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The Wright Stuff

Back in the mid 1890s, two brothers – the owners of a bicycle manufacturing and repair business in Dayton, Ohio – developed a fascination with the science of aeronautics. In particular, they were interested in the concept of heavier-than-air powered flight. Working after hours, they voraciously studied the best available information of the day, applying their mathematical and mechanical skills to the analysis of these earlier works. By 1899, they were building kites and gliders to test their theories.

The brothers soon directed their efforts toward building a glider that could carry a man, but realized they'd need a more practical site – one with wide-open space and steady winds – if they were to continue their research. The brothers considered numerous sites before settling on an area of North Carolina's Outer Banks called Kitty Hawk.

On October 20, 1900, Orville and Wilbur Wright made their first successful manned glide from an area south of Kitty Hawk called Kill Devil Hills. Between 1900 and 1903, they returned to Kitty Hawk often to test new designs. By the end of 1902, they had completed more than 700 separate glides, including one that lasted more than 26 seconds and reached a distance of 622.5 feet.

During the winter of 1902 and spring of 1903, Orville and Wilbur Wright turned their efforts toward attaining their ultimate goal: powered flight. By the summer of 1903, their engine-powered aircraft, dubbed the *Flyer*, was ready for testing; they packed up their flying machine and headed back to Kitty Hawk.

On December 17, the Wright *Flyer* slowly moved down a 60-foot wooden launching track under its own power, and lifted off at an air speed of 30 miles per hour. The *Flyer* reached an altitude of 10 feet and traveled about 120 feet before dropping back to Earth 12 seconds later. It was the world's first successful sustained powered flight in a heavier-than-air machine. Three more flights followed, each better than the last. At noon, Wilbur made the fourth and final flight of the day, traveling a full 852 feet.

The world was changed forever that day. The Wright brothers' innovation and determination gave us not only flight, but the promise of higher possibilities and greater dreams. Today, more than ever, we need that kind of innovation and determination. In this issue of *CNC Machining*, we'll introduce you to a few companies that are using the Wright stuff.

For our cover story this issue, we sent our roving reporter Matt Bailey to New Zealand, where he discovered a Kittyhawk of a different sort: a Curtiss P-40N-1 Kittyhawk fighter plane. Found disassembled and abandoned in the South Pacific, it was shipped to New Zealand, where it eventually landed in the hands of one Garth Hogan. Determined to bring the plane back to life, Hogan formed his own company, Pioneer Aero Restorations, to resurrect the P-40. He enlisted the aid of Eric Paton Ltd, a nearby engineering workshop, for the precision machining work.

Back in the States, we visited two distinctly different shops, on opposite sides of the country, that are using two completely different approaches to achieve the same thing: survival. General Pattern of Blaine, Minnesota, is a rapid tooling and prototyping company whose motto is "change or die." They continually reinvent themselves – investing in new equipment, changing processes and even changing the work environment – in order to remain globally competitive.

On the other side of the U.S., Crown Valley Precision of Baldwin Park, California, is staying competitive by changing the way they do business. They've thrown out the old model of telling customers what a minimum order will be, and adopted the new model of giving customers what they want, when they need it. To streamline their processes and handle just-in-time deliveries, the company has switched to a system of machining cells.

For another approach to cutting costs and boosting production, we hit up our friends at FANUC Robotics for some info about industrial robots. In this informative piece, you'll discover how even small shops can benefit from robotic automation.

Cutting costs and boosting production are nothing new at Haas Automation – it's something the company does every day. We'll take you inside for a glimpse at how Haas is able to manufacture high-quality products and sell them at such affordable prices. In this first installment about common components, you'll see why inexpensive doesn't always mean cheap.

And, be sure to check out our education piece for a look at the BattleBots the students at Cuyahoga Valley Career Center are building. There's also the Race Report, for the latest news about Haas-sponsored race teams, and the Answer Man, for applications solutions and more.

As always, there's more. So sit back, relax and enjoy!

IN THIS ISSUE

ON THE COVER

This Curtiss P-40E "Kittyhawk" was brought back to life by New Zealand-based Pioneer Aero Restorations, with precision machining assistance from Eric Paton Ltd. The stunning photograph was taken by San Francisco-based photographer Philip Makana. For a look at more of his work, check out www.ghosts.com.

Photo: © Philip Makana / GHOSTS

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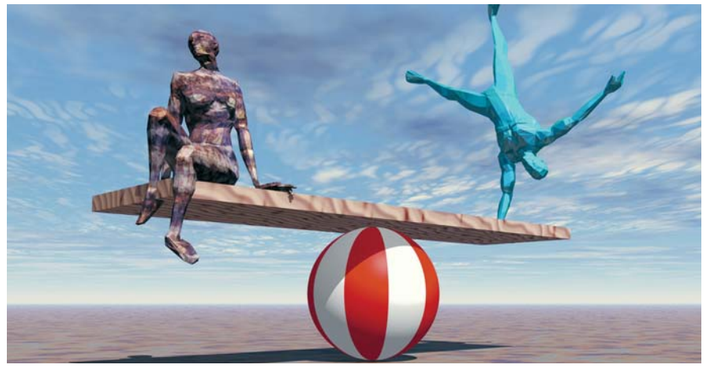
by Denis Dupuis

Trade, Jobs and Déjà Vu



As we continuously hear about all of our jobs moving to China, I get a sense of déjà vu. It was some 25 years ago that the newspapers were filled with stories touting the demise of the U.S. manufacturing sector, and saying that all of our jobs were being sent to Japan. The argument was that nothing was being made here anymore, and that our economy was therefore doomed. Remember Jimmy Carter and the double-digit interest rates and inflation? No longer were televisions or computer printers – along with a whole host of other products – made in America. People from those industries were displaced by the millions, and no end was in sight. Washington was deluged by trade associations clamoring for government protection for all of the industries affected by the movement of manufacturing to Japan, Inc.

During the 1980s, the manufacturing sector regained some of its prowess, and companies began to re-evaluate the way they were working and launch improvement programs. While some would say the recovery in the '80s was due to the Cold War arms build-up, fueled by Reagan's supply-side economics and huge deficit spending, the fact is, the manufacturing sector regained its strength. Factories became more efficient by upgrading their equipment and reorganizing their processes. New inventions were created to replace the parts or products that had been lost to overseas manufacturers. The manufacturing sector grew slowly but steadily – more than regaining its losses of the previous decade.

Except for the burst of the real estate bubble in the early '90s – due in large part to excesses created by the Savings and Loan debacle – the manufacturing sector flourished. It responded to the new technology by embracing it: by producing what needed to be produced. By the end of the '90s, U.S. manufacturing had experienced the longest and strongest growth period in the history of the nation. Millions of new jobs were created – not manufacturing the same products as two decades previous, but manufacturing the new, high-tech products that continue to improve productivity and enrich our lives today.

This productivity run-up, of course, overheated the economy. The tech sector became over-subscribed in the stock markets, creating a bubble which – much like that of the real estate industry in the early '90s – eventually burst, as all bubbles do.

Today, as in past recessions, millions of people are unemployed, and it appears that the manufacturing jobs that have been lost will not return. For a number of reasons this may be true – at least for the exact same jobs. The equipment being designed today is much more efficient at manufacturing the same amount of goods. Thanks to gains in technology, we can make more parts in less time with fewer people. As more technology is created and added to the manufacturing sector, the downward trend in employment will continue. As in Kurt Vonnegut's classic novel *Player Piano*, we are building machines that are taking our jobs.

Should we be screaming to our politicians to protect jobs? Well, that fosters a whole new debate, one that has not been terribly effective in the past. For every protectionist argument there is an offsetting viewpoint concerned with all the ramifications of trade restrictions, tariffs, etc. I've discussed my thoughts on this subject before, and they haven't changed much.

So what lies ahead? I believe that new products will be designed – products that we'll want, need and/or have to have to improve our lives. So, while we won't be manufacturing computers and cell phones in the next decade, we will be building something else. What might that be? I wish I knew; then I could corner the market and become the next Bill Gates. Employment will come back for these new products, but some retraining will be required. Retraining and our educational system, however, are fodder for another editorial. In this volume of the magazine, you will read about some innovations and wonderful ideas. That's our future.

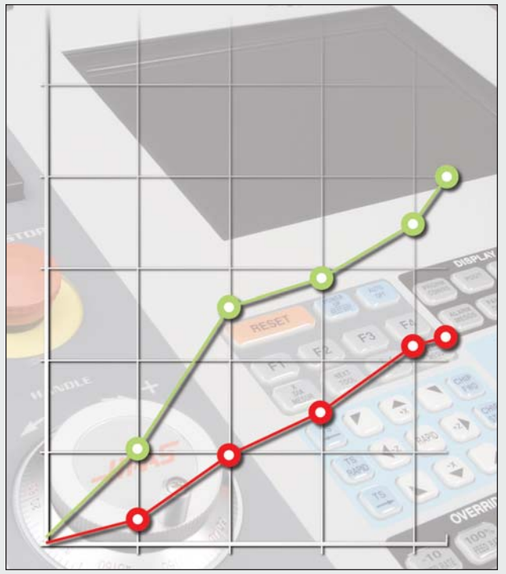
Haas Flourishes in 2003

Everyone is looking for signs that the economy is improving, and recent indicators are definitely showing a slight uptick. Even machine tool consumption figures, which have been dismal for quite some time, are finally on the rise.

One unmistakable signpost that things are looking up in the metalworking sector is Haas Automation's sales numbers for 2003. In a year when U.S. machine tool sales were off by more than 7.5%, according USMTC reports, Haas reported nearly a 10% increase in unit sales over 2002, and a significant increase in market share.

Much of the increase came during the final months of 2003, further proof that things are on the rise. During the fourth quarter of the year, Haas Automation's worldwide machine tool sales swelled, showing a 51% improvement over the previous quarter. December contributed hugely to the year-end numbers: It was the second highest sales month ever for Haas, and a 45% increase over the previous December.

Please see FLOURISH on page 33



Presidential Candidate Visits HTEC in South Carolina

Photo: Reuters

The manufacturing industry, long the banished step-child of U.S. politics, has recently been welcomed home again. With manufacturing jobs rapidly disappearing to overseas competition – and unhappy voters asking why – politicians who talk about the economy have to address the manufacturing sector. While the U.S. economy has been gathering some momentum of late, analysts note that the expanding recovery is not producing all that many new jobs. Presidential contenders and wannabe contenders have taken note.

