposite sides of a cube fixture mounted on the VF-6TR's trunnion table, and five sides are machined on each. The partly finished left- and right-sided components are unloaded from the VF-6TR for manual operations, including tapping and removing surplus material. The tapped and cleaned pairs are then transferred to the company's 20-hp Haas VF-0E, where the sixth side is machined. Finally, the parts are finished manually before being quality checked on a coordinate measuring machine.

"Because the part is a prototype, we are only making about 200 left- and 200 right-sided components," says Steinkamp. "This is typical of the non-mold and die development work we are involved in. The volumes are not high, but every time we machine a new part, we have to produce the design, the CAM programme and the fixture. It's very valuable business."

WHERE ROMANS FEAR TO TREAD

The local Haas Technical Centre (distributor) provides the support for Steinkamp's Haas machines, and Lars Steinkamp is delighted with the service. "Our local service engineers have a lot of experience with Haas machines, gained from when the Haas product range was first launched in Europe."

Regular readers of *CNC Machining* will know that the Haas Europe headquarters was opened in Brussels in early 2001. Since then, the company has been busy appointing and setting up Haas Technical Centres all over the European continent.

Like all other Haas Technical Centres, the German outlets employ teams of Haas factory-trained sales and service engineers dedicated to providing the extraordinary service which Haas customers worldwide have come to expect. Unlike Rome's easily frightened legionaries, however, "dark forests and terrible swamps" hold little fear for this particular army's front line.

Mr. Deblister Saves the Day!

When you're sick and looking for relief, the last thing you need is a difficult package to open. But state and federal laws require certain drugs – the most effective ones, it seems – to be contained in childproof packages.

So, bleary-eyed and achy, you stumble to the kitchen in search of a pill or capsule to relieve the stuffed-up nose and headache that plague you every winter. After much digging, you locate the appropriate box, open it . . . and find yourself faced with the frustrating task of removing the desired medication from a seemingly impervious package. At this point, you probably refer to this innovative containment system as a %#@&! package, but its real name is a blister package.

A typical blister package consists of three layers: a layer of paper that is printed with a warning label, a layer of foil that seals in the medication and a layer of plastic bubbles, or blisters, that holds the pills or capsules. To you these little bubbles may simply hold relief from your cold symptoms, but for one machine shop near Philadelphia, the same package is earning them profits.

Photo Illustration: Scott Rathburn

0025036 66 **Story & Shop Photos** Scott Weersing

Using a Haas rotary table and a four-sided tombstone, Gemel Precision Tool Company reduced their cycle time for these parts from 45 minutes per plate to 4 minutes. The parts are machined on a Haas VF-3 equipped with a 15,000-rpm spindle and high-speed machining software.

The Gemel Precision Tool Company, Inc., of Ivyland, Pennsylvania, specializes in making blister-package tooling for thermoform packaging machines. They make the tools that form the bubbles, seal the packages and perforate the cards into sections. Their tooling has been used to package such well-known products as Sudafed, Actifed and Benadryl.

It would seem that getting the medications into the packages would be the primary objective. But sometimes a drug company finds something wrong with a blister package – some of the blisters may be empty, or the labeling may be wrong – and needs to get the product back out. They could just throw the packages away, but disposing of the drugs properly can be expensive. And, depending on the medication, the packages may contain a fortune in product – some tablets can cost 50 to 75 dollars apiece.

Using their knowledge of tooling for blister packages, Gemel designed a specialty machine in 1994 that takes the drugs out of the packages. The Mr. Deblister™ product recovery system allows drug companies to recover inventory by punching holes in the blister packages and retrieving the tablets so they can be repackaged.

Gemel began as a tool and die shop in 1971, but started doing work for the maker of Tylenol in the early eighties. "Most of the machinery used in the drug packaging industry is made in Europe," explains Ernie Gehlert, vice president of Gemel. "Because of this, the replacement parts are costly and the lead times are very long. So nearby drug companies started coming to us to fix broken parts. We got kind of lucky." Such companies as Pfizer and Warner Lambert are among Gemel's clients.

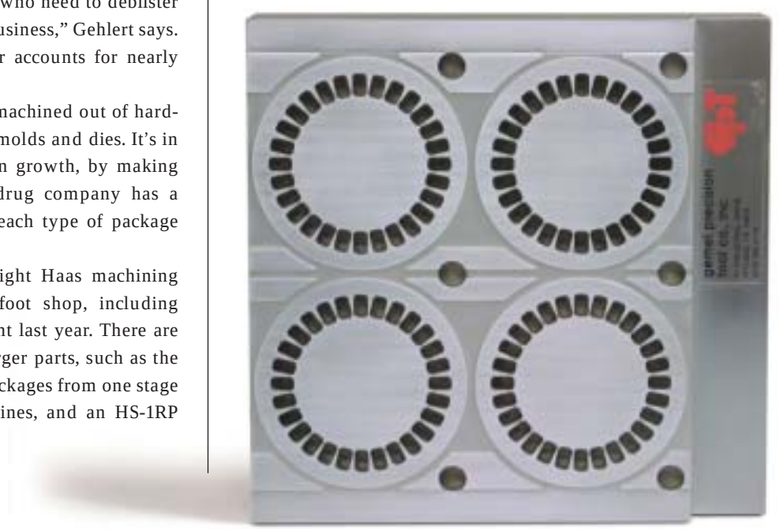
The idea for the Mr. Deblister came from serving their customers' needs, Gehlert says. Yet, some customers still don't know what the machines are for. "Even people inside the industry don't know what the Mr. Deblister does," he says. "Start listing some of the reasons to use it, though, and they see the possibilities. You can have a fortune's worth of product in one card, and some companies have a room full of people sitting around and tearing packages apart by hand. Then they buy a machine like ours and do it automatically. If the medicine is expensive, the return on investment can be one day."

Each Mr. Deblister has a custom set of tools created specifically for the dimensions of the package and the arrangement of the blisters holding the drugs. The tools are either modeled from the actual package or, since Gemel made the tooling that created the package in the first place, they just reverse the toolmaking process.

Gemel sells more than 50 Mr. Deblisters a year, and then manufactures sets of tools for customers who need to deblister new packages. “We keep getting repeat business,” Gehlert says. With sales worldwide, the Mr. Deblister accounts for nearly 25% of the company’s workload.

