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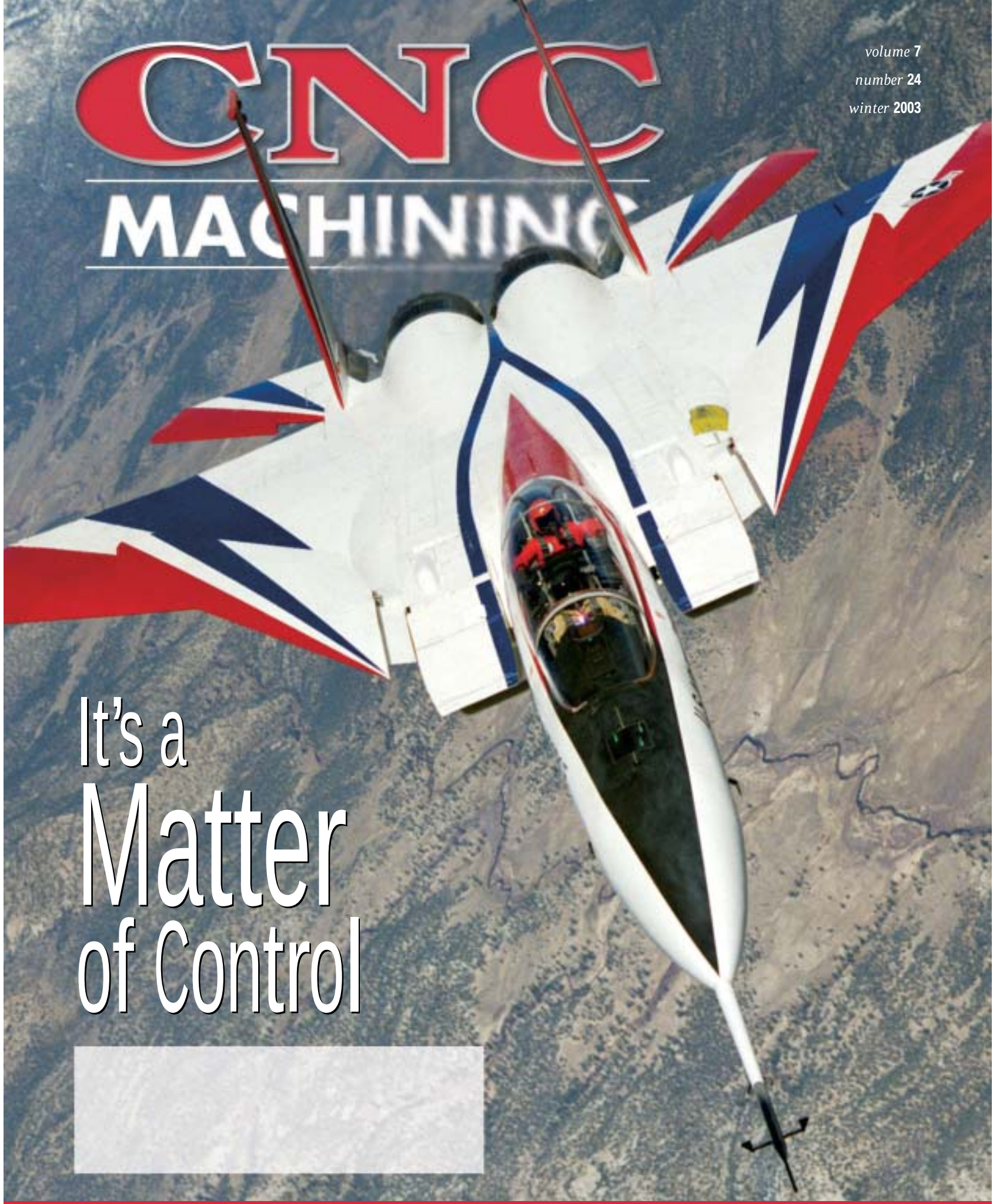
CNC MACHINING



It's a Matter of Control

INSIDE! LIMITED EDITION 2003 HAAS PULL-OUT RACING CALENDAR

CNC MACHINING IN THIS ISSUE

Everyone likes to be in control – of their lives, of their finances, of their business. But maintaining control requires a certain amount of information, or data. To be of value, this data must be acquired in a timely, thorough and accurate manner. In certain industries – aerospace, automotive, medical – accurate data acquisition can mean the difference between continuing a project or scrapping it; using a design as is or improving it; saving a life or losing it.

One of the first applications of data acquisition was aircraft flight-testing. Of course, in the early days, the primary data acquisition device was a well calibrated behind. Daring test pilots the likes of Chuck Yeager strapped themselves into experimental aircraft and took to the skies, regularly risking their lives to provide seat-of-the-pants evaluations of often unproven designs. Their feedback provided the data necessary for engineers to improve, modify and develop new and existing aircraft designs – to take control of the development process.