Massachusetts Senator John Kerry, campaigning for the Democratic presidential nomination in January, visited the Haas Technical Education Center at Midlands Technical College in Columbia, South Carolina. Kerry, sporting Haas stars-and-stripes safety glasses, watched a Haas VF-6TR trunnion and a VF-5 cutting demo parts, while the press corps looked on.

Please see KERRY on page 33

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

Photo: Scott Weersing

Haas CNC Racing Hits the Track Running with Two Teams

There are no vacations for the elite NASCAR race teams. In fact, there really isn't *any* time off. As soon as one race season ends, teams start building new cars for the next season; by January, they're back on the track for testing.

While testing doesn't earn a team any series points, what happens on the track in January can make a big difference once the series gets underway. And if the first races of season are any sign, the Haas CNC Racing team could soon find its way to Victory Lane.

The Haas CNC Racing team began its second season with two full-time NASCAR teams. The first has veteran driver Ward Burton guiding the No. 0 NetZero Chevrolet in the Nextel Cup Series, while a second team has Jason Leffler driving the No. 00 Haas Automation Chevrolet in the Busch Series. Burton ran four Cup races with the team in 2003, while Leffler ran both Cup races and Busch Series races with the team last year. Leffler's best finish was fourth in the Busch Series at Homestead-Miami Speedway to end the 2003 slate.

Daytona 500

The Daytona 500 is the biggest race of the year – the biggest crowd, the biggest TV audience, the biggest total payout of prize money for any motorsports event in the United States. It's also the first points race of the NASCAR season.

Ward Burton and the Haas CNC Racing team kicked off the 2004 Nextel Cup season with a 17th place finish in the Daytona 500. Burton, who won the Daytona 500 in 2002, was hoping for a little magic again on the famed 2.5-mile superspeedway. But the No. 0 NetZero Chevy did not have the power, nor the handling to keep up with the top cars.

The No. 0 Chevrolet qualified for the Great American Race in 19th position and stayed in the middle of the pack for the first laps of the race. It wasn't long before Burton radioed to crew chief Tony Furr that the car was difficult to handle. The team then spent the rest of the afternoon chasing the handling of the NetZero Chevrolet, and making changes at every possible opportunity.

On Lap 72, Burton narrowly missed disaster when several cars crashed in front of him, resulting in damage to 12 cars, including Michael Waltrip's Chevrolet ending up on its roof. When the smoke cleared, Burton held on to 12th place at the halfway point of the race.

During a pit stop on lap 139, NASCAR officials penalized the Haas team for failing to secure all five lug nuts on the left rear of the car. Burton was forced to return to pit road, and lost a lap in the process. Continual changes to the car began to pay off near the end of the race, though, and Burton captured 17th place. The win went to Dale Earnhardt Jr.; it was his first Daytona 500.

"We weren't exactly where we needed to be as far as the handling of the car," said Burton, "but Tony and the guys adjusted it all day. And during those last two runs, the car was a lot better – the best it had been all day. Overall it was a pretty good day; anytime you can leave a restrictor plate race with your car still intact, you've had a pretty decent day."

Burton and the No. 0 Chevy finished ninth the following week at North Carolina Speedway. It was the first top-10 and the best ever finish for the team. The great finish put Burton in ninth place in the Nextel Cup Series standings after two races.

In the Busch Series, Jason Leffler and the Haas CNC Racing team knew the No. 00 Haas Automation Chevrolet was a fast car coming into the season opener at Daytona. During testing in January, the No. 00 Monte Carlo was the fastest Busch Series car at Daytona. Leffler then qualified sixth for the first race. But it took three days to find out where the team would finish.

The Hershey's Kisses 300 began under cloudy skies and a threat of rain. Leffler fell to 11th place in the first laps of the race, and then just missed an accident on lap 11 that sent six cars to the garage. The No. 00 Chevy pitted during the subsequent caution and managed to move up to seventh place when rain halted the race on Lap 31. Officials postponed the race until the day after the Daytona 500. Once the racing resumed two days later, Leffler kept with the leaders and managed to move up to second place, before dropping back to eighth. The win went to Dale Earnhardt Jr., for the second time in two days.

Leffler and the No. 00 Haas Automation Chevy had some trouble in their second race of the year and finished 32nd at North Carolina Speedway.

Hendrick Motorsports

Hendrick Motorsports is celebrating its 20th year of racing in 2004. Rick Hendrick founded the race team in 1984 with one driver and one racecar. Now, the company from Concord, NC, has become a model for other race teams, with four Nextel Cup teams and one Busch Series team.

Jimmie Johnson was tops among the HMS drivers at Daytona, with his fifth-place showing in the Daytona 500. Driving the No. 48 Lowe's Chevrolet, Johnson started sixth in the 43-car field and led for 16 laps. "We had a great car," said Johnson. "We led some laps and worked our way through the pack a couple of times. This is a great start to the season for us to come out of here with a top-five."

Teammate Jeff Gordon had a tough time in qualifying, but showed on race day why he is one of the great drivers. The No. 24 car started the race in the 39th position, but quickly moved up in the field. Gordon ended the day in 8th place – his 12th top-10 finish at the famed track. In the second race of the year at North Carolina Speedway, Gordon finished tenth, while Johnson crashed and ended up in 41st place.

Rookie-of-the-Year candidate Brian Vickers was second among the four HMS drivers at North Carolina Speedway, finishing 16th overall. "We were just too tight in the corners all day," said Vickers, who started 20th in the No. 25 GMAC Financial Services Chevrolet. "We kept adjusting and kept adjusting, until the very end, and we ended up with decent finish." The 20-year-old moved up 10 spots to 29th in the NEXTEL Cup driver standings. Two-time Cup Series champ Terry Labonte finished one spot behind Vickers in 17th overall, after starting 35th in the No. 5 Kellogg's Chevy.

The newest driver to the HMS stable is Kyle Busch, who is driving the No. 5 Team Lowe's Chevrolet in the Busch Series. The 18 year old won two races last year on the ARCA Series, and has been racing full time since he was 16 years old.

The youngster claimed his first top-10 finish of the 2004 Busch Series with a seventh-place result North Carolina Speedway. "We're happy," Busch said. "I didn't think we had that good of a car after yesterday's happy hour session, but overall the guys made awesome changes since last night." Busch is in 12th place in the Busch Series standings after two races.

NHRA

J&B Motorsports of Aliquippa, Pennsylvania, started the 2004 NHRA season with a brand-new chassis built by ProStart Race Cars of Asbury, NJ. The team showed off their new Top Alcohol Funny Car in March at the Gator Nationals in Gainesville, Florida.

"We're looking forward to racing with the new chassis," said driver Paul Lee before the race. "Our chassis last year was hard to tune in, because it had more than 200 races on it. Nothing beats a brand-new chassis."

"With a brand-new car, 2004 promises to be an exciting year for the entire J&B Motorsports team," said team owner Jeff McGaffic.

Change or Die

President of General Pattern, Denny Reiland

Many companies believe they can keep on doing business the same way year after year. If it works, why change it? At General Pattern of Blaine, Minnesota, that type of thinking would only bring about the inevitable – going out of business. The rapid prototyping and tooling company truly lives by the motto, **"Change or Die."**

General Pattern began in 1922 by making patterns for the local foundries. Since then, they have continuously looked for the best new technology to avoid becoming extinct. The company has been quite successful in reinventing itself and finding success.

General Pattern provides high-quality rapid prototypes, rapid tooling and rapid manufacturing for automotive, medical, industrial and consumer products. "We're a leader in getting prototypes to clients so they can get their products out to market faster," says president Denny Reiland.

All types of equipment are at hand in order to quickly deliver what the clients need. There are stereolithography (SLA) machines, selective laser sintering machines and injection molding machines, along with 13 Haas vertical machining centers, recently purchased from the Haas Factory Outlet in Minneapolis, a division of Productivity, Inc. "We perceive ourselves as being all things to all people," explains Reiland. "If you want to be all things to all people, you need all the right equipment."

Having the right working environment also helps, and that's an area where General Pattern is quite unique. The outside of the building looks like any other industrial park, but things are quite different once you step inside. The walls of the lobby are decorated with modern sculptures, and the sales staff works behind sleek black desks. Atop the main conference room's table sits a large Oriental gong, which is sounded every time the sales staff takes a $10,000 order. This usually happens several times a day.

Most tool shops have a CAD/CAM area with programmers working in lifeless cubicles, but General Pattern's computer area feels like it's from a science fiction movie. The only light in the room comes from six-foot-tall red lamps, and the floor and ceiling are decorated with black and white tiles. Each person has their own workstation where they convert data files into prototypes.

Story & Photos Scott Weersing

The machine shop at General Pattern is divided into three unique areas. The first is the additive room, which is dominated by a theater-size movie screen showing the latest movies. Below the screen sit laser sintering machines and SLA machines – equipment that creates prototypes by adding material and increasing its mass.

A second room hosts six new Haas Super Mini Mills. This room is bathed in purple light, along with light from a mirrored disco ball hanging overhead. Black and white tiles cover the floor and ceiling, and the walls are made of aluminum paneling. It looks like the Super Mini Mills could be enjoying a cocktail after a tough day at work. Instead, they work around the clock to create small tools for injection molding.

The main machine shop at General Pattern has the high ceiling common to machine shops, but the room with Haas VF-2s and VF-3s looks more like an art museum. The walls are painted red and the floor gray, to match the six Haas VMCs. On the wall is a large black and white photograph of a foundry, which serves as a reminder of how the company got its start. This same large room is also home to a pair of enormous Haas VF-9 VMCs. They look like a pair of mechanical monsters, ready to chew up the largest blocks of aluminum to make tooling for manufacturing door panels and car interiors.

According to Reiland, the workplace at General Pattern is unique for a reason. "We want it this way to attract good people. If you want people to work around the clock, then you need to create an environment they want to come to, and that they're proud to work in," Reiland says. "Customers remember General Pattern when they leave here, because we look different than the competition."

The decision to purchase 13 new Haas VMCs supports the philosophy of "Change or Die" and the desire to have the best technology possible. "At any given time, one technology will move ahead of another," says Reiland. "Today, because of great leaps forward in software, we're seeing the subtractive technology – machining and CNC milling – ahead of the additive processes, because of the speed, cost, accuracy and surface finishes. So we went to IMTS 2002 with the intent of selecting a vendor for a million dollars worth of machine tools," Reiland says.