The tooling for the Mr. Deblister is machined out of hard-coated aluminum, as are the company’s molds and dies. It’s in the tooling where the company has seen growth, by making new tools for each machine. Once a drug company has a Mr. Deblister, they need new tools for each type of package from which they want to recover drugs.

To create the tooling, Gemel has eight Haas machining centers housed in their 25,000-square-foot shop, including a VF-0 bought in 1992 and a VF-3 bought last year. There are also a VF-6 and a VF-7 for machining larger parts, such as the aluminum tracks that transport blister packages from one stage to the next in the thermoforming machines, and an HS-1RP horizontal machining center.



“The first machine worked great,” says Gehlert, “so we bought more, because we wanted to standardize the controls. We don’t do high-production runs here. I don’t have a programmer, a setup guy and then an operator. With the Haas controls, each guy can work at any machine.”

Steve Sweeney, one of Gemel’s programmer/operators, says the Haas machines are ready for anything, and he likes knowing they’ll be up and running every day. “The zero downtime is the best,” he says. Sweeney uses the HS-1RP to machine large parts for the packaging machines, such as cooling rolls and barrel cams. “I have a vise on one pallet and a rotary table on the other, so I can have the machine doing rotary work on one side while I’m setting up the vise on the other side,” he says.

Gemel’s experience making tooling has helped the company earn a variety of other jobs as well, such as creating a sealing plate for a medical product. They needed to machine oval openings in a piece of plate-stock aluminum that had vulcanized rubber on one side of it. Originally, it took two setups to mill each side. But when Gemel purchased a Haas VF-3 with a 15,000-rpm spindle, the high-speed machining option and a rotary table, the time savings were enormous. Sweeney created a four-sided tombstone and mounted it on the Haas rotary table to machine four plates in one setup.

“We were able to take our run time from 45 minutes per plate down to 4 minutes with the high-speed machining,” said Sweeney. “We indexed the rotary three more times and got a total of four parts with one push of the start button. The time savings were tremendous.”

Such savings are necessary to remain profitable in the current economic climate; the recent recession has hurt Gemel. “Normally, pharmaceutical companies don’t feel the recession, because people are always getting sick and need to take medicine,” says Gehlert. “But this past year we are feeling the downturn. The drug companies are not developing new products and new packaging.”

But Gemel and Mr. Gehlert are positive that things will improve, and the company hopes to purchase more Haas machines. “I would love to buy ten more if I had the work for them,” Gehlert says. “When I need more capacity, I will go with Haas machines. The value and price are all there.”

Deep Blue MOVIES

Story and shop photos by Matt Bailey

It was most likely the late Captain Jacques-Yves Cousteau who started it all. Whilst exploring the previously un-photographed wonders of the deep, the French sub-sea naturalist and co-inventor of the Aqualung took along his movie camera so he could show the world that life beneath the ocean waves was just as rich and varied as that on land; probably more so. More than half a century later, Cousteau would probably marvel at the images achievable with modern, high-definition underwater digital video cameras, particularly those made by Canadian design and engineering company Amphibico Inc. We report on how one man's passion is revolutionising the world of underwater movie making.

photo courtesy Getty Images

t s a rare person indeed who, to paraphrase Mark Twain, makes his or her vocation their vacation. To be able to make a living from one s passion is a privilege not many achieve. To successfully combine several passions into one profitable activity is harder still. But that s exactly what Val Ranetkins has achieved. He is the inspiration behind, and the current director of research and development at, Montreal-based Amphibico. As well as being a keen photographer and a passionate diver Ranetkins is, above all, an inveterate innovator. Finding himself out of work in the late 1980s, he turned his hand to designing and making underwater housings for still cameras, combining his interests to make a living and, in the process, building a successful engineering design company.

For Ranetkins, it all started with a passion and (the never-to-be-underestimated, all-important) contacts, two things you can never have too much of when starting a venture.

"When I started out," says Ranetkins, "I was making very basic products using an epoxy and polyurethane-based housing. I was doing almost everything by hand, working from my basement."

Little did he know, but a key contact at the world-famous National Geographic Society would soon prove vital to the future of his fledgling activities. The National Geographic Society is the world's largest nonprofit scientific and educational organization, and is well known for its adventures above and below the waves, documenting its expeditions in its monthly magazines and on its TV channel.

"The National Geographic people came to see me and liked what they saw," Ranetkins explains. "They asked me if I could make something similar, but out of aluminium rather than epoxy. I said sure, of course, but the problem is, I don't have any money. They asked, 'Well, how much do you need to make a mold?' I said about $12,000. Next thing I knew, they had sent me a cheque for $12,000! I was stunned, but pretty pleased, so I told them I'd have their housings for them in three months, which was a very ambitious deadline."

But, despite his impetuosity, Ranetkins kept his word and managed to deliver, as promised, in just three months.

"Years later I met the National Geographic director who signed the cheque, and he said, 'You know Val, I don't know how you talked me into it.' He said he didn't sleep for three months once he'd written that $12,000 cheque. He really put his job on the line."

Once Ranetkins had his foot in the door at National Geographic, word got around, and almost everybody who was anybody in the underwater film business wanted to talk to him.

"These days, customers are mostly people like underwater photographer Tom Campbell, Air Sea Land Productions, Eyewitness in the UK and other companies that rent the equipment to individuals and companies," says Ranetkins. "They're almost all professionals, although occasionally we sell to wealthy or very keen amateurs, as well as non-profit organizations like the Cousteau Society and the Boston Aquarium. Of course, we also do a lot of business with Hollywood and with rental companies serving Hollywood."

Making a Movie Star

According to Ted Overton, affiliate of the Canadian Society of Cinematographers, writing in the June 2002 issue of the society's monthly publication, Amphibico Inc. manufactures "what are probably the most sophisticated underwater (camera) housings in the world of video." And, although Amphibico produces housings for most consumer and 'prosumer' (high-end, sophisticated consumer) type video cameras, Overton claims that the jewel in the company's crown is the all-new AMPHIBICAM® camera housing, designed and built specifically for the Sony HDW-F900 high-definition digital video camera.