For our cover story this issue, we visited SpaceAge Control of Palmdale, California, just a hop, skip and a jump from Edwards Air Force Base, a long-standing bastion of aircraft flight testing. The company got its start more than 30 years ago manufacturing devices to protect the highly calibrated butts of those early test pilots. Within a few years, they were producing high-precision position transducers and airflow data devices to measure and record hard data to supplement the test pilots' hands-on evaluations. Today, the company's products are used extensively for research, development and testing by a wide variety of industries.

Sticking with the aircraft theme, we visited the Canadian firm of Reil Industrial Enterprises. The company was founded as an aerospace shop some 35 years ago – and it's still their primary business. But in recent years, the father-and-son team of William H. and William L. Reil have diversified their customer base to better handle the economic ebbs and flows of the industry, and control their own destiny. As the elder Reil explains: "If you're going to survive, you have to be flexible."

If anyone knows about survival, it's Rick Hendrick, patriarch of Hendrick Motorsports (HMS). Back in 1986, he formed the first two-car team in NASCAR – against all advice. Critics laughed, saying it would never work, but Hendrick proved them wrong. In 1996, Hendrick was diagnosed with a rare form of leukemia that, according to many medical experts, claims up to 95 percent of its victims. Again, Hendrick beat the odds. Not only did he survive, but he also went on to establish the Hendrick Marrow Program to help others suffering from the disease. Today, Hendrick Motorsports fields four different NASCAR teams, and supports four others with engines, chassis and technical support. We visited the HMS facility for a look at the machining side of the organization.

For our education piece this issue, we visited Stanford University, where they're working to improve the communication between those who design and engineer parts and those who machine them. In the school's Product Realization Lab, engineering and design students get to see hands-on just what it takes to bring their designs to life. Armed with this experience, they'll enter the workforce more able to bridge the communication gap, and keep the processes under control.

As always, there's much more, such as the race report, a preview of what's in store at WESTEC this year, and a look at some of the latest new products from Haas Automation. If that's not enough, there's also the Answer Man, with some handy tips about the Haas control, and a pull-out race calendar to grace your walls for the 2003 season.

So sit back, relax and enjoy!

photo courtesy NASA

CONTENTS

ON THE COVER

NASA pilot Jim Smolka and McDonnell Douglas pilot Larry Walker fly the F-15 ACTIVE (Advanced Control Technology for Integrated Vehicles) program at NASA's Dryden Flight Research Center, Edwards AFB, California.

THE MASTHEAD

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by Denis Dupuis

An Ounce of Prevention

I was talking with a customer recently, I'll call him Bob, about his machines and their life cycles. Bob owns a fairly large shop with about 40 machines, half of which are Haas VMCs set up in cells with robotic loading systems. The cells were necessary, he explained, to reduce labor costs for a specific part, so the company could compete for the contract. To meet the quantities required by their customer, the cells – 20 machines in all – run 24 hours a day, 7 days a week, 52 weeks a year. They've been running this way for 4 $^1/_2$ years.

Bob noted that his payback for the machines and robotic loaders took less than 2 years, so he's been able to reduce the price to his customer each year in order to keep the contract. One of his concerns, though, is that the machines are coming on 5 years old now, so he's thinking of replacing them to ensure that he can maintain the quantity and quality of parts coming off them.

The machines have been virtually maintenance free, he said, but added that he wants to keep it that way. The machines are holding the same tolerances as the first day he got them, so that isn't an issue. He just feels that, after effectively running the machines for 15 years, maybe it's time to change them. That was his plan when he bought the machines, he told me.

This led to a discussion about preventive maintenance on his machines. I explained that, in the Haas facility, we have a crew of people who do nothing but PM on our machines according to a pre-set schedule. The downtime is scheduled through our ERP system to eliminate any surprises, especially in the middle of a "hot" job.

Bob replied that they don't do regular PM at his facility, but he didn't think they'd had any service calls on his machines. "Really?" I asked. After a minute he said that he recalls maybe changing one board in all this time.

Anyway, back to my point. In discussing a PM program, which Bob didn't seem to see the value of, I asked how many miles he drives his car a year. "About 20,000," he replied. And how often do your change your oil? "Every 3,000 miles, without fail!"

I asked if he did it himself. No, he said. He takes it to a service station; he's getting too old to crawl under the car and change it himself. Besides, what does one do with used oil these days? I then asked if the oil change was all he had done, to which he responded that he has all the fluid levels checked, the belts checked: "You know, the 21-point service check."

So I asked the loaded question: Would you drive your car 24/7, 52 weeks a year without changing the oil?