"We did our survey of the companies and chose Haas, not so much on price, but on productivity and service. The idea here is that we try to rotate out all of our equipment every three years, simply because the technology, whether it's additive or subtractive, is advancing so quickly. Three years is about how long you can hold onto a piece of equipment and still stay on the cutting edge of technology," Reiland says.

One of the reasons for choosing Haas VMCs was the proven reliability that allows them to run 24 hours a day, 7 days a week. General Pattern has dismissed the typical 40-hour work week in order to be globally competitive. "In order to compete," explains Reiland, "we decided that we would be 24/7. The entire company is 24/7. Our tool making, our injection molding, everything is 24/7, because that's the way our competition is in China. We don't look to the U.S. as our competition; we look at China as our competition. They are 24/7, so we are 24/7," he says.

"We price our product to compete with them, not because we have a low labor rate, but because we have the best technology, and therefore we can stay current with China. Ultimately, technology replaces labor, because it doesn't get sick. It doesn't take time off. It doesn't take coffee breaks like the rest of us inferior humans. We had to find technology solutions. That's the only way you can compete against the low labor costs in Asia," says Reiland.

New technology provides solutions, and one example is the way General Pattern downloads programs to their VMCs. All of the Haas controls are networked together through the Ethernet connection, which allows toolmakers to load programs directly from PCs to the VMCs. "The files can be sent right from the computer. It's more reliable than the bit stream from the RS232," says Calvin Mitchell, shop foreman. "With our old machines, we were getting interference or dropped signals. We would get here in the morning, and there would be a problem overnight causing the machine to stop. We would lose 12 hours, so the job would take an extra day. But with the new machines and Ethernet, that problem has been eliminated."

With a philosophy of change or die, why has the company kept the name General Pattern? "It's tough to come up with a new name," says Reiland, "because we reinvent ourselves each year. Today, we would have some sort of name associated with rapid tooling, but next year we could be considered a rapid solutions company. It's hard to put a name on it, so we stick with the tried and true."

General Pattern Co.
763-210-3423

How small shops can stay competitive with industrial robots

Story Kapyoung Choi **Photos** Courtesy FANUC Robotics America, Inc.

As the U.S. economy makes a slow recovery, and foreign competition, particularly in China, continues to gain momentum, small shops are realizing that industrial robots are more than just pieces of manufacturing equipment. They are key business tools that provide a means for companies to fight back, win orders and remain profitable.

In fact, since the first industrial machine-tending robot was introduced in the U.S. in the 1960s, the industry has grown to more than 126,000 machine-tending robots in operation, according to the Robotic Industries Association (RIA).

Many companies now realize that, in order to stay competitive, they must have the manufacturing flexibility to respond quickly to market demands. As companies strive to enhance their time to market, the role of robots becomes particularly critical for smaller shops, where ergonomic issues and absenteeism impact the bottom line.

By implementing robotic solutions, small shops are able to increase their revenue per production employee by 50 percent, and reassign workers to less hazardous and repetitive tasks. Also, robotic automation helps companies streamline operations and realize a quick payback.

The following provides pointers on how small shops can get started on the road to automation.

UNDERSTANDING YOUR NEEDS

An effective automation supplier is one that understands its customers' process needs. By performing a needs analysis to evaluate current manufacturing processes and business priorities, the automation supplier can make recommendations that will provide efficient and cost-effective results.

Because the day-to-day activity of running a job shop often prevents production managers from evaluating manufacturing alternatives, it's best to find a local integrator or robot OEM to kick-start the needs analysis process with an automation audit. The RIA is a good resource to locate suppliers/integrators (http://www.robotics.org). The RIA website offers a list of robot suppliers, integrators, tooling suppliers and other robotic peripheral equipment suppliers.

ADVANTAGES OF ROBOTIC AUTOMATION

Industrial robots are more affordable than just 10 years ago. It may surprise some manufacturers to learn that a six-axis robot with a payload of 5 kg – packaged with a six-axis manipulator, controller and software – is available for less than $30,000. And with some vendors offering competitive leasing programs, small shops can find alternative ways to finance robotic systems at low monthly payments.

In addition, robots are extremely easy to install and operate. Many pre-packaged cells are available that allow customers to integrate the robot, tooling, part delivery unit, cell guarding and control interface to the peripheral devices/machinery in a matter of hours.

For all types of applications, including machine tending, today's industrial robots are much more sophisticated than earlier models. Several choices are available, with capabilities to meet a wide range of payload, reach, speed and flexibility requirements. Typically, robots can handle payloads that range from 3 kg to as much as 600 kg, and offer reach capabilities of 700 mm to more than 3000 mm. Servo-controlled industrial robots are used to tend CNC lathes, mills, machining centers, drills, grinders, EDM machines and more. They are accurate enough to load three-jaw chucks, live tooling, collets, fixtured tombstones or pallets.

Robots with at least four axes of motion can help manufacturers optimize cell layout, floor space usage, chip management and workpiece flow. Robots can be mounted on the floor, upside down, on a machine tool or on a floor track. More recently, a six-axis, overhead, rail-mounted robot (toploader) has gained popularity for tending multiple machines from the top. These robots operate as articulated gantries, and allow for more efficient use of floor space and capital.

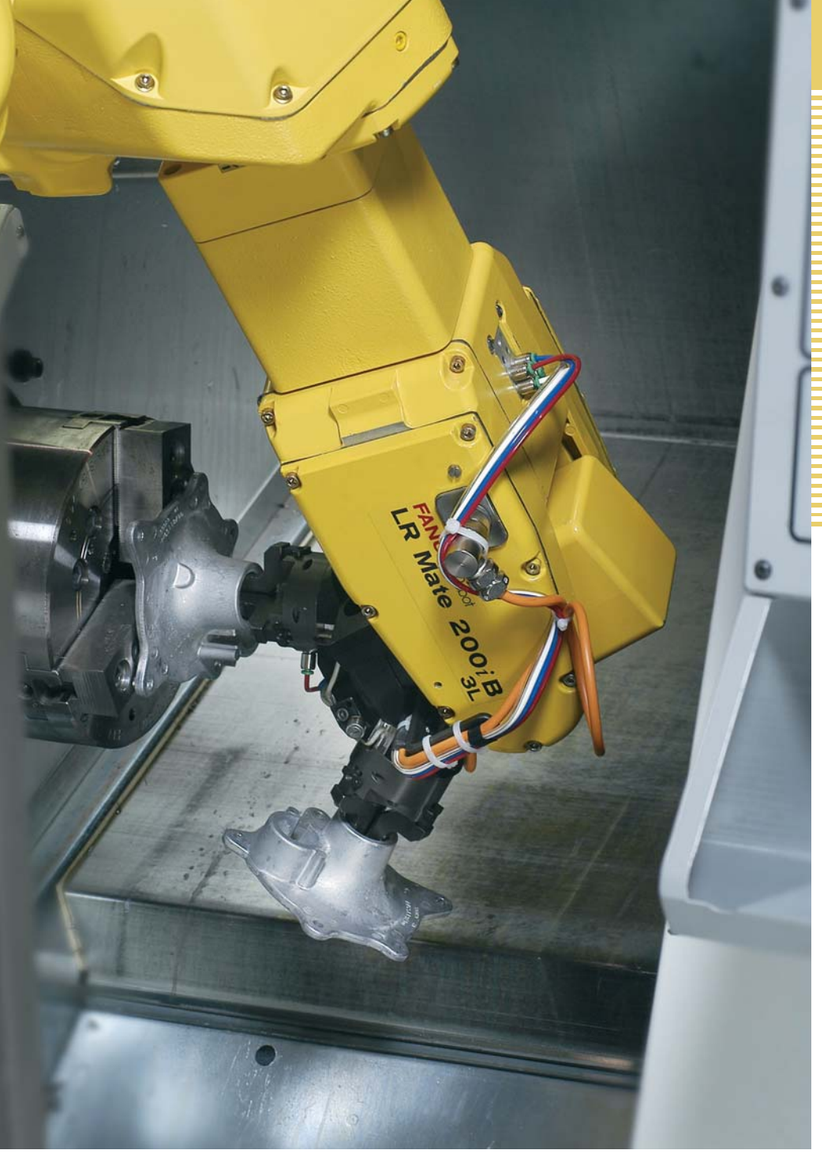
Another advantage of robotic solutions is speed: The load and unload cycle time for robots is just five seconds or slightly more. The time is based on how long it takes for a robot to move into the machine, exchange a part with the machine's workholding device, and for the machine door to open and close. If the robot supplier designs the system correctly, the robot should wait for the machine, not the other way.

PICKING A ROBOT THAT FITS THE APPLICATION

There are several items to consider when sizing a robot to a machine-tending application. The robot OEM or integrator will assign a team that will help evaluate the application during the needs analysis.

Survey parts and group them into families based on size, weight, production requirements, machining time and machining operation. First-time robot users should not expect to automate all parts at once. It's best to start with one part family, develop a good understanding of the automation, and gradually automate additional part families. Starting at a slower pace will allow companies to thoroughly evaluate the benefits of robots and streamline the implementation of future automation projects.

Determine the best route for parts to move into and out of the robotic system. Many part-delivery systems are costly; however, the robot supplier will be able to recommend the most efficient and affordable delivery system. How long does the cell need to run unattended? What is the profile of the part or the part family? How much is in the budget? What is the expected return on



investment? Answers to these questions will help narrow the choice of part-delivery methods.

The use of gravity conveyors with part escapement is an effective means of presenting parts to an automation cell, and typically is less expensive than powered conveyors. Another choice might be part pallets that move manually or automatically into and out of the robot work area.

The use of vision with a simple indexing belt conveyor or table is another possibility. Vision provides higher flexibility and reduces the cost of part location. More than one part type can run on the same cell without the need to invest in dedicated fixtures. Vision is more forgiving of slight part-to-part variations, compared to a fixtured part-delivery system designed to handle nominal part tolerances. When a six-axis robot is used with vision, the robot will position itself at the optimum pickup location based on how the part is positioned for pick-up, versus dedicated automation, which is designed to pick up parts at the same location each time.

Vision provides part location and orientation information to guide the robot. Part-delivery flexibility will increase if vision is integrated into the robot's end-of-arm tooling. This allows parts to be delivered to the cell in a structured bin or on a simple multi-layered tray system. In addition to eliminating the high cost of part fixturing, vision provides the capability to automate small part runs.