Santa Barbara-based photographer Tom Campbell is shown above and below the sea with the AMPHIBICAM® underwater HD video housing.

To see more of Tom's work, please visit his website: http://www.tomcampbell.com

Tom Campbell's Film & Video Productions
805-965-4951

For Ranetkins, it all started with a passion and (the never-to-be underestimated, all-important) contacts, two things you can never have too much of when starting a venture.

Ranetkins designed the new housing specifically to meet the demanding criteria of high-definition (HD) video; in particular, to allow the operator unlimited access to all of the functions offered by the very sophisticated camera "right at your fingertips, as if you were hands-on with the camera itself." Such comprehensive control from an underwater camera housing has never been achieved before. Using the AMPHIBICAM®, the operator can select and adjust all of the camera settings to best suit the underwater light and environment, whilst submerged.

"This project has been the most ambitious ever undertaken by Amphibico," says Ranetkins. "As well as taking up all of my time, it's also been a major commitment for our team of electronics and optical engineers, as well as our mechanical design and production engineers. The result is one of the most technologically and optically innovative housings ever conceived in the videography industry. We've had praise from some highly respected authorities."

The AMPHIBICAM® housing is designed to be as compact and as easy to use as possible, vital when most of its working life will be in such difficult and potentially dangerous environments. In fact, its design is both technologically clever and innovative; on land it weighs a hefty 72 lb, but in salt water it has neutral buoyancy, so that a diver can control it with just one hand.

Such comprehensive control from an underwater camera housing has never been achieved before. Using the AMPHIBICAM®, the operator can select and adjust all of the camera settings to best suit the underwater light and environment, whilst submerged.

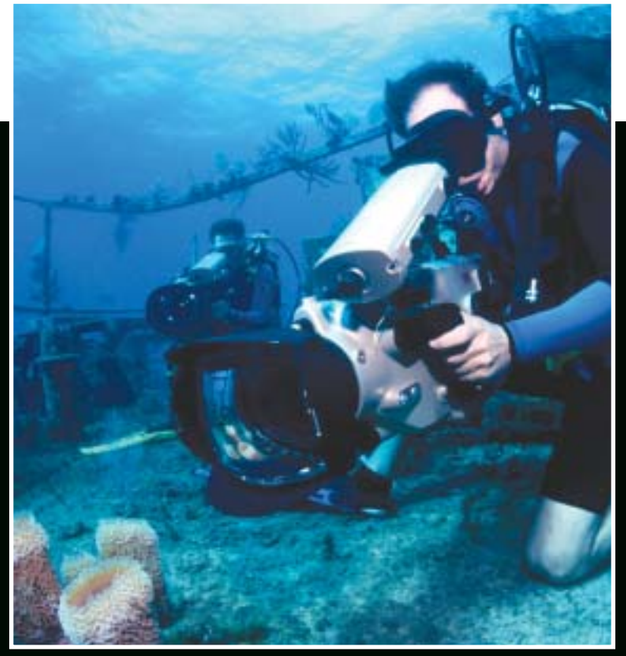
Underwater videographers at work in Nassau, Bahamas, with the AMPHIBICAM® underwater HD video housing.

Air Sea Land Productions Inc.
888-ASL-LENS or online at http://www.airsealand.com

Streaming video of this and other productions may be viewed online at:

http://24fpsProductions.com/24fps/
24fps Productions
646-638-0659

Contact info:
Amphibico Inc.
514-333-8666 or online at http://www.amphibico.com

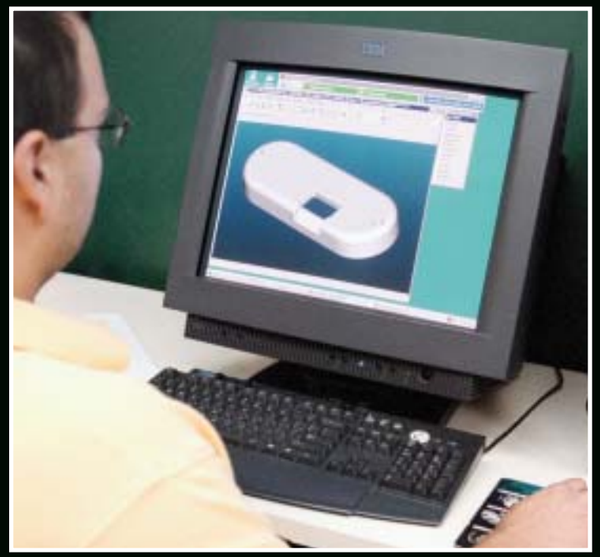


The company developed the initial housing design using Pro-engineer," says Ranetkins. "We started by scanning the Sony camera to get all of the dimensions, and then we looked at the required specification for the system and what that specification would be likely to cost. Once we were happy, we started building the design on the CAD system and machining prototype parts on our Haas VF-3 vertical machining centre."

Ranetkins claims that the company's investment in new technology played an important part in developing the new product. "Before we bought the Haas VF-3," continues Ranetkins, "we did most of the machining of our products on a variety of different manual and CNC machines in our on-site shop. On this occasion, we wanted to invest in something exclusively for the R&D department: Something particularly accurate to work with, and something suitable for the development of the new product. We bought the machine through the Montreal Haas Factory Outlet (a division of Sirco Machinery)," he says. "They were extremely helpful. They allowed us to go and see a variety of Haas users in the Montreal area to see how they were getting on with their machines.

"Although the Haas is still used mostly for R&D," he says, "in the case of the new housing, it's used to machine all of the 120 milled parts. The other 80 components that go to make up a finished housing are lathe parts. Looking at the AMPHIBICAM®, it's hard to believe that there are that many components, but it's really quite complex."

The main aluminium extrusion that constitutes the housing body is the largest component to be machined on the Haas. In this case, the complete manufacturing process is made up of three operations: The first two use the VF-3 working in three axes, whilst the third and final includes the use of a fourth axis, thanks to a Haas HRT 310 rotary table mounted on the machine's table.



Needless to say, this kind of technology doesn t come cheap, but Ranetkins knows his market and has positioned the company and its products to appeal to those with the highest professional standards and aspirations.