If you religiously service your car, which is in effect a preventive maintenance program, why not do the same for your machine tool? It has a transmission, a spindle, lube lines, etc. A machine costs more than a car, yet we often don't care for our machines as well as we do our cars. If our car stops on our way to someplace, we think it has let us down. Likewise, if our machine stops in the middle of a parts run, isn't it just as inconvenient as – and probably more costly than – our car breaking down? Bob agreed, and asked how he could start a PM program of his own. I told him to call his local HFO; they will tailor a program to his needs.

This may sound like a commercial for PM programs, but I thought it worthy of writing. Because of the mentality we have in the machine tool industry, for some reason, we don't think of our machines the same way we do our personal equipment. When, in fact, our machine tools are our personal equipment, and the better we take care of them the longer they will last.

After all this discussion, Bob told me he still wants to replace his equipment at 5 years of usage. That was his original plan, and besides, he wouldn't drive his current car for more than 5 years. Touché.

Turning Solutions Across the Nation – Demo Day 3

Buying a machine tool is big, and it's not something most shop owners take lightly. Before they plunk down their hard-earned cash (or put themselves seriously into debt), they want to see the machine in person, watch it cut, hear it run, use the control.

While trade shows provide the perfect opportunity to see machine tools up-close and personal, they don't always happen "at a location near you." Haas Automation has solved this problem by establishing a series of biannual demo days. These one-day events are, in essence, mini trade shows that take place at local Haas Factory Outlets throughout the U.S. and Canada – nearly 60 locations in all.

The most recent of these, Haas Automation's 3rd national Demo Day, was held last November. Billed as a "Turning Spectacular," the event showcased the latest production turning solutions from Haas. Each HFO presented live demonstrations that best suited the industries in their geographic area – from precision micro parts on the Mini Lathe to twin-spindle turning on the TL Series lathes to giant oil field parts on the VTC-48. Materials ranged from 1018 steel to 4140 to 303 stainless.

Educational seminars on some of the latest turning trends were also presented, including setup-reduction techniques, hard turning and cost-effective automation. And visitors saw first-hand the newest turning/boring tools, workholding, quick-change tooling, production-enhancing accessories and CAD/CAM software – all demonstrated on the largest and most complete line of Haas CNC turning centers ever. Haas applications engineers, along with representatives from major tooling, workholding and CAD/CAM manufacturers, shared their insights and answered questions, and food and drink were provided.

Demo Day 4, the next in this series of twice-yearly events, will be coming to an HFO near you on June 3, 2003. Be sure to mark your calendar now.

Toolroom Mill Winner

Last September, visitors to IMTS had the opportunity to win a fully loaded Haas Toolroom Mill – valued at more than (US) $35,000 – by registering at the Haas Automation booth. Haas received a total of 8083 eligible entries for the contest. Each entry was assigned a discrete number, and then company president Gene Haas used a random number generator to select the winning number.

Terry Coykendall of TEKE Machine in Rochester, New York, was the lucky winner. She took delivery of the machine in early November, and was putting the Toolroom Mill through its paces shortly thereafter.

Look for a full story about TEKE Machine in a future issue of *CNC Machining*.

WESTEC Condenses; Haas Expands

Every March, the metalworking industry descends upon Los Angeles for the largest annual metalworking and manufacturing event in North America: WESTEC. This year marks the event's 40th showing, and more than 600 exhibitors are expected to fill the Los Angeles Convention Center, March 24 – 27, with the latest machine tools, accessories and cutting-edge manufacturing technology.

To make visiting the show easier in 2003, WESTEC has been condensed into one building, with all exhibits now located in South and Kentia Halls. The show will also feature two new pavilions focused on assembly and software, in addition to the customary Job Shop Pavilion.

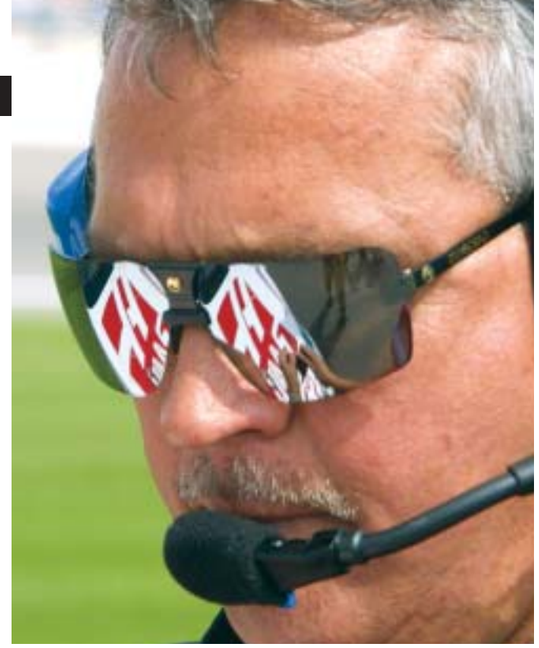
Taking place just south of the company's Oxnard manufacturing facility, WESTEC is considered the home court for Haas Automation. As such, it is where the company traditionally debuts its latest prototype machines and new products. This year will be no exception. In fact, while other manufacturers are scaling back their show efforts, Haas has increased its booth space by more than 50%, and will present its largest WESTEC display ever.