End-of-arm tooling (EOAT) design is defined by part size, weight, gripping location, gripping surface quality, throughput and workholding device interference zones. Many grippers used for machine-tending applications are off-the-shelf, pneumatic, parallel motion types with two or three jaws, depending on the part's shape at the gripping location. Others have customized fingers and pneumatic valve systems, which control the EOAT. Based on the requirements of the application, some gripper modules are assembled with part-present sensors, vision and/or part-orientation mechanisms.

Application software has also been simplified to the point that users with little or no experience can program a robot. Today's programs are provided in plain English, and use drop-down menus to select commands or functions. The Teach pendant can be used for programming, to jog the robot, and to monitor and control the robot cell.

A single robot can tend one or two machines, with the robot set as the master and the CNC machine as the slave. This allows the robot Teach pendant and the controller to be used as the operator station, offering simplified panel functions such as graphic status displays, online help and diagnostics, production reporting and the ability to surf the Web.

Local and remote monitoring networks can be created with Ethernet connections on robot controllers. Other controller features include the ability to multi-task different activities; perform PLC ladder tasks; detect collision without the use of external sensors; define interference zones between the robot and peripheral devices; and control auxiliary axes.

Guarding and safety are important aspects that should be reviewed and understood by everyone involved in the design, implementation, and production of a robotic system. The American National Standard for Industrial Robots and Robot Systems – Safety Requirements (revision of ANSI/RIA R15.06-1986) was approved August 19, 1992, and is available from the Robotic Industries Association.

Today's robots provide maximum flexibility and are often capable of duplicating human dexterity. With six axes of coordinated motion and a programmable machine controller, robots can be used to automate an existing or new machine. In either situation, the machine tool must be updated to accept robot automation, with features such as an automatic door, automatic workholding device, physical I/O points to control the external device, and logic in the PMC to interface with a robot.

Industrial robots provide a number of direct and indirect economic benefits. Usually, one robot can perform the work of three to five people, reducing the cost of labor in the machine-tending area. As the price of robots continues to drop, manufacturers can realize other direct and indirect economic benefits, including:

DIRECT

- **Reduced scrap**
- **Lower product liability costs (such as shipping defective parts)**
- **Increased machine capacity**
- **Reduced workers' compensation liability**

INDIRECT

- **Post-processing tasks such as inspection and gauging performed with one robot**
- **Operator error eliminated**
- **Reduced machine cycles**
- **Increased possibility of future business**
- **Predictable machining processes**
- **Improved competitive position**

With the ability to perform a variety of tasks and achieve a mean time between failure of more than 60,000 hours, robots are also more advanced than traditional automation process systems, such as linear gantries.

Faced with global competition, manufacturers are reinventing their factories and building manufacturing systems using robotic technology that helps produce high-quality products at a reasonable cost. If a company's objective is to achieve one or more of the following competitive advantages, then robotic automation is the right business tool for success.

- **Increased incremental productivity**
- **Flexible and predictable production**
- **Improved part handling**
- **Labor savings**
- **Monotonous tasks eliminated**
- **Safer working environment (hazardous environment, back injury and carpal tunnel syndrome)**
- **Improved machine utilization (30% or more)**
- **Improved quality (reduce or eliminate the risk of defective parts)**
- **Less work in-process and less production downtime inventory**

FANUC Robotics America, Inc.
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Serve the Customer

Cells Save

Story & Photos Scott Weersing

At first glance, Mark Miller is your typical machine shop owner. He has a background in engineering and operates a shop specializing in aerospace components. Yet, Miller has seen the future, and realizes it is customer-driven. Gone are the days when a machine shop told customers what the minimum order would be and when they would receive their parts.

These days, customers inform suppliers electronically what parts they need, and then the job shop has to make just what is needed – and on time. If a business cannot provide this type of service to its customers, then those customers will find it elsewhere, whether in North America or overseas in Asia.

Miller is the president of Crown Valley Precision, a contract engineering firm in Baldwin Park, California. Recently, he made significant changes to the way his company operates – switching to a system of machining cells – all because a customer wanted faster delivery. Since the switch, Crown Valley has realized a wealth of benefits, including improved quality, reduced production time and lower costs.

"The change to cells was customer-driven," Miller explains. "One of our customers wanted to streamline their processes and set up a just-in-time delivery system. That's where the impetus came from."

Miller knew it was time to change, or risk losing business to overseas competition. "I looked at cells and read up on lean manufacturing and single-piece flow," he says. "It made a lot of sense, knowing that the future is going to shorter and shorter lead times. This industry in the United States is going to be challenged by China big time in the next five to ten years. If we can't modernize and run more productively, then we're going to be out of business."

Crown Valley Precision specializes in manufacturing hydraulic actuator parts for aerospace companies such as Boeing, Embry Air and Gulfstream. In the past, the company's predominant method of production was a batch and queue system. Miller set up one machining cell several years ago, but he resisted changing the entire operation to cells, because it wasn't practical to stop production and rearrange the shop. The recent slowdown, however, gave Miller time to review operations, determine what type of cells to set up and then actually move machines.

For many shop owners, the cost of moving and rewiring machines often prevents them from switching to a cellular production system. But Miller and his staff moved all the machines themselves, while another employee performed the electrical work. The company only needed to add three new machines to their inventory to complete the cell system.

It wasn't long before Crown Valley was reaping the benefits of the change.

IMPROVED QUALITY

"Our quality is better," says Miller, "because all the tools for the guys to inspect the parts are right there at the machine. And if they find something off, then they can correct it right away. When we get done with the job, we know what we have. Our parts meet our customer's specifications.

"Because you are concentrating on one part [in each cell] and completing the turning and milling, you have consistent parts," Miller adds. "The parts we manufacture here are so good they go directly to the point of use. Our customers don't inspect them, and they don't stock them; they go directly into assembly."

INCREASED PRODUCTIVITY

It used to take eight to 10 weeks to complete jobs with a batch and queue system, but the cell system at Crown Valley has cut production time in half. “We were a typical batch and queue operation,” Miller notes. “We would have a stack of parts and run the first operation, then change everything over and run the second operation. Now, the longest it takes is three to four weeks – including sending parts out for grinding, chrome plating and heat treating.

“Your work in process is greatly reduced, so your inventory goes down,” Miller continues. “We’re running smaller lots, which accommodates the customer better. It doesn’t tie up the machines running a bunch of parts that are going to end up sitting on the shelf.”

And although external costs continue to increase, Crown Valley has been able to cut their internal costs. “Even though we have dropped from 33 employees to 26, we’re still able to produce at the same rate we did two years ago,” says Miller. “Our cost per part has come down 18 to 20 percent. We have seen increases in our outside processing costs, such as chromers, platers and heat treaters, especially here in California with all the environmental regulations, but even as those things increase in price, we have been able to keep our costs down.”

According to Miller, the switch to cells took some time to get used to, but Crown Valley’s productivity continues to increase as they become more familiar with the new production system. “When you tool up the cell the first time,” Miller relates, “it takes quite a while. One part took 12 minutes to finish the first time we ran it in the cell. Then we retooled it, and now it takes just seven minutes.”

MORE SPACE FOR EXPANSION

Crown Valley also found that, although they already had enough space to meet their current demand, switching to a cell system freed up additional room for expansion. Miller explains: “There

were machines scattered all over. We added three more pieces of equipment, and then rearranged and consolidated all of the machines, which freed up almost half the shop. By arranging the machines in a compact fashion, it has opened us up for future growth. We’re already talking with customers about specific products that we could bring in here and manufacture with another cell.”

HOW TO SET UP CELLS

There’s more to setting up a machining cell than just plopping machines next to each other on the shop floor, however. “We sat down and looked at all the parts we run on a regular basis, especially the ones that were big quantities,” says Miller, “and then we broke them down into processes. We counted how many turning operations and how many milling operations there were. Once we put together a matrix with the part number and the operations, the groupings stood out – we saw certain parts that could be grouped together. From that, we made a list of what we needed in the way of equipment. There were quite a few parts that fit the configuration of four turning operations and two milling operations.”

Even so, not all parts fit perfectly into the normal operations of the cell. “Sometimes we have a part that needs only one turning operation, or we have a part come back in that needs a finish operation,” says Miller. “We schedule those jobs when we have a machine free. Usually, we don’t have a lot of spindles sitting idle, but when we’re not running every machine in the cell, we utilize the spindles that are open by putting in other jobs.”

IMPORTANCE OF GOOD MACHINES

One of the keys to making a cell system work is having dependable machine tools. “If a machine goes down, then you have to shut down your cell, and you’re not making any parts,” says Miller. “One of the concerns with putting these cells together was the dependability and reliability of the equipment.”

For their turning operations, Crown Valley has a number of lathes from a Japanese manufacturer. For milling, they rely on machining centers from Haas Automation.

“We’ve been very happy with the Haas mills,” Miller notes. “Having machinery that is new and accurate makes a big difference in improving quality.”

Crown Valley purchased a Haas VF-0E vertical mill in 1999, and then added a pair of VF-2 VMCs soon after. “The Haas mills are accurate and they’re easy to program,” says Miller. “The other thing I like about the Haas mills is they are easy to operate. The controls are consistent, so if I move an operator from one cell to another, I don’t have to worry about retraining him. That’s why I have standardized using one or two manufacturers. We don’t have issues with training.”

According to Miller, changing to a cell system is more than just a physical change; there’s a mental aspect, as well. “You have to completely change your mindset,” he says. “You can’t think batch and queue anymore. Cells force you to change. But I think the benefits far outweigh the costs of making the change. I wish we had gone to cells sooner.”

Crown Valley Precision
626-962-1087

The Value of Using Common Components

by Alex Loyd (correspondent at large)

In the world of CNC machine tools, Haas owners and operators know that their machines deliver value. But what, exactly, does "value" mean? In the case of a Haas, it means that the machine's performance exceeds customers' expectations. For the price of a particular product, people expect a certain level of performance, reliability and customer service. Once a customer owns and operates a Haas machine, and interacts with both the company and their local distributor, they realize that they're getting a lot more for their money than they expected.

But what about people who aren't Haas customers yet? What do they know about Haas machines? They may have heard good things from Haas owners, but there remains one residual issue – the mildly negative reputation given to Haas by machine tool sales folks from competing companies. There is a lot of trash talk out there that goes something like this: "That Haas machine is OK but, you know, how good can it be? Jeeze . . . look at the price."