We cut each housing length with a band saw and calibrate it prior to machining," says machine operator and production engineer Freddy Espinoza. "For the first operation the component is located in a special custom fixture, so that the top surface is presented to the machine spindle. This surface, the seal surface, is machined at close tolerance, a critical operation to ensure the performance of the camera housing at extreme ocean depth pressures. The first operation also includes drilling and tapping various location holes."

The second operation is similar to the first. The part is held in another specially designed fixture to allow the underside seal surface to be machined to a high tolerance.

Finally, the housing is mounted to the 4th-axis rotary table and is presented to the spindle in various planes for detailed machining of multiple features on the part surface. Cutting operations include fly cutting, spot drilling,

normal drilling, tapping, finish machining and dovetailing. Again, Amphibico is keen to point out that, to maintain the reliability of the product under extreme conditions, all processes require tight tolerance repeatability. For exactly the same reason, inspections are performed after each operation to ensure accuracy, flatness and continuity in the component.

Again, Amphibico is keen to point out that, to maintain the reliability of the product under extreme conditions, all processes require tight tolerance repeatability.

All Singing, All Dancing

Aside from its build quality, the other factors that make the AMPHIBICAM® truly special are its optics and electronics. For a start, the aspheric and binary lenses virtually eliminate refraction in water, meaning that a shot scanning from underwater to above water (or vice versa) won't lose focus or distort.

In the case of operator control, Amphibico had to work closely with camera manufacturer Sony to ensure that all of the camera's advanced features were available on the housing. Where many housings are primarily mechanical, the AMPHIBICAM® uses electronic connections with the camera's systems to ensure faultless communication.

"We eventually collaborated with Sony to develop the protocol allowing our housing to interact with that of the camera," says Ranetkins. "Initially, we'd already done quite a lot of work, but we were having problems. With some gentle persuasion, Sony eventually agreed to work with us to help solve some of those problems. We signed a confidentiality agreement and they sent us 300 pages of control protocol! This was perhaps our second-biggest breakthrough in the development of the product, after developing the optics. Now, all of the fine controls and menu options normally accessible on the camera can be controlled outside of the housing."

Needless to say, this kind of technology doesn't come cheap, but Ranetkins knows his market and has positioned the company and its products to appeal to those with the highest professional standards and aspirations.

"Our housings for high-definition digital cameras cost up to around (US) $60,000, and, when you think that the camera and lens for this kind of housing might cost (US) $150,000, you can see that the whole system can easily run to almost a quarter million dollars. This is a major investment, but it's the kind of investment you have to make if you want to be a serious naturalist videographer. For the good ones, it can also be quite a lucrative profession, but there aren't many good ones out there."

Quite what the Captain would have made of all this is anyone's guess. Suffice it to speculate that if it helps to further the public's love, understanding and respect of the world's oceans, he would have approved for sure.

Overcoming the power Shortage

Story & Photos Scott Weersing

The recent collapse of energy giant Enron has given the power industry a black eye. Despite this, behind the scenes, companies such as DuHadaway Tool and Die Shop, Inc., of Newark, Delaware, continue providing support for those working to overcome the ongoing electricity shortage.

For more than 12 years, DuHadaway has manufactured components for power generation units, and their future looks bright. As new power plants are built to quench the public's insatiable thirst for electricity, the company continues to thrive and prosper.

DuHadaway Tool and Die was founded in 1957 by Robert DuHadaway with just seven people. Today, the company has 120 employees working in three different buildings totaling 85,000 square feet. As the name implies, DuHadaway began as a tool & die shop, mainly producing dies for the automotive wheel industry and parts for the oil industry. But the ups and downs of these industries led DuHadaway to look for a more stable market. The power generation industry was the answer.

Most of the electricity used by homes and businesses today is produced by steam turbines: Water is heated to produce steam, which in turn drives the turbine to generate electricity. When additional electricity must be produced quickly to meet peak demand, however, power companies often fire up fuel-powered combustion turbines. These turbines work much like jet engines. Air is heated by burning fuel, such as natural gas or oil. As the temperature increases, the air builds up pressure. This super-hot, high-pressure air is forced into the turbine section, where it expands and applies pressure across the blades, causing the turbine to rotate and produce electricity.

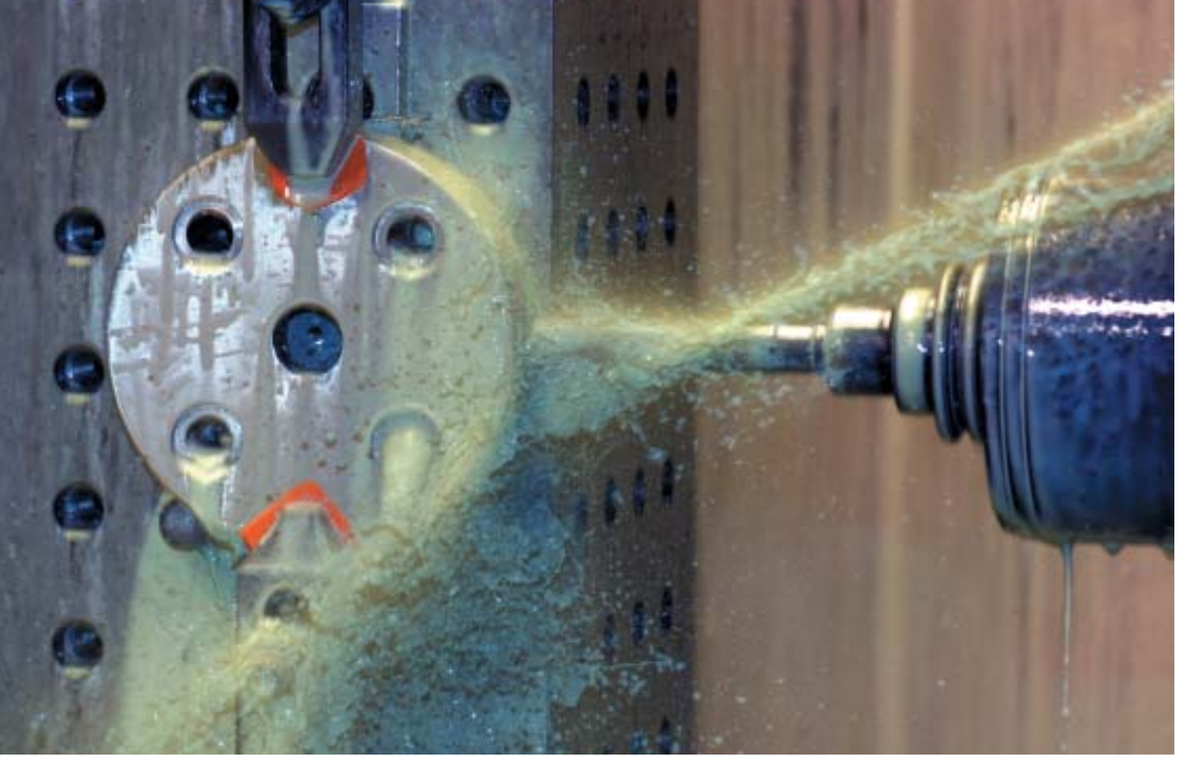
This simple process has been golden for DuHadaway, as they manufacture components for a variety of combustion turbines. John O'Donnell, the company's VP and general manager, explains: "With the growing need for electricity in the U.S. and abroad, most of the turbine manufacturers, such as Siemens Westinghouse, have increased their production of turbines for delivery to the power companies. In the past, they were building 12 to 18 turbines a year; now they're probably building 40 to 65 turbines a year, if not more."