Visitors to the Haas booth will get a first look at such new machines as an affordable Toolroom Lathe with full CNC control; an inverted vertical lathe with automatic parts loader; a 6' x 12' Gantry Router; a small-footprint YAG laser cutting system; a compact trunnion rotary table with dual 160 mm platters; and an all-new line of pallet changing HMCs. Of course, a wide selection of standard machines from every product line will also be on display. And as always, the machines will be hard at work, cutting parts and making chips.

Don't miss this chance to see the largest and most comprehensive display of manufacturing technology on the West Coast. Admission is free when you register online at www.sme.org/westec before March 7.

Haas CNC Racing Gains Experience

Although rain and accidents conspired to keep them off the track at times during 2002, the Haas CNC Racing team and driver Jack Sprague were still able to gain valuable Winston Cup experience and make improvements to the car as they prepared for a full-time Winston Cup run in 2003. The team's best finish came in the final race of the season at Homestead-Miami Speedway, where Sprague captured 30th place in the Ford 400.



"I think the Haas CNC Racing team is on the right track and doing all the right things," said Sprague. "The races last year were all about gaining experience and points, so we'd have a shot at the first four races of 2003."

The red and white No. 60 Haas CNC Racing car made its Winston Cup debut at Kansas Speedway last September, but an accident early in the race forced Sprague to retire the car midway through the race. "It was an embarrassing finish," Sprague said after the race. "Thirty-fifth isn't what we were looking for. It was our first race and we really wanted to come out looking like we knew what we were doing."

The team then missed out on two Cup races in October when rain canceled qualifying at Charlotte and Atlanta (when qualifying is canceled, grid order is determined by team owners' points). "I really hate that we didn't get a shot at it, but there's nothing we can do about the weather," said Sprague.

But the rain stayed away long enough the following week for the No. 60 Chevy to qualify in 28th place for the Pop Secret Microwave Popcorn 400 at the North Carolina Speedway. Sprague struggled with a loose car during the race, yet still finished in 35th place. "We didn't have the best day of racing," Sprague said, "but we have some notes to put in our files for next year, and that's good."

For 2003, the Haas CNC Racing team has signed NetZero as the primary sponsor of the No. 60 car. The car's color scheme will be similar to that of the No. 24 NetZero Busch Series car that Sprague drove in 2002. The 2003 Winston Cup season kicks off in February with qualifying races for the Daytona 500. Look for Sprague to make a bid for Rookie-of-the-Year honors.

While Sprague was busy gaining experience for 2003, the battle raged on for the 2002 championship. When the smoke finally cleared, Tony Stewart walked away with his first Winston Cup title, after edging out Mark Martin by 38 points. Hendrick Motorsports drivers Jeff Gordon and Jimmie Johnson, who had been in the hunt for the title all year, finished the series in 4th and 5th place, respectively. Gordon closed out the season with three victories, 13 top-5 finishes and 20 top-10s ; Johnson logged three wins and 21 top-10s. Despite Johnson's impressive first-year performance, though, poor finishes down the stretch kept him from wrestling the 2002 Rookie-of-the-Year award away from Ryan Newman. Joe Nemechek, another Hendrick stable mate, finished the year on a high note by bringing the No. 25 UAW / Delphi car across the line with two second-place finishes – one at Atlanta Motor Speedway in the Napa 500, and another at Homestead in the Ford 400.

In other NASCAR news, Hendrick Motorsports is assisting the first minority-owned team in Winston Cup history. Businessmen Sam Belnavis and Tinsley Hughes have founded BH Motorsports, with Ron Hornaday behind the wheel of the No. 54 Army National Guard Car. The team failed to qualify for any races in 2002, but plans to run a full schedule in 2003.

"It is our duty to try to make this work," said Rick Hendrick "We will open up our resources to them and let them use what we have. And I believe there will be other car owners who will step up and help make this happen."

Busch Series

Hendrick Motorsports driver Ricky Hendrick has ended his career as a full-time stock car driver due to lingering effects of a shoulder injury suffered last March. "This was an incredibly hard decision to make," said Hendrick, who underwent extensive shoulder surgery following a severe crash at Las Vegas Motor Speedway. "After a lot of soul searching, I've decided to step away from the driver's seat to pursue other opportunities within Hendrick Motorsports. I love this team and I love this sport, but I'm not able to perform at a level that I'm comfortable with."