And there you have it – the rumors start flying. In fact, this suggestion – that a low price implies low quality – is usually presented by a salesman from another machine tool company during the last few days of the month . . . while trying to close a deal against a Haas. On the surface, this argument might seem to have some logic to it. Let's face it: A "too good to be true" price sometimes points to inferior materials, questionable workmanship or unreliable service and parts availability. Unfortunately, most of us know this from experience, and it doesn't take much to project our expectations from one situation to another.

So, the word on the street from salesmen who are struggling to compete is that Haas machines are OK – but don't expect too much. Haas owners, however, will tell you another story altogether. In fact, Haas machines are made with the same top-quality components as you'll find in the machines that have the best reputations out there – and much higher price tags. Haas employs the same guideways, ballscrews and motors as every other respected name in the machine tool business. Could it be that, because these other companies charge more for their machines than Haas does, people actually believe their machines are superior?

Let's ask the question another way: How can Haas build a CNC machine that is every bit as good as the competition's, but charge considerably less – and still stay in business and continue to grow? The answer sounds simple, but making it a reality isn't always easy.

What Haas does is strive for efficiency in everything they do. That doesn't just mean clever designs, smart engineering and innovative solutions – it means constant improvement everywhere. It includes every department at the company, from front-office operations, to engineering, to manufacturing and assembly, to seemingly small things like facility maintenance and scrap removal.

This approach – total commitment to improving efficiency – lowers operating costs while allowing Haas to build a better product today than was built last year, last month or even last week. It's all about keeping manufacturing in-house, investing in high-efficiency equipment, streamlining operations, and simplifying both the designs and the assembly of the machines. It's about making these things part of the company culture – the normal mode of operation.

This may sound like just so much good marketing hype if you're not already "in the know." So, for the next few issues of *CNC Machining*, we'll detail some of the ways that Haas Automation constantly improves operations, thus reducing expenses and delivering ever-improving machine tools at the industry's most reasonable prices.

Installment One:

COMMON COMPONENTS – THE HAAS CONTROL

Today, Haas Automation's machine product line numbers more than 60 different models. Every one of those machines comes with a Haas control, and every aspect of both the hardware and software for the Haas CNC is designed in-house by Haas engineers. The Haas control utilizes industry standard G-code programming, and is extremely easy to use.

With more than 45,000 Haas machine tools in use today, the Haas control is a widely accepted industry standard. Complete rule over the design and development of nearly every component of the control, coupled with the savings that come with volume purchasing, gives Haas the ability to build a robust control at a cost that other machine tool companies can only dream about.

Haas doesn't just build its own computer numerical control – they also design and build the axis drives and spindle drives, for a complete, seamless package. Combine all this with the ability to institute changes immediately and improve outcomes almost overnight, and you can see the pricing and quality advantages this brings to Haas machines.

Haas owners get real advantages from this situation as well. Most importantly, the machine cost is reduced considerably, while the quality can improve without restraint. Compatibility between the control and the machine is simply a non-issue, so you'll never get finger pointing from Haas. Since they design and build the entire machine – hardware and computer control – they're responsible for the entire machine.

The Haas control is a good illustration of how in-house design and manufacturing, coupled with economies of scale for component procurement, and a culture that rewards constant improvement, can deliver a superior product at a very affordable price.

Next time: efficiency on the assembly line.

Laughter-Silvered Wings

Story and Photos by Matt Bailey

Since New Zealand first took possession of the America's Cup 9 years ago, Auckland, City of Sails, has become the global epicentre of custom-designed maritime engineering. If you're in the market for a state-of-the-art ocean racer or a floating gin palace, this is the place to shop. The city's harbour is usually packed with homegrown creations. If you can't find what you're looking for, someone can almost certainly design it for you.

When you consider New Zealand's size and location, perhaps it's no surprise that "Kiwis" are such extraordinary boat builders. At around 104,000 square miles, the country's two main islands – with a sum landmass roughly the size of Colorado – are nestled between Australia and Antarctica, bordered by the Tasman Sea to the west and the Southern Pacific Ocean to the east and south. Until the advent of affordable long-haul airliners, the only way to get to or from New Zealand was afloat.

But this isn't a story about boats; it's a story about vintage aeroplanes. Warbirds, to be precise, and how a local company and its supplier employ the same Kiwi talent for one-off craftsmanship used in the boat building industry to realise dreams of a different kind.

Photo: © Philip Makana / GHOSTS

THE PAST UNCOVERED

The story begins in May 1944, when a Royal Australian Air Force pilot of 75 Squadron crash-landed his Curtiss P-40N-1 Kittyhawk fighter at Tadji Airstrip in Aitape, New Guinea, in the South Pacific.

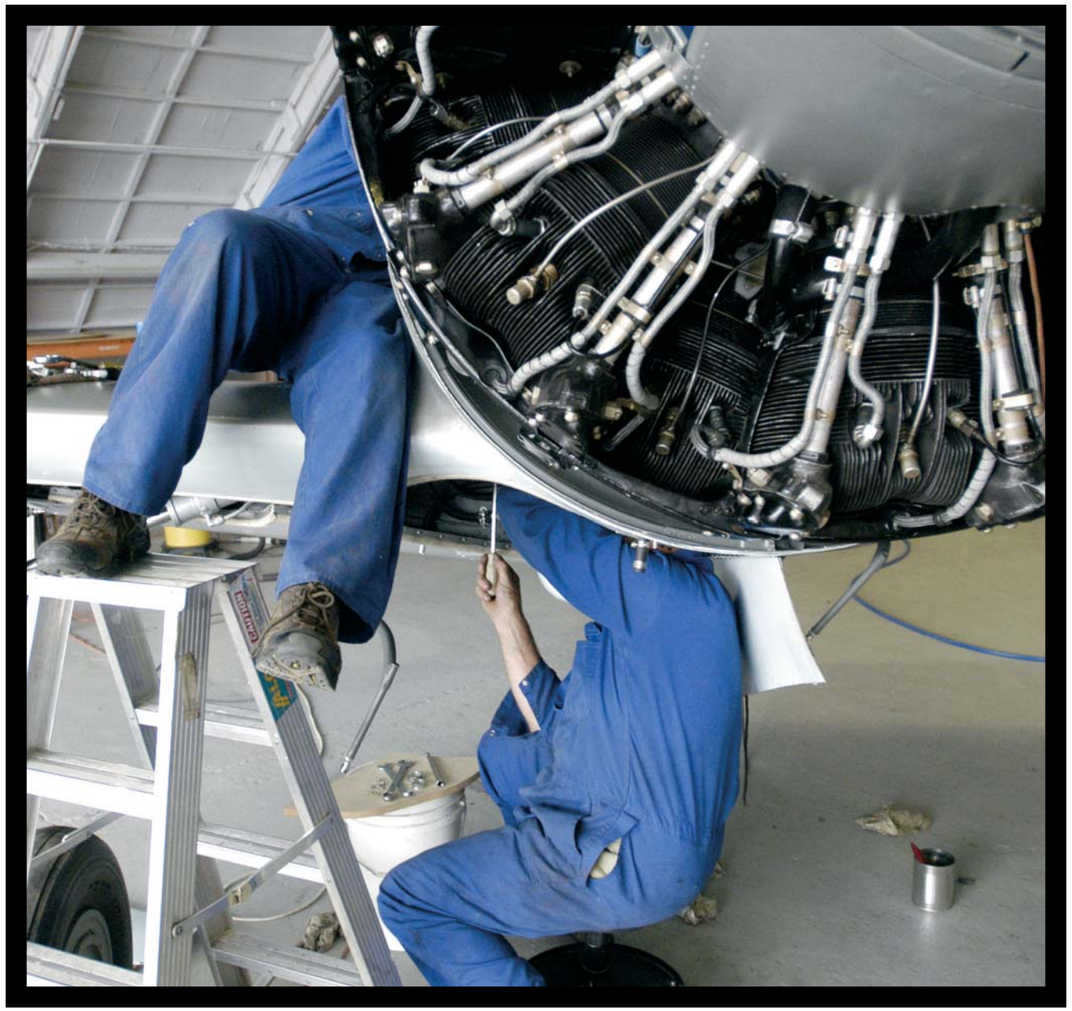
Damaged beyond economic repair, the aircraft, like many of its kind, languished until conflict ceased, after which it was disassembled and placed in open-air storage. It remained there, effectively abandoned, until it was discovered and shipped to New Zealand in 1974 by a well-known Kiwi aircraft enthusiast, Charles Darby.

Whilst the globe was scoured for replacement parts and finance, the rescued and dismembered Kittyhawk remained hangared in New Zealand for another 20 years. Finally, in the mid-1990s, Darby and a number of business colleagues established Pacific Aircraft Ltd. to restore the plane – and to restore the increasing number of similar warbirds being salvaged from the bottom of the world's oceans and the dense jungles of its islands.

Whether Pacific Aircraft was driven more by passion than clear business objectives is a moot point. Suffice it to say that, despite the completion of some notable projects, in 1997 the operation entered a financial flat-spin, the result of which was its inevitable demise. The partners went their separate ways and several projects were left unfinished, their owners grounded and frustrated.

Amongst Pacific Aircraft's jilted clients was an affable and wide-eyed Kiwi businessman who had come to aviation relatively late in life, via a succession of other high-octane pastimes, including top-fuel drag racing. Having made his fortune in the auto-parts industry, Garth Hogan had entered a partnership with Darby and already made a considerable investment in the P-40 project when Pacific Aircraft "augered-in."

Ever the opportunist, Hogan wasn't about to sit back and watch his investment atrophy. In true Victor Kiam spirit ("I liked the shaver so much, I bought the company"), Hogan purchased the assets, rehired the engineers and formed his own company: Pioneer Aero Restorations.



RE-ENGINEERING

Warbirds like the Kittyhawk were conceived with function well and truly taking precedence over form. Handsome it may be, but the P-40 and other aircraft of its age were designed for ease of manufacture and low production costs. In a conflict where the life expectancy of an operational aircraft could be measured in months, manufacturability usually took precedence over longevity.

Sixty years later, the job of restoring a P-40 is a long and painstaking process, not least because airframes and components designed and built during wartime now have to comply with the regulations of the modern, increasingly safety-conscious aviation authorities. As if the process of compliance weren't tricky enough, clients investing in warbirds don't want aircraft re-built on engineering supposition and best guessing – they want historical accuracy. And, more often than not, they're prepared to pay for it.