DuHadaway Tool and Die Shop has an armory of Haas vertical and horizontal machining centers to manufacture components for power generation units – specifically, fuel nozzles for combustion turbines.

One of the key components of a combustion turbine is the fuel nozzle, which controls the flow of fuel into the combustion chamber. Each nozzle consists of a fuel cap and several – 8 or 12 – gas tips. The increased production of combustion turbines has led to a corresponding increase in demand for these components. To keep up with the demand, DuHadaway had to find a way to increase their production of gas tips and fuel nozzles.

"The way it was set up before, we had to manually index the gas tip for machining," says O'Donnell. "We had to mill it across the top four times, then we had to use a separate fixture to set it at 30 degrees, and then mill it one slot at a time. We are now able to turn the gas tip around with our rotary tables and position it, index it and mill the eight slots."

DuHadaway machines the gas tips out of 310 stainless steel using a Haas VF-2 vertical machining center with an



HRT 210 rotary table. “After the eight slots are milled, the inside of the gas tip is then milled in the same type of setup. The internal part is at a 30-degree angle, and we can counterbore to depth, then drill and ream the gas ports – holding a five tenths (0.0005") tolerance – after which a small radius is formed for flow. All four of these operations can be performed in one setup,” O’Donnell reports. “The piece would have taken us about 60 minutes to produce before, but now we can make it in 15 minutes with the rotary table.

“The Haas 4th- and 5th-axis rotary tables also make a big difference for us in the manufacture of fuel caps,” O’Donnell continues. “Traditionally, we had to rotate many of the parts manually. Now we can write the program to do all 8 holes or 12 holes in one setup. It will counterbore, drill, ream and then form the radius for the gas ports.”

The finished gas tips and fuel caps are fabricated into fuel nozzles, and the entire nozzle goes into the combustion chamber of a turbine. DuHadaway tests the nozzles with a water / air mixture to ensure that flow rates are correct. The consistent test results are proof of “the great accuracy and repeatability we get with the Haas machines and indexers,” says O’Donnell.

DuHadaway acquired its first Haas vertical machining center in 1995, and has added 11 more Haas machines since then. Besides the VF-2 used for the gas tips, the company has recently added six horizontal machining centers to mill other parts from stainless steel, Hastelloy ‘X’, and Inconel 625. One part that keeps the HMCs busy is a circular base of 304 stainless steel, in which holes are milled to attach the nozzles and gas tips. “We saw the demand increasing for power generation parts,” says O’Donnell. “We just turned around at that point and stepped up our production. The only way we could do that, obviously, was to add more equipment.”

The choice for new equipment was an easy one. After the success of the first Haas machine, the company kept adding more machines to keep up with production. The key was the ability of Haas to deliver machines that would start cutting immediately. “Having reliable machines means a lot in a production environment like this,” O’Donnell explains. “That’s the difference between making a job or eventually losing a customer.

“Once a Haas machine is set up, we don’t have any problems with it. That’s something you look for in this age when you talk about quality, whether you’re talking about buying an automobile or anything,” O’Donnell adds. “You want to be able to take it home, plug it in and it works. And then you live happily ever after. Years ago that wasn’t the case with most machine tools.”

The Haas line of machining centers has helped the company keep up with demand and keep customers happy. “From our manufacturing standpoint, we have reduced the number of setups, and that’s a big cost savings,” explains Bob DuHadaway, president and son of the founder. “The Haas machines give us greater ability to increase our workload. The uptime – being able to run the machine – has been great.”

While other companies have seen business fluctuate, DuHadaway has continued to prosper, with steady work on power generation components. “Our business has been pretty constant, because not only are we involved in new manufacturing, we are also refurbishing components,” says DuHadaway.

With peak generators sometimes running 24 hours a day to keep up with demand, DuHadaway is looking to the future when repairs will start coming in. Power generation components are subjected to severe temperatures, but instead of being replaced with new parts, they can be effectively overhauled. “Fifteen percent of our work is repair. But we are going to see that change in the next couple of years as parts wear out,” DuHadaway says. ”We’re busy right now with the new production, but we’re also seeing an influx of parts coming back for repairs.”

While the energy crisis may have negatively affected some organizations in the power industry, DuHadaway’s use of Haas equipment has enabled them to thrive. Recognizing the changing needs of their customers, the company successfully modified their processes and enhanced their equipment in order to build quality power generation components in a timely, cost-effective manner.

Chips Ahoy!

Christopher Land isn't your average CNC machining instructor. Six years ago, when he landed the job he has now, "I really didn't know what an endmill was," he admits. To be fair, though, the job he applied for wasn't that of CNC machining instructor – he was hired to teach engineering at Sussex County Technical School, a public high school in Sparta, New Jersey.