Hendrick was replaced by interim driver David Green, who proved to be the perfect replacement. Green guided the No. 5 GMAC Financial Services Chevrolet to four top-10 finishes in seven races, including a fourth-place finish in the Sam's Club 200 at North Carolina Speedway.

Jack Sprague and the No. 24 NetZero car ended the season with an 11th-place finish at Homestead-Miami Speedway, wrapping up a successful year with nine top-5 finishes and 15 top-10 finishes. "It's pretty amazing how the year ended up," Sprague said. "We led the points race for a long time, but struggled more than we ever imagined toward the end. The team fought back with everything they had, but so many little things kept us from gaining on the points. Fifth is still a great effort, considering it was our first year in the series. But you still wonder if things might have played out differently without a few of those little things." Sprague moves to Winston Cup for 2003.

Photo by Master Sgt. Bob Haskell, National Guard Bureau

The National Guard Car team standing behind BH Motorsports' efforts to bring diversity to NASCAR Winston Cup racing includes, from left, driver Ron Hornaday, co-owner Sam Belnavis, crew chief Doug Richert, co-owner Tinsley Hughes and Lt. Gen. Roger Schultz, director of the Army National Guard.

NHRA

Sometimes you just hope for a miracle. For Todd Veney in the J&B Motorsports Firebird Top Alcohol Funny Car, that sometime could be anytime he lines up against the best in the class, Frank Manzo. But there were no miracles in September as the eventual champion eliminated Veney in two events.

At the Lucas Oil NHRA Nationals in Pennsylvania, Veney got off to a good start by defeating Craig English and Bob Newberry, but then faced off in the semi finals against the unbeatable Manzo. The matchless Manzo once again nailed the start, but Veney wasn't far behind until his car lifted off the ground. Manzo went on to win his ninth event of the year.

Later in September, at the Craftsman 75th Anniversary NHRA Nationals in Illinois, Veney defeated English and then had a rematch against Manzo. Veney was a little late off the line, but managed to pull even with Manzo at the 60-foot mark. But there was no upset as Manzo pulled away for the win.

Building an Empire

There was a time, not too long ago, when Rick Hendrick was just another owner of a small race team in North Carolina. But as the popularity of NASCAR rose to record heights over the years, so did the size and success of the Hendrick Motorsports empire.

Story & Photos Scott Weersing

Today, Hendrick Motorsports (HMS) supports eight different NASCAR teams with engines, chassis and technical support. Over the years, HMS teams have won more than 100 Cup races, and brought home five Winston Cup championships and three NASCAR Truck championships.

Arguably the best-known team at HMS is that of four-time series champion Jeff Gordon and the DuPont No. 24 car. Gordon entered, and held, the limelight by winning Winston Cup titles for HMS in 1995, 1997, 1998 and 2001. Although he made a strong showing in 2002, with several race wins keeping him near the top of the points, Gordon failed to clinch another title – at least as a driver. But Gordon isn't just a driver for HMS; he's also co-owner with Rick Hendrick of the Lowe's No. 48 car driven by rookie phenom Jimmie Johnson, who seriously challenged for the series championship in 2002.

Other HMS cars on the Winston Cup circuit are the Kellogg's No. 5 car driven by 1996 series champion Terry Labonte, and the UAW/Delphi No. 25 car driven by Joe Nemechek. Rounding out the HMS stable are Jack Sprague and David Green driving the Hendrick entries in the Busch Series. For 2003, Sprague moves to the Winston Cup Series to drive the No. 60 Haas CNC Racing car. Also making its

With more than 700 engines being machined per year, there's plenty to keep the CNC department busy.

appearance in 2003 will be the newest team at HMS, and the first minority-owned team in Winston Cup history, the No. 54 Army National Guard car with Ron Hornaday at the wheel.

For the past five years, Haas machining centers have played a central part in the successful growth of HMS. The CNC department acquired its first three Haas machines in 1997, and now has a staff of nine working on 16 Haas machines. The shop has six HMCs, six VMCs and four lathes – leaving just enough space for raw material in the 15,000-square-foot shop. The sheet metal shaping department has also added a new Haas Z4-500 Laser to cut small parts for stamping dies, as well as a VS-3 50-taper VMC for cutting blanks.

"It has been a gradual expansion," says Jim Wall, Hendrick Engines Engineering group manager. "Every year we replace a few machines and add a few machines. We've gotten to the point where we're about to fill the room up. Our engine production has gone from a couple hundred a year to over 700 a year.