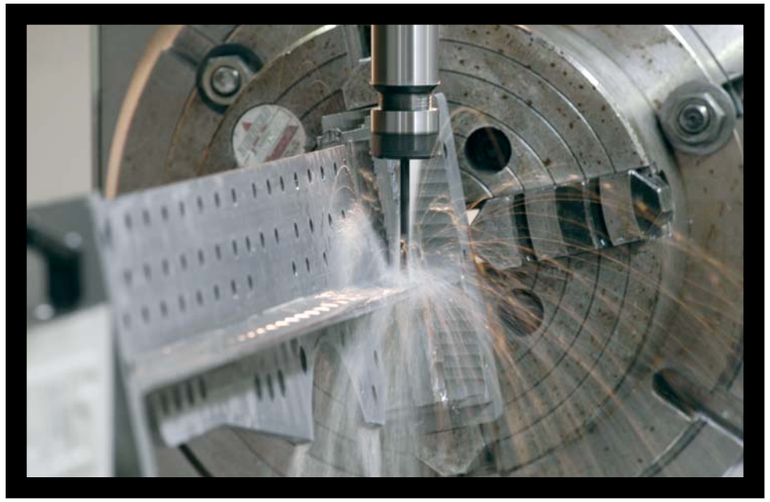
According to Hogan, there's only a handful of air-worthy P-40s around the world, and restoring another to flying condition normally requires considerable hunting around for the necessary engineering drawings and technical information. But the fun doesn't stop there. When the planes were first built, many of the components were made from forgings, which kept part costs low and manufacturing output high, but required expensive tooling. To replicate similar tooling for a one-off aircraft would push the overall cost of restoration well beyond the already high price that clients consider acceptable. For this reason, once the engineering drawings have been found, the next job is establishing cost-effective processes to reproduce the replacement parts.

"Pioneer builds to a pre-agreed contract price," says Hogan. "Many restoration companies are run by enthusiasts, not businessmen, and they frequently deliver aircraft well over the original quote. We've established a reputation for delivering very high-quality aircraft without over-shooting our cost estimate. In this industry that, in itself, is very unusual."

And with costs normally upwards of $1 million (US) per aircraft, payment is usually made in increments, as and when Pioneer meets pre-agreed build deadlines.

"We'd been using a local machine shop to produce certain difficult-to-manufacture parts," continues Hogan, "typically, parts requiring a lot of engineering, but manufactured in small and infrequent batches.

"Unfortunately, for these reasons, the shop we were using considered our work very low priority, and since we're working hard to meet build deadlines – and payment depends on us meeting them – we simply couldn't afford to be at the mercy of a single supplier."



ERIC PATON

Help was at hand: A long-time personal friend of Hogan, Peter Thompson, Managing Director of Auckland-based Haas distributor Aotea Machinery, knew exactly who could deliver Pioneer from its potentially ruinous predicament.

In April 2001, Thompson's company had installed a Haas VF-3 vertical machining centre at the Penrose workshops of Eric Paton Ltd, a general engineering workshop specializing in precision machining, with almost 60 years of experience in solving complex engineering problems.

Thompson introduced the two companies, knowing full well that Paton's Haas VF-3 – equipped with a Haas HRT 310 rotary table – together with the company's Mastercam offline programming package would be the ideal combination for reproducing otherwise prohibitively expensive parts.

Eric Paton was established in 1948 as a general engineering and heat-treatment workshop. As the company grew and prospered, it eventually expanded into making woodworking heads in the 1960s, and then, in 1971, gearboxes under licence for an English company.

These days, Eric Paton Ltd is owned and run by Doug Burt. Originally hired by the founder in 1958 as company secretary, Burt bought the company two years after Paton's death in 1985. After some painful restructuring, he set about consolidating the company's position as a general engineering and machine shop, and as a maker of replacement parts and repairs for the dairy, forestry, steel and agricultural industries.

No stranger to CNC machine tools – Burt claims that the company was the second in New Zealand to install a CNC machine, back in 1967 – when the time was right to invest in a new machine, Peter Thompson arranged a trip to Chicago, to the biennial International Manufacturing Technology Show IMTS, to see the latest range of Haas VMCs. On the way home, Burt and Thompson stopped off in Oxnard, California, to take a look at the Haas manufacturing facility.

"We'd been looking at other machines, but we had serious reservations about the backup and support," says Burt. "When I saw the Haas factory, I was so impressed – with the company, its infrastructure and the general attitude there – that we decided there and then to buy a Haas machine. I have to say, it probably won't be the last."

One of the main reasons Burt chose the VF-3 is because of the space it allowed for adding a good-sized rotary table.

"We needed a 4th axis with plenty of torque for machining the woodworking cutters," says John O'Dwyer, Eric Paton's workshop manager, "so we bought the Haas HRT 310. The VF-3 gives plenty of spindle clearance," he adds. "We're also machining a number of long parts, so the VF-3's 1219 mm table is very useful. Quite often we have to open the two end windows on the machine so we can pass long parts through."

"We really market ourselves as a general machining and design shop," explains Burt, "so we do a wide variety of work for a lot of different clients, including making complete winches for a company called Alloy Yachts, one of New Zealand's best known super-yacht builders."

In fact, it was the company's versatility and ability to engineer complex parts that made it such an attractive candidate when Pioneer was looking for an innovative and reliable machine shop.

"When Garth Hogan brought us the P-40 wing components to re-engineer," says Burt, "John Dwyer, programmer Gavin Davies, and machine operator Nigel Allsop-Smith put their heads together and devised a way of machining the parts."

Re-engineering components originally designed and made in the 1930s and ’40s is a tricky business, and the fact that they’ve been rotting and corroding at the bottom of the sea or in a jungle on a Pacific island for 50 years certainly doesn’t help.

“Pioneer located and supplied the microfilms,” says O’Dwyer, “but they were incomplete and, in many cases, very difficult to interpret. For example, with regard to one rather vital but missing piece of information the drawing simply stated ‘same as Navy’!

“As interesting and challenging as they may be, Pioneer may only be working on a couple of aircraft at any one time,” continues O’Dwyer. “So, although the jobs may take a while, the volume is quite low.

“For such low quantities we don’t want to go to the extra time and considerable additional expense of making the tooling to reproduce these parts as forgings, so we’re machining them from solid using the Haas HRT 310 rotary table to reproduce the difficult angles between the surfaces.”

“Gavin and John deal directly with Garth at Pioneer,” adds Burt. “Between them they guide the company through the process of re-engineering a part, then actually making it. So they tell us, it’s exactly the kind of service they were looking for.”

Garth Hogan has another business near to Eric Paton, so when he’s in the neighbourhood, he often drops in to see Gavin and John to discuss exactly what he needs. They work the details out between them and move jobs along quickly and with minimum delay. Hogan claims that working this way has made a big difference and given him the peace of mind he needed.

“Pioneer is nowhere near our biggest customer,” says Burt, “and the work isn’t very regular. On the other hand, it is interesting work. Gavin and John certainly find it challenging, and they’ve made very good use of the Haas and the CAD/CAM software.”

MARCH 17TH, 2000 – OF MUSTANGS AND MOTORCYCLES

Almost 56 years after her hapless pilot consigned her unceremoniously to an uncertain future as part of the New Guinea landscape, the Kittyhawk, re-registered G-AC, took to the skies at the hands of Pioneer test pilot John Lamont.

As well as being an emotional moment for Hogan, the P-40’s rebirth was an important milestone for Pioneer: the best marketing the company could wish for, especially during the early stages of establishing a name for itself.

On Sunday, February 2, 2003, a few days after my visit to Pioneer and Eric Paton, I had my chance to see Hogan’s Kittyhawk in action.

At exactly 12:30 pm, accompanied by a restored P51 Mustang, G-AC swept fast and low across the start-finish line of a classic motorcycle race meeting at the Pukekohe race circuit just outside Auckland; the roar of the Allison V12 engine prompting spectators and riders to look skyward, silent and awestruck.

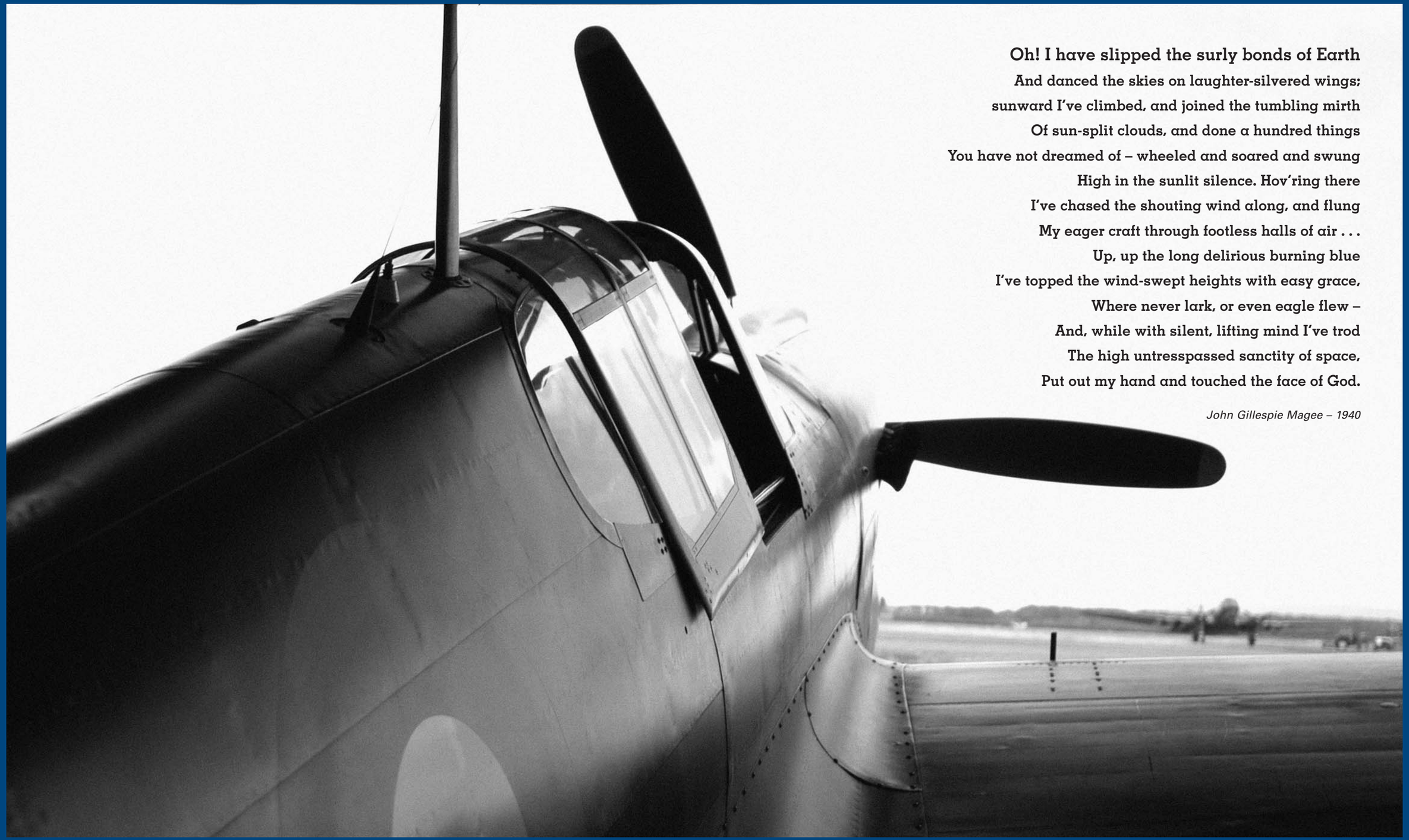
The venue was fitting; the sights and sounds overhead were undeniably evocative, and the rolling and wheeling pair flooded the event with a wave of nostalgia fully appreciated by the classic motorcycle crowd below.