Story
Linda
Dorr

Photos
Barbara
Simmons

His route to teaching was rather circuitous, too. After college, he spent five years in the Navy as a submariner. He then worked as an environmental engineer for a few years. But, "I'd always wanted to teach," he says, "so I interviewed when this job opportunity came up. They had a full-size CNC mill and a lathe that hadn't even been used. I'm pretty good with computers, and I had a real strong mechanical engineering background from the Navy, so I knew I could figure it out."

In addition to figuring out the machines, Chris got some formal CNC training, and also some help from EBI Medical Systems, a local manufacturing firm. The company's CNC manager contacted Sussex Tech, looking for student interns. EBI was very happy with the engineering students Mr. Land sent their way, and shortly donated a Haas VF-2 with a 4th axis to the Sussex Tech machine shop.

It became clear quite quickly that the best way to teach engineering to high-school students was to introduce them to "the fun stuff" – hands-on manufacturing – right off the bat. "I can tell you what *not* to do," Chris laughs. "Don't take 12 kids into the shop and have them stand around the machine while you do something. It doesn't work!"

The safety rules come first, followed by a tour of the machine shop and some work with the manual machines. Once students begin working on projects, "you take each team over to get some experience on the CNC machines." Once they have enough experience, students do their own setups. "They're under my supervision the whole time, but I don't have to watch the entire process. I do have to inspect it before they run the program."

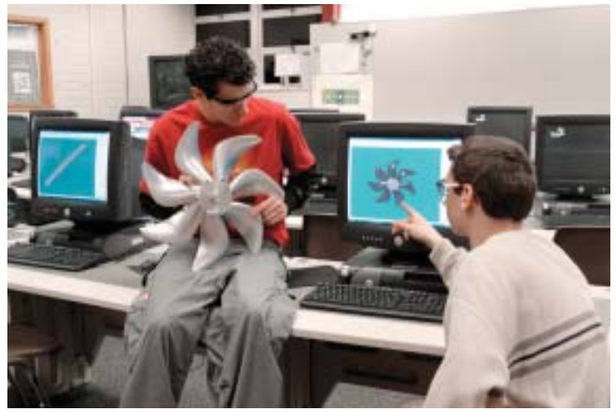
Once a class is past the introductory stage, Sussex Tech students don't often see Mr. Land lecturing in front of the blackboard. Instead, project teams meet with him to review their work and get his input. "I don't teach the kind of class where I tell them what to do every step of the way – they have to think."

Students who want a really intensive engineering experience apply to the Engineering Academy program, now in its 5th year. That curriculum has the usual complement of humanities classes – literature, history and so forth – but when students are accepted into the Sussex Tech Engineering Academy, they're electing to take a lot more math and science than the average high-schooler. "To the greatest extent possible, we emulate real-world engineering," notes Chris. "I'm

Instructor Chris Land with students from his Engineering Academy class. As a class project, the students are building a human-powered submarine. They hope to enter it in a competition that includes both a design portion and a race.

the senior engineer or group leader, and the students become project engineers." Students choose their own projects, and each team puts together a proposal. Then there's a research paper to do, followed by design, manufacture and testing of the product. A multi-media presentation completes the project.

Six years ago, there were 10 students enrolled in the Sussex Tech engineering program – all boys. These days, there are 36 students enrolled, and roughly a quarter of them are girls. Chris says he doesn't have to do any advertising; the engineering program is steadily growing because "the kids go out and recruit. It's just word of mouth, and I think it's because they have *fun* in here."



Senior engineering projects cover a wide range of ideas, and student teams often write proposals for grant money to cover the cost of their materials. This year, two different teams of girls won a Young Science Achievers grant, to the tune of $400 each. One team is designing and manufacturing a gadget that will fit over a key to help elderly or disabled people turn the key in a lock. The girls on the second team, both competitive swimmers, are designing a training device to help teach competitive swim strokes. Still another team is prototyping a ski pole holder for ski lifts. "They machined the [EDM] electrode on the VF-2, and right now we're burning the molds," says Chris.

Students in this year's senior Academy class are all working together on a class project. They hope to enter their human-powered submarine in a competition that includes both a design portion and a race. "This project will stretch the limits of our engineering abilities," says Chris, "and the project team will be gaining insight into so many aspects of engineering. What they learn from this they'll use for years. And not just the engineering and manufacturing – it's also really good for teamwork and project management skills."

Ray Mount, CNC manager at EBI, is downright effusive about Chris Land's students. In addition to part-time interns, EBI currently has seven full-time machinists who are Sussex Tech grads. "They're unbelievable – every single one Chris has sent over has been phenomenal. Their skills are good, they're conscientious – they call if they're going to be ten minutes late! I haven't hired anyone from outside [of Sussex Tech] for four years."

Sussex Tech won their state's SkillsUSA-VICA Automated Manufacturing contest last year, and came in 15th in the nationals. "These kids already think about how to make things," Chris says. "I see it every day; they'll look at each other's designs and say, 'Well, it looks cool, but how are you going to make that?' Or, 'How are you going to hold that part?' That's a pretty advanced skill, and that's why I emphasize the manufacturing side of it so much. They learn physics and geometry while they're figuring out how to make their parts. . . . I'm big on this manufacturing thing, and I think more people should be doing it."

The consensus in the machine tool industry is that high-school students need more exposure to the high-tech world of CNC – and a lot more teachers like Chris Land. Thanks to programs like those at Sussex Tech, more people are doing the manufacturing thing, to the benefit of us all.

For more info, see www.sussex.tec.nj.us/eng

New Machines steal the show at WESTEC

A new low-cost bar feed system designed for the Mini Lathe and SL-10

Affordable automation for small Haas lathes is now available. The new Haas Bar-100 bar feeder is a low-cost pneumatic bar feed system designed specifically for the Haas Mini Lathe and SL-10 turning centers. It handles stock up to 1" diameter, and provides fully automatic loading of single bars up to 6' long using an air-driven push rod. With the push rod removed, bars up to 12' long can be loaded for manual feeding using a bar puller (not included; additional liner components required).

The Bar-100 includes a draw tube liner that handles bar stock from 0.125" to 1" diameter. A convenient tray underneath the feed tube provides storage for multiple bars and has a built-in scale for measuring bar length. A three-point leveling system makes setup fast and easy.