"When we had fewer machines, we had to change the fixturing for different parts," Wall explains. "But now we have the luxury of dedicating certain machines to certain tasks that we do over and over again, such as cylinder heads and manifolds. We have four HS-1Rs, and one of them is dedicated just to cylinder head work.

"Having machines dedicated to a specific part gives us much more repeatability and accuracy, and allows us to turn around parts much faster," says Wall. "Once you get a race car tuned in and the geometry is just right, then you can actually have spare parts that fit. So if you do get in an accident and bend something, you can replace the parts and put the car back exactly where it was."

One of the biggest changes at HMS over the years has been the increase in four- and five-axis work. "We're doing more five-axis work, because it reduces the number of times a part has to be fixtured," says Wall. "Every time you take a part out of a fixture and put it in another fixture, there will be inaccuracies due to alignment."

A new setup in the CNC department uses a Haas HS-2RP with an HRT 310 mounted sideways on the machine's built-in 4th-axis rotary table. "We took the guts out of the machine and added five-axis capability to it," says Wall. The HS-2RP, a twin-pallet machine, is dedicated to engine blocks, with each pallet set up for different operations. Dean Millican runs the machine full-time. "In the first setup, we machine the end face and bore the cam tunnels," he says. "Then we drill and tap for the motor plate." The second setup for the engine block is on the other pallet, using the HRT 310 matched with a manual tailstock. "We use the 310 for cylinder bores, along with drilling and tapping deck holes and the main caps. It takes about ten

"Our race teams can design their own part and then send it here to be machined," says Wall. "The team here in the shop can pull up the program and manufacture the part without having to go through a bunch of blueprints."

hours for each engine block, but I save time with the pallets," says Millican. "I can usually go through six engine blocks at a time – three on one pallet and three on the other."

Millican adds that the setup allows them to consistently produce good parts. "It's a really accurate machine, and we're getting really good quality reports from CMM on the blocks," he says. With more than 700 engines being machined per year, there's plenty to keep the CNC department busy.

HMS has a central department that oversees common parts for all of the teams, and each race team has a department of its own to hold team-specific parts. "We don't do just-in-time inventory very well," notes Wall. "Most of the time, a team says they're out of something and Randy Troyer [head of the CNC department] will juggle the priorities to get the parts done. We have lots of parts that are specials, done on a requested basis. We try to stay ahead of that curve."

Keeping track of everything is a new computer network. "Our race teams can design their own part and then send it here to be machined," says Wall. "The team here in the shop can pull up the program and manufacture the part without having to go through a bunch of blueprints."

Supporting the computer network is a new information technology center that allows easy access to programs for standard parts. "The nice thing about the Haas equipment is that the control is a common platform, so there is little difference between a program for a vertical or horizontal machining center," says Wall. "It makes it much easier, because the machines are tied in with the servers through Ethernet, and you can easily do a backup of what you're doing."

Despite the large number of parts being machined, the CNC department at HMS isn't into high production. "We try to focus on the parts that give us a competitive advantage, and leave the commodity parts for vendors," says Wall. "For example, we have done a lot more work with intake manifolds. We can do complete machining in one setup on the HS-1R.

"The number of machines we have really gives us flexibility. Part of that flexibility is being able to use it in panic mode," Wall continues. "There are times when a team makes a change on Sunday night after a race. They change a design and then we are able to machine it and test it before the next race." And, he notes, "It is better for us to design our own part rather than trying to spend time modifying a store-bought part."

So whether there is an engine block that needs to be machined or another problem to fix, the CNC department at Hendrick Motorsports has the Haas machines to meet the demand.