Like classic race bikes, restoring warbirds is about reliving the spirit of a bygone age: In this case, a flying reminder of a period that has come to be regarded as amongst humanity’s darkest hours. Warbirds are restored and flown by the passionate, with deference for and in honour of the men and women who built them, and to the memory of the often very young pilots who selflessly flew them in combat, many of whom made the ultimate sacrifice.

Also like classic racing motorcycles, the magic of warbirds lures the passionate to a place where danger and thrills keep uneasy company. There’s nothing inherently safe about ripping up a stretch of asphalt on a vintage racing machine. Likewise, there’s little room for error in a 60-year-old aircraft touching speeds of more than 400 mph. Occasionally things go wrong.

In white letters on its portside fuselage, G-AC carries a tribute to the memory of Mark Hanna of the UK-based organisation The Old Flying Machine Company. An ex-Royal Air Force fast-jet pilot and personal friend of Hogan, the 40-year-old Hanna perished in an accident during an air display near Barcelona, Spain, in 1999. He was flying a restored Spanish-built version of the World War II German Messerschmitt Bf109 fighter.

For those who wonder what strange forces compel enthusiasts like Hogan to continue in the aftermath of such painful losses, a young Canadian by the name of John Gillespie Magee, a mere teenager when he died at the controls of his Spitfire in 1941, offers the earthbound insight into the passion and the poetry of high-flight (on the following page). Sentiments shared, perhaps, by all those who have ever looked skyward to fulfill a dream.



Oh! I have slipped the surly bonds of Earth
And danced the skies on laughter-silvered wings;
sunward I've climbed, and joined the tumbling mirth
Of sun-split clouds, and done a hundred things
You have not dreamed of – wheeled and soared and swung
High in the sunlit silence. Hov'ring there
I've chased the shouting wind along, and flung
My eager craft through footless halls of air . . .
Up, up the long delirious burning blue
I've topped the wind-swept heights with easy grace,
Where never lark, or even eagle flew –
And, while with silent, lifting mind I've trod
The high untresspassed sanctity of space,
Put out my hand and touched the face of God.

John Gillespie Magee – 1940

Ready to Rumble

Imagine a contest where remote-controlled vehicles battle to the death in front of a live audience. The arena, packed to overflowing, throbs as the roiling masses cheer on their favorite contestant. When all is said and done and the dust has settled, there will be but one victor.

Story & Photos
Scott Weersing

While this may sound like a scene out of a science fiction movie, high school students from across the country are preparing for just such a competition: The third annual BattleBots IQ High School Robotics National Championship, which takes place in Minnesota this April.

Among the competitors will be students from the Cuyahoga Valley Career Center (CVCC) in Brecksville, Ohio. For the past six months, the juniors and seniors at CVCC have been designing and building a 120-lb robot to compete in the BattleBots IQ against robots built by other teams from across the country.

BattleBots is an extreme robotic competition in which remote-controlled machines battle each other in an obstacle-filled arena. Although the BattleBots competition was organized in 1999, robots such as these have been facing off against each other since 1994. But it wasn't until the cable TV channel Comedy Central began televising the bouts that BattleBots grew in national recognition and popularity. It's hard to resist watching a show where machines destroy each other. Just think of it as a remote-controlled demolition derby.

The instructors at CVCC saw the competition as the perfect learning ground for their students. "We wanted a project that would spur a little excitement in the students, and be a good vehicle for student skills," says Richard Parrott, machine trades instructor at the career center. CVCC serves eight high school districts in the Cleveland area, with 27 different programs that prepare students for entry-level jobs and apprenticeships in a variety of industries. Three groups from CVCC's manufacturing cluster – Machine Technology, Electronics and CAD – worked together to design and build the BattleBots robot.

"We tried to come up with something to bring all three groups together with some sort of centralized project," says Parrott, who has been teaching at CVCC for five years. "The biggest reason for doing the BattleBots competition was so the students in the different skilled trades could learn what we call cross trades. Students need to know what the other skilled tradesmen and craftsmen are doing," he explains, "and they need to see how the components they build have something to do with what the other person is doing."

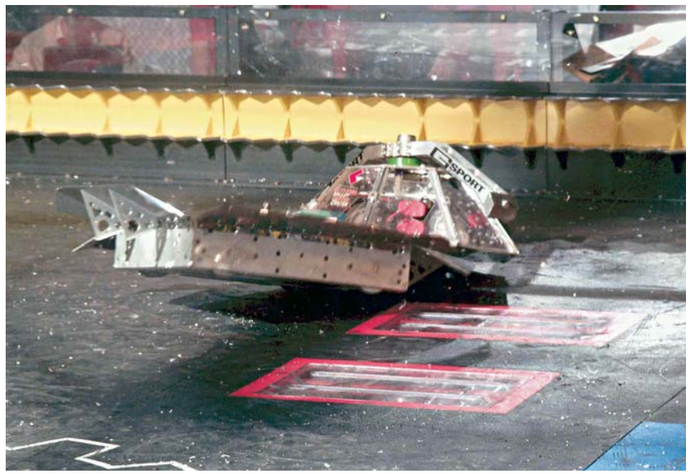


Photo courtesy of BattleBots Inc. Copyright © 2004 BattleBots Inc. Photo by Daniel Longmire

This will be the third year that students from CVCC have participated in BattleBots IQ. In 2002, the competition was held at the Universal Studios theme park in Orlando, Florida. Last year the competition was held in San Francisco. This year the Minnesota Precision Manufacturers Association is hosting the competition at the Four Seasons Centre in Owatonna, Minnesota.

The team from CVCC has been successful in past competitions and earned several awards. "We've walked away with the sportsmanship award two years in a row," beams Parrott. "It recognizes that our students are helping others who they are competing against. They are helping others get their robots back on track. Our students have been glad to help others. You don't want to win a round by default because your opponent's robot stopped working."

There are several types of robots that compete, going head-to-head in an arena full of obstacles. A spinning robot uses a hammer that spins quickly to inflict damage on its opponent. A wedge robot tries to get under its challenger and push it onto one of the arena's obstacles. A plow robot uses brute strength to push its opponents into the obstacles. But the biggest barrier is often just keeping the robot operating properly. Students get ideas for their designs from watching past competitions, and new creations often mimic winning robots.

"In a bout, you're going against another 'bot, and you don't know if it is going to be a spinning 'bot, or a wedge 'bot or a plow 'bot," explains Parrott. "But the idea is to be the victor after a three-minute round. Inside the arena there are weapons like hammers and saws that come up through the floor. A lot of it is playing cat and mouse to maneuver the opponent's 'bot over one of the hazards. Or you inflict enough damage to the other 'bot so it stops working. A panel of judges scores the competition, and you score points from strategy, impact damage and aggression."

Parrott adds, "The competition is great practice for the students; they learn a lot about troubleshooting on the fly. It's just like being on a pit crew for a racecar. If something breaks or gets damaged, you only have 20 minutes between bouts to fix it. And you don't have a machine shop available."

CVCC's BattleBots are manufactured using a variety of CNC and manual machine tools. The students used a Haas VF-0 vertical machining center and a Toolroom Mill to make the gears and brackets, as well as other parts. To help students transition from manual turning to CNC turning, the school recently purchased a new Haas TL-1 Toolroom Lathe. "Our administration has been very supportive in bringing our lab into the 21st century," says Parrot. "They've helped us with computers, networking and using CAD/CAM systems."

The Machine Technology program at CVCC is making a shift from manual machining to CNC machining with the

Please see RUMBLE on page 33

Ingenuity at WESTEC '04

Since 1964, WESTEC has been an institution in the manufacturing community, bringing together exhibitors and customers alike in the largest annual metalworking and manufacturing event in North America.

Although primarily a West Coast show, WESTEC draws visitors from around the country – and around the world. For this reason, most of the major players in the machine tool world show up every year to exhibit their wares. This year was no exception.

But WESTEC looked a little different in 2004: The show was smaller than usual, with the entire event taking place in South Hall, and many exhibitors moved from long-standing locations to new booth sites. Haas Automation's new location was front and center: directly in front of the main entrance, with space on both sides of the center aisle. The 6,000-square-foot Haas booth was the first thing attendees saw when they entered the hall.

The Haas booth was, of course, full of CNC machines making chips – and full of show attendees watching them. Among this year's line-up of 27 machines were several new additions to the Toolroom line, a VMC designed for mold making, a brand-new heavy-duty HMC and the two smallest machines Haas has ever made.

Building on the success of the TL-1 Toolroom Lathe, Haas showed off not only a TL-2, but a TL-3 as well. The Toolroom Lathes all feature the Haas Intuitive Turning System, conversational software that makes the transition from manual to CNC turning incredibly easy, and doesn't require knowledge of G code. A mill version of the system, aptly named the Haas Intuitive Milling System, was introduced with the TM-2 Toolroom Mill. This proprietary Haas operating system has proved to be very, very popular.

Also generating lots of interest were two new machining centers, and a pair of portable but fully capable CNC machines. The EC-1600 is a rugged 50-taper HMC, while the VM-3 vertical machining center is designed for the high speeds and fine finishes required in mold making. The Office Mill and Office Lathe are a duo of ultra-compact machines designed for spaces where you wouldn't ordinarily put a CNC machine, such as an office, jewelry shop or research facility.