Bar-100 Capacities
Standard Bar Capacity: 0.125" to 1"
Automatic Operation: up to 6' bar
Manual Operation: up to 12' bar

EC-1600

The EC-1600 is a 50-taper HMC with travels of 64" x 40" x 32" (xyz) and a 64" x 28" table. It comes standard with a 7,500-rpm spindle, a 30-hp vector drive system and a 30-pocket side-mount tool changer.

EC-400

The EC-400 is a 40-taper, twin-pallet HMC with 400 mm pallets, a 20" x 20" x 20" work cube and a built-in high-accuracy rotary indexer (1-degree indexing ±3 arc-sec). It features an 8,000-rpm, inline direct-drive spindle powered by a 20-hp vector drive system, and a 24-pocket side-mount tool changer is standard.

The Mini HMC is a compact horizontal with a 15" x 15" x 10" (xyz) work cube, twin pallet changer and built-in 4th axis. It features an 8,000-rpm, inline direct-drive 40-taper spindle that is powered by a 20-hp vector drive system. An optional 12,000-rpm spindle with 30-hp vector drive system is also available.

The Mini HMC's twin pallet changer (300 mm pallets) allows the operator to load and unload parts on one pallet while the machine mills parts on the other. A servo-driven changer swaps pallets in approximately 2 seconds, and the integrated 4th axis provides precise positioning for multi-sided parts and tombstones.

Travels	15" x 15" x 10" (xyz) (381 x 381 x 254 mm)
Pallet Capacity	200 lb each (91 kg)
Pallet Change Time	2 sec
Spindle Speed	8,000 rpm (12,000 optional)
Drive System	Inline Direct Drive
Spindle Max Rating	20 hp (14.9 kW)
Max Rapids	1,200 ipm (30.5 m/min)
Tool Capacity	24+1
Tool Type/Taper	CT 40
Tool Change Time	2.8 sec tool to tool

The new Haas TL-1 Toolroom Lathe

combines the simplicity of a manual lathe with the power and flexibility of the easy-to-use Haas control, in an affordable machine that is fast and easy to use.

This prototype Toolroom Lathe features a 7.5-hp (peak) vector drive spindle that spins to 2,000 rpm and provides 27 ft-lb of torque at 1,500 rpm. It comes standard with a manual 5C collet chuck with a bar capacity of 1.06". Maximum cutting diameter for the TL-1 is 16", with a maximum cutting length of 30". A manual tailstock provides 30" of travel. Brushless servo motors provide precise positioning, and a one-piece cast-iron base damps vibration and provides rigidity for heavy cuts. The machine runs on either single- or three-phase power.

TL-1 Toolroom Mill Swing Diameter	
Over Front Apron	25.5" (648 mm)
Over Cross Slide	8.8" (224 mm)
Capacities	
Chuck Size	Manual 5C collet
Standard Bar Capacity	1.06" (27 mm)
Between Centers	30" (762 mm)
Max Cutting Diameter	16" (406 mm)
Max Cutting Length	30" (762 mm)
Spindle	
Max Speed	2,000 rpm
Torque	27 ft-lb @ 1,500 rpm (37 Nm)
Peak Power	7.5 hp (5.6 kW)
Spindle Nose	A2-5
Spindle Bore	ø2.31" (58.7 mm)
Tailstock	
Taper	MT3
Travel	30" (762 mm)
Thrust	Manual Quill
Travels & Feedrates	
X Axis	8" (203 mm)
X-Axis Thrust	2,000 lb (8 896 N)
Z Axis	30" (762 mm)
Z-Axis Thrust	700 lb (3 114 N)
Rapids	300 ipm (7.62 m/min)
Miscellaneous	
Weight	4,000 lb (1 814 kg)
Power Requirement	240V single-phase @ 40 A 208V three-phase @ 25 A
No bar feed provision	

June 11, 2003
Demo Day 4

Contact your local Haas Factory Outlet for details.

Find out more online:

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

www.HaasCNC.com

The Haas Mill Drill Center

provides high-speed drilling and tapping, as well as full milling capabilities, in a compact, affordable package. Dual fixture stations allow the operator to load and unload parts on one fixture while the machine mills, drills and taps parts on the other. A servo-powered, gear-driven changer swaps the fixture stations in less than 1.9 seconds.

The Mill Drill Center provides a generous work cube of 12" x 10" x 12" (xyz) and features a 10,000-rpm (15,000-rpm optional) 40-taper spindle with a 15-hp vector drive system. Ultra-fast ballscrews and high-torque servos provide rapids to 2,000 ipm and accelerations to 0.8 g, and a high-speed side-mount tool changer (24+1 tools) changes tools in just 2.8 seconds.

Travels	12" x 10" x 12" (xyz) (305 x 254 x 305 mm)
Load Station Capacity	250 lb each (113 kg)
Station Change Time	1.9 sec
Spindle Speed	10,000 rpm (15K optional)
Drive System	Direct Speed, Belt Drive
Spindle Max Rating	15 hp (11.2 kW)
Max Rapids	2,000 ipm (51 m/min)
Tool Capacity	24+1
Tool Type/Taper	CT 40
Tool Change Time	2.8 sec tool to tool

Dear Applications:

On my SL-20 lathe, I have used the jog handle to control feedrate overrides, but I would like to control dry run feedrates too. It would make this machine a lot easier and safer to dry run, especially when tooling is close to the chuck. How can I do this?

Richard Beever

Dear Richard:

The Graphics mode is the safest way to check a programmed tool path. You could also try using the handle feed override while in Memory mode; this is useful when setting up a job where the tool comes close to the chuck (within a couple thou'). Single-block through the program and override the feed to a stop if you want, then check your "distance to go" on the Current Commands page. You can feed hold and stop the spindle to make sure the distance to go doesn't exceed the gap between the tool and the chuck jaws. This method is better than using Dry Run, because you can slow the feed down to 1% (or 0%) and react quicker if it looks like the tool will cut into the face of the jaws. To review:

1) Run the program in Graphics to check the tool path.

2) Run the program in Memory, with rapid override at 5%, and use the jog handle for feedrate override. Use the "distance to go" display on the Current Commands page to compare tool position relative to the workpiece (the spindle may be stopped at any time to check the gap).

3) This is also a good time to make sure other tools and index points clear the workpiece, chuck and tailstock.