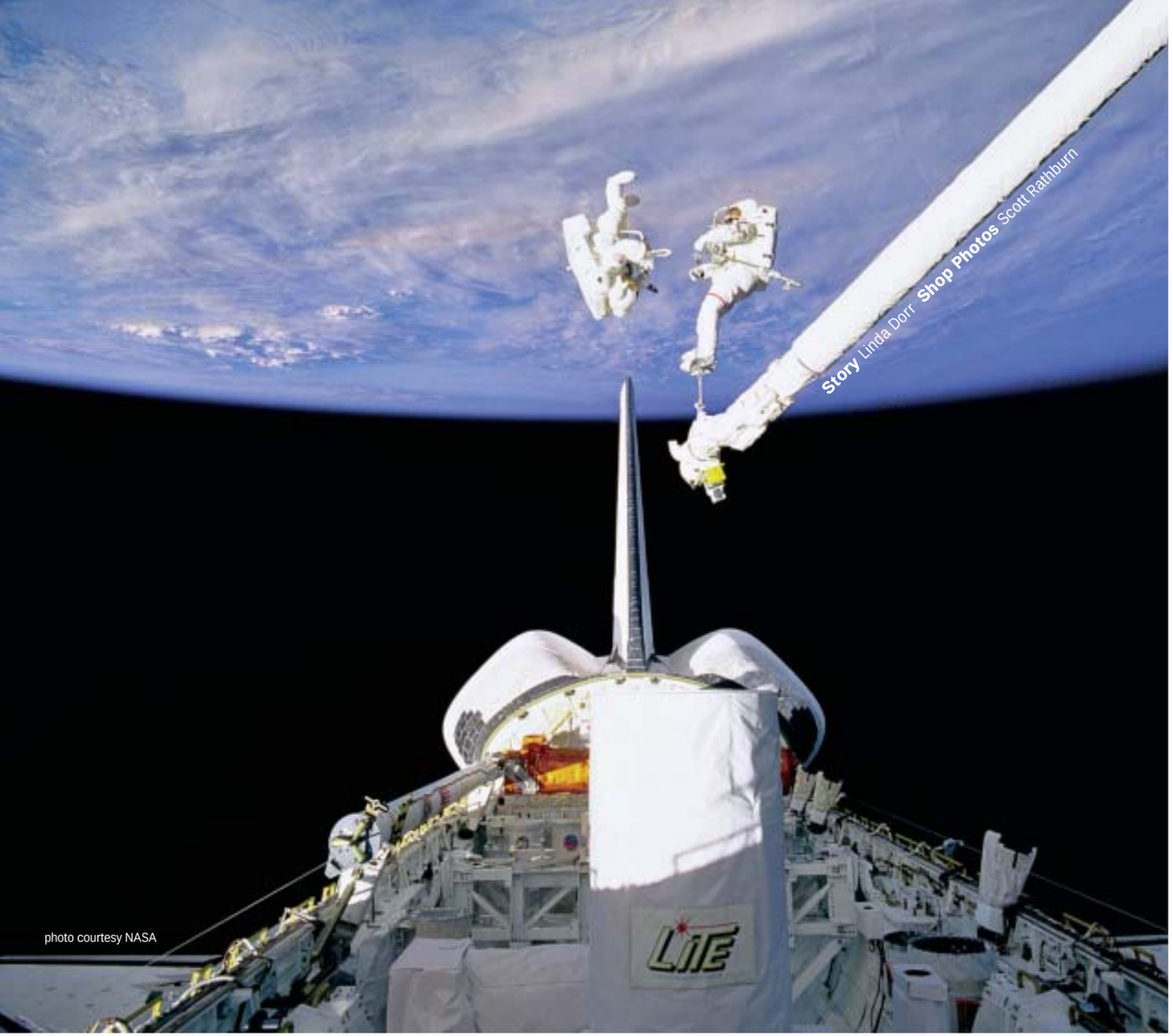


photo courtesy NASA

Story Linda Dorr **Shop Photos** Scott Rathburn

the Reil Story

Diversify!

That's the key to survival in the metalworking business these days. It's a very cyclical industry, with highs and lows much like the crests and troughs of a rough sea. Putting all your resources into a single industry is like navigating that sea in a rowboat: You ride the face of each wave to its highest peaks, then plunge into the deepest troughs.

Diversify into many industries, however, and it's like sailing that same sea in a cruise ship (or at least a large yacht): You don't so much ride the face of the waves as pass through them, avoiding both the high peaks and the low valleys. Although the rewards may not be as great during high times, the advantages during low times more than make up for it.

Reil Industrial Enterprises Ltd., of Mississauga, Ontario, started out as an aerospace shop – and that's still their primary business. Certified to ISO standards and a Gold Supplier for Boeing, Reil decided a few years ago to broaden its horizons. The company celebrated its 35th year back in 1999 by purchasing a couple of Haas machines, in order to get into tool and die work. They've also recently added repair and overhaul work on aircraft undercarriage and airframe components to their list of services.

"We used to make all similar parts," said general manager William L. Reil. "Not a family of parts, but similar sizes. And you knew there would be a certain amount of work out there. Not now, though – now, you have no idea from day to day. Definitely all different types of work now, so we have to have different capabilities to be able to take on work from all these sources."

Adds his father, owner William H. Reil, "If you're going to survive, you have to be flexible." The company's customer base waxes and wanes with the economy. "There's been a lot of consolidation at the top levels. You may have had three customers, and they consolidated and now they're all the same one. Right now our customer base is probably 12 to 15 companies. That's not a tremendously large number, but the companies tend to be quite large."

As do some of the parts the Reils cut: "We just finished some parts for the transporter that takes the components up to the space station," reports the senior Reil. "It's wonderful stuff, but how many of those do you need? You know, we're making something that's a hundred thousand dollars, but they only need one. So the element of risk is high, and we need to have good equipment and diligent people."