There was also a wide range of production machines on display, from the small-footprint Mini Mill to the GR-510 Gantry Router with 5' x 10' table. For a closer look, check out the Haas website at www.HaasCNC.com.

FLOURISH continued from page 3

"Of course we are extremely pleased with these record results, especially because they were achieved in a very tough economic cycle," said Managing Director Denis Dupuis. "The ability to increase our sales volume is a reflection of the tremendous value our machines provide, day in and day out, for machine shops of all sizes."

Other factors included a perked-up economy and increasing job orders, which gave shop owners incentive to replace older CNC machines. Haas also introduced a line of toolroom machines that make it very easy for manual shops to transition into CNC machining. And, of course, the Jobs & Growth Tax Relief Reconciliation Act was another motivator for purchasing capital equipment.

"We expect to build on these record results and achieve even greater industry leadership in 2004," said Dupuis. "We will continue to provide the manufacturing and metalworking community with the best CNC machine tools and technology at the best prices, while providing the best service in the industry."

Judging by first quarter numbers, this high-value approach continues to bear fruit for Haas Automation in 2004. The company continued to log record sales numbers, even in January and February, which are traditionally slow months for machine tool sales, and there are no indications of a slow-down any time soon.

KERRY continued from page 3

"He was interested in how to keep this type of industry here in the United States," said Ed Koehne, shop manager, who gave Kerry a tour of the facility. "It was great that he came here – he got to see how educational partnerships with industry can help keep our country strong. Plus it was outstanding press for us and the Haas Technical Education Center.

"I was impressed that he took the time to talk with our students," added Koehne. "It was a great experience for them."

The HTEC at Midlands Technical College opened in October of 2002, and provides students with hands-on experience in metalworking and manufacturing. The college has nine Haas CNC machines, including seven mills and two lathes. The HTEC also serves as a demo room for the local Haas Factory Outlet (HFO Simpsonville), and has hosted several Haas Demo Days.

RUMBLE continued from page 31

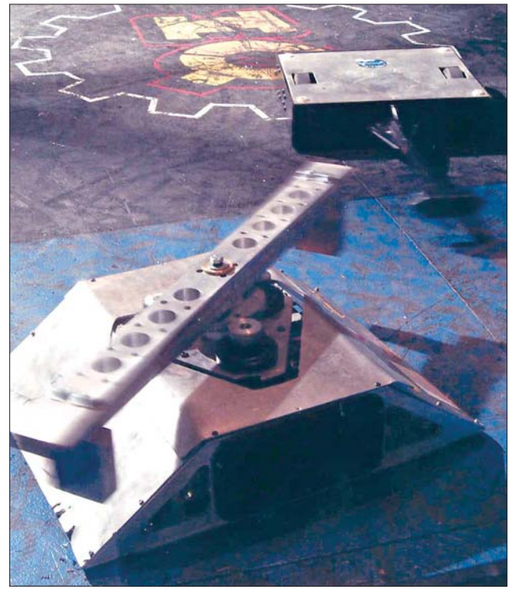


Photo courtesy of BattleBots Inc. Copyright © 2004 BattleBots Inc.
Photo by Daniel Longmire

addition of new CNC machines and a change in instructional style. "This year I did things a little differently with the new students," Parrot explains. "First, I had them run a part on a CNC machine with the program already written, and then I had them manufacture the same part on a manual machine. Now they're not afraid of the automated machines. But they still need to respect them and realize they're going to do exactly what they tell them to do. And they've started seeing that, with automation, you don't have that same sense of feel you have on a manual machine."

The Machine Technology program at CVCC has 22 students enrolled, and eight of them will travel to Minnesota for the BattleBots IQ competition. "Our biggest problem is that not enough people around here know about us," says Parrott. "We're hoping to show others that this is a fun place to be, and that you can learn some things, too."

Preparing for the competition, says Parrott, has yielded a number of benefits. "It's a great example of a real-life situation, and it is fun to do. It also has helped the students think about what the parts have to do. A lot of times in the machining industry you really don't know what the part does, you're just manufacturing some parts. This way, the students get to see how the parts work together . . . and if they did their work well."

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the answer man

Dear Applications:

How well does the Mini Mill machine steel? We are considering purchasing one. Most of our machining is in Ultem, Delrin, and various other plastics, but once we get a new machine we'll want to do more in-house. Maybe 25% of the work on the mill would be steel – A-2 tool steel and stainless.

John Kulpepper

Dear John:

The Haas Mini Mill is fully capable of cutting all types of mild steel. Our Applications department has Mini Mill demo parts cut from 12L14, 1018, and 4140 steels. (One of our Applications experts has even cut Nakhigh hard steel on a Mini Mill.) You should have no problems at all with the applications you've described. Your local Haas Factory Outlet will be more than happy to run a test cut for you, and discuss your specific applications.

Sincerely,
Haas Applications

***

Dear Applications:

We would like to use the rigid tapping function to tap a 1/4-20 left-hand thread. How do we do that? Thanks.

Joel Frost

Dear Joel:

The Haas control has a G-code command specifically for this purpose: G74, Reverse Tap Canned Cycle. Like the normal tapping canned cycle (G84), it uses the variables F, J, L, R, Z, and optional X and Y commands. G74 is also modal like G84. The difference is that it starts with the spindle rotating counterclockwise, so you don't need to program a CCW spindle motion. **TIP:** When you're using rigid tapping with G74 (or G84), be sure that the ratio between the feedrate and the spindle speed is exactly the thread pitch you want to cut. That means rpm x thread pitch = feedrate, so, in your case (1/4-20): 500 rpm x 0.05" = 25 ipm.

Sincerely,
Haas Applications

***

Dear Applications:

I have a question about subroutines on my VF-6. I want to mill the same contour in several places – a 10 x 10 mm rectangle, repeated 100 times. What's the best way to do this?

Gunnar Gustavson

Dear Gunnar:

It's pretty easy. Here is an example, in inches, of calling an incremental (G91) pocket subroutine from within a main program.

```
Main Program:
O01235
T1 M06
G90 G54 G00 X-9. Y5. S1500 M03 (first pocket location)
G43 H01 Z1. M08
G01 Z0.1 F50.
M97 P5000 (first pocket subroutine call)
X-6. Y4.5 (second pocket location)
M97 P5000 (second pocket call)
X-3. Y4. (third pocket location)
M97 P5000 (third sub call)
X0. Y3.5
M97 P5000 (fourth sub call)
X3. Y3.
M97 P5000 (fifth sub call)
X6. Y2.5
M97 P5000 (sixth sub call)
G00 Z1. M09
M05
G91 G28 Z0
G91 G28 Y0
M30

(Subroutine for pocketing)
N5000
(must pre-drill)
(no cutter comp)
G91
G01 Z-0.35 F30. (depth of pass)
X-1. Y1. F7.
Y-2.
X2.
Y2.
X-2.
X1. Y-1.
G90
G00 Z0.1
M99
```

TIP: your machine [given serial number] has a powerful Haas option that allows you to manipulate subroutines using rotation and/or scaling. You will still have to program the subroutine in incremental mode. With this option enabled, G68 commands rotation at any angle from the designated center of the part or from the subroutine zero point, and G51 controls scaling. Your operator's manual has details on the correct use of these G codes, or you can contact us for further assistance.

Sincerely,
Haas Applications

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Dear Applications:

I'm looking to assign M codes to control air flow through an aftermarket air/oil misting system during machining. I'm using a 1-inch, 2-flute endmill that is run using air instead of flood coolant to cool the inserts and clear chips. This would be like using M88 and M89 to turn through-spindle coolant on and off. Can I do this on a Haas?

Rob Durham

Dear Rob:

Yes, Haas machines have a set of user-definable M codes. An optional M code will activate one of the relays, wait for an M-fin signal, release the relay, and again wait for M-fin. (The RESET button will terminate an operation that gets hung up waiting for M-fin.)

Most Haas machines, including all VF base models, come standard with 5 spare M-function user interfaces (if you have an older machine, you may have only 4). If your spare M functions are already being used by probes and/or other options, you can purchase an option that provides 8 additional M functions.

There are a couple of parameters that must be changed in order to assign new M functions. One parameter allows you to select which M-code relay bank to use, and the other one activates the relay bank. Please call us with your machine's serial number so that we can determine the values for these parameters.

You'll need to contact the manufacturer of your mist system for installation and wiring instructions. Haas Customer Service will be happy to provide any information they may need. **TIP:** Haas has an auto air gun option, activated by M code, that provides a constant air blast to the cutting tool during dry machining.

Sincerely,
Haas Applications

***

Dear Applications:

We have four Haas machines, including an SL-30 lathe. We've been running parts on some older, smaller lathes that require both turning and boring. We'd like to move these to the SL-30. Can we use our existing programs "as is" on the SL-30? Also, what type of tool bushings do you recommend for bar holders on a bolt-on turret? Any other hints are welcome, too.

Len Flockstra

Dear Len:

Yes, you can use your existing programs, as long as your older, smaller lathes have G-code controls. As for the bushings, we recommend split bushings for holding boring bars, as these tend to reduce vibration and cutting tool harmonics. Make sure you don't over-tighten the toolholding bolts – this can affect the position of the tool in relation to the part, causing the tool's cutting edge to be off the centerline. Here are a few other guidelines to keep in mind.

1) Minimize tool overhang – it should be the least possible for the specific application.

2) Adjust surface feet per minute. You will not be able to use comparable speeds and feeds from a smaller machine to a larger one without editing the program, because cutting performance/behavior will be different.

3) Check boring bar inserts and the insert clamps to ensure that they are seated properly.

4) Check for proper insert configuration and type according to the process you want to perform (rough, finish, etc). Depth of cut is also important.

5) Verify that the tool is at the workpiece centerline. Rotate if necessary, and experiment at higher/lower cutting edge.

Please don't hesitate to call us for further assistance.

Sincerely,
Haas Applications

Toolroom Series Lathes

The Haas Toolroom Lathes combine the full functionality and simplicity of a manual lathe with the power and flexibility of the easy-to-use Haas CNC system. With standard handwheels and high-accuracy DRO, manual machinists will be cutting parts in minutes. And with the new Haas Intuitive Turning System, they'll transition quickly and easily into automatic modes and full CNC. Even novice machinists will find the TL-1 and TL-2 very easy to learn and operate.

Only from HAAS