Another alternative is to turn on Setting 103, so that the Cycle Start and Feed Hold functions are both controlled by the CYCLE START button. Hold the button in and the program runs; release it and the machine stops in a feed hold. This is a very useful setting, but remember to turn it off when you're through using it.

Sincerely,
Haas Applications

• • •

Dear Applications:

Is it possible to cut multiple start threads on an SL-30? If so, how?

Carter Marcy

Dear Carter:

Yes, you can cut multiple start threads on an SL-30 – and on every other Haas lathe. Just change the start point of each threading cycle. For example, to cut a two-start 1"-8 thread:

```
G00 X1.2 Z0.5          (1st thread Z start)
G76 X0.8446 Z-1.25 K0.071 D0.022 F0.250
G00 X1.2 W0.125        (2nd thread Z start)
G76 X0.8446 Z-1.25 K0.071 D0.022 F0.250
(Note:  0.250" lead ÷ 2 starts = 0.125"
Z shift from original start point)
```

Here's something else to think about: Watch your feedrate! (MMSonline.com says it so well, we're quoting them almost verbatim.) While the machine's maximum feedrate is more than adequate for most machining applications, occasionally it can be a limiting factor. When threading on a turning center, for example, it is possible to unwittingly exceed the maximum feedrate. Say a turning center has a max feedrate of 300 ipm (with 600 ipm rapids). If you're machining fine threads in large diameters, you are not likely to exceed the max feedrate. A 3.0"-16 thread machined at 300 sfm, for example, would require a feedrate of 23.88 (3.82 x 300 [sfm] ÷ 3.0 [dia] x 0.0625 [pitch]). This relatively slow feedrate is allowable on all current CNC turning centers. On the other hand, when machining coarse threads at high speeds, you do need to worry about maximum feedrate. And multiple-start threads present the most problems, since the lead of the thread (not the crest-to-crest pitch) determines the feedrate. Say you're machining a four-start 1.25"-4 thread having a lead of 1" (0.25" crest to crest) at 600 sfm. Now, the required feedrate becomes 1,833.6 ipm (3.82 x 600 [sfm] ÷ 1.25 [diameter] x 1.0 [lead]). This exceeds the capabilities of even the fastest CNC turning centers.

Sincerely,
Haas Applications

• • •

Dear Applications:

I have been going through the programming examples for our new TL-15 twin-spindle lathe. Each process has a B-2.0 command. Where does this number come from? Will it be a constant in any program involving the sub-spindle?

Gerry Bennett

Dear Gerry:

The B-2.0 in the program examples is to position the sub-spindle (the B axis). The B command or "address" is where the sub-spindle will be when you set offsets for the second operation on the workpiece. Part size is what dictates the B-axis starting point, so this number will be a constant in programs for similar-size parts, where you want to start the sub-spindle work at the same point every time. If B were set to 0 in the program, all of the second-op machining would be done at the far end of the machine. Moving the second-op starting point closer to the main spindle (2 inches closer in this example) reduces cycle time by reducing the distance the turret has to move.

Sincerely,
Haas Applications

Dear Applications:

I'm wondering if there's a faster way to do tool changes on my Haas VF-2. Here's the sequence I'm using:

```
M05
M09
G91 G28 G00 Z0.0 M19
M06
```

Is this the best way to do it?

Brian Sandstrom

Dear Brian:

Actually, all you have to do is program an M06, and the Haas control will take care of everything else. When the Haas CNC reads "M06," it will:

1) retract the Z axis to the tool change position;
2) stop the spindle;
3) orient the spindle;
4) turn off the coolant; and
5) change the tool

Presto change-o! It's not quite magic, but it is faster.

TIP: For super-fast tool changes on a VF-2, check out the new Haas VF-2SS, a high-speed machine with a tool-to-tool change time of 1.6 seconds, a 12,000-rpm spindle and 1400-ipm rapids.
See www.haascnc.com/news/new_machines.asp for details.

Sincerely,
Haas Applications

• • •

Dear Applications:

When dealing with arc moves while cutting circles, is there a minimum straight line move required to have cutter compensation work?

Dan Kafun

Dear Dan:

The short answer is "yes." Cutter compensation can only be turned on and off in G00 (rapid) or G01 (linear) mode. After you've turned it on and before you start cutting, you must make a linear move that is the same or greater than the radial compensation value in your offset. If your radial cutter comp is set at 0.5", for instance (for a 1" diameter tool), then you must make a linear cut of at least that length before you start cutting. Here's how the program would look:

```
T01 M06
G54 G00 X3.6 Y0.0 S500 M03      (X = 3.6)
G43 Z1. H01
G01 Z-0.25 F50.0
G01 G41 X3.0 D01 F10.0   (X = 3.0, a move of 0.6,
                          allowing cutter comp
                          of 0.5 to be established)
Y-1.0
G01 G40 X3.6
G91 G28 Z0
M30
```

Sincerely,
Haas Applications

• • •

Dear Applications:

I have a VF-3 with a 4th axis (an HRT model). I want to rotate the A axis 1,088 degrees, while feeding the Z axis -0.50" and the X axis 0.25" for each 360 degrees of A-axis movement. Can you help me program this?

Dave Coffey

Dear Dave:

Here's how it works:

```
1088 ÷ 360 = 3.0222
0.5 x 3.0222 = 1.5111
          (distance move in Z = -1.5111)
0.25 x 3.0222 = 0.7556
          (distance move in X = 0.7556)
```

So you would write the program as follows:

```
G01 X0.7556 Z-1.5111 A1088.0 F20.0
```

although the feedrate, of course, will depend on the diameter of the part (Setting 34), the material you're cutting and the tool(s) you're using.

Sincerely,
Haas Applications

Haas 40 x 20.

The American Workhorse.

The Haas 40" x 20" x 25" VF-3.

IN THE TRADITION OF PROVIDING UNCOMMON CAPABILITY AT COMMON-SENSE PRICING, THE HAAS VF-3 VMC OFFERS FAST MATERIAL PROCESSING WITH A TIME-PROVEN PLATFORM AND AN AFFORDABLE PRICE.

HAAS – HIGH TECHNOLOGY THAT'S A REAL VALUE.

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