When William H. Reil founded Reil Industrial Enterprises, it was a manual shop in a two-unit rental space in Weston. The company grew into a four-unit rental, moving to Rexdale, and then in 1987 bought the building that currently houses them. Reil's priorities are clear: The machine shop takes up 22,500 square feet of the 25,000-square-foot total. Their aerospace production work includes airframes, undercarriage systems and avionics. "We do a lot of electronics work for heads-up displays and radar systems, and we also do structural things, wings and so forth," notes general manager Reil. The parts are cut from titanium, steel, aluminum, alloyed steels – "nothing intimidates us."

Reil is very much a hands-on general manager. "I started working here when I was probably three. To me it's fun, I've always liked machining. For a while I went out and did some things of my own, and one of them was selling software. Then I got to see so many shops, because I was doing demos and stuff, and I just had such a hankering to come back. It gets in your blood, I guess. To me it's not work; it's fun."

Reil Industries got into CNC in 1978, and still has some of its vintage machines. "We've got about eighteen CNC machines, and they go from American to German to Japanese back to made in the USA, depending on where our [Canadian] dollar was and the economy when we bought them. And delivery; availability was important. My feeling for Haas machines is they're the best dollar value around," says the senior Reil. His son echoes this sentiment. "We decided to buy the Haas VF-8 because it's a good dollar value, and because of the size of the table. We were turning down work because we just couldn't cut it in the envelope we had. The Haas was the only one of that size that was reasonably priced. We bought based on capability, too, not just capacity. That goes for both the VF-8 and the SL-30 – there's good power behind it."

Reil's new machines were put to work post-haste, notes the general manager. "They [the local Haas Factory Outlet, a division of Sirco Machinery Company] delivered them on a Friday, they came in on Monday to set them up, and on Wednesday we were cutting. Your service is excellent.

"Some plastics guys walked in the door on Tuesday and said 'I need this as soon as possible,' so the first job we cut was a bunch of plastic dies. We were up and rolling within four or five days – including training; that's from out of the crate to the first part produced. And it was a whole new part!"

One item the Reil shop now has the capacity for is a cylindrical part for the Canada Arm (a manipulation system that is a component of the space shuttle). Cut on the SL-30 from 7076 aluminum, "It's at least 12 or 13 inches long. It starts out as a three-inch plate that we saw into pieces three inches wide. We start with square stock because we have to leave a square flange near one end of the finished part. We turn the OD, then bore out the center. The wall thickness goes down to 0.070 inch – that's a lot for that material – and it's parallel within one tenth over the whole thing."

General manager Reil appreciates how much easier job changeovers are. "On some of the older machines, something as simple as changing a zed height could take 20 minutes. You have to home the machine, shut it down, restart it, and then come back to do it. It's a big thing just to drop it five thou, and then you've got to resend the program. On the Haas, it's just that fixture offset. What I like about it is even if you're not sure exactly where you want to be, you can just bring it down, touch off, home it – and you're done. Away you go.

"I took the training for the mill," he continues, "and it was so simple, more user-friendly than other machines. It's all conversational, you don't even have to know what you're doing. If I was going to start my own shop today, I would probably buy Haas for that reason alone – it's one training for both lathes and mills."

One of the Haas options Reil likes is through-spindle coolant. "It's great – we used to get chips built up inside some of those pockets and recut the chips. Now it just shoots them right out. Some of the stainless dies we've made, with $^1/_4$"-20 holes, we used solid carbide drills and just blasted through them, no pecking. That was exciting, the first time we did that. If you can get excited about drilling!"

The Reils have also used their Haas machines to cut dies from beryllium copper, an alloy valued by aircraft manufacturers not only for its strength and corrosion resistance but also its nonmagnetic and nonsparking characteristics. With machining properties similar to various bronze and nickel alloys, "It's tough to machine and tough to hold close tolerances on, besides the fact that it has to be vented because it gives off a little gas," notes the senior Reil. "And we held the tolerance."

"We do a lot of stainless, and loads of titanium," reports the younger Reil. "There's nothing I wouldn't put on [a Haas], and we cut it all. I know I can hold the tolerances, and I know I can hold the accuracy. And with coolant through, there's no chips and a perfect finish. We just load it up and let it rip."

The next step for the Reil shop will be a couple of Haas Toolroom Mills. Touted for prototyping and one-off parts, the Reils plan to use them for the repair and overhaul work they've undertaken. When the economy improves again and their production work increases, they will no doubt find more uses for the smaller machines. "The success of a country depends on what it produces," says William H. "There aren't a lot of people in the world who know how to make things. They know how to look after it, how to inventory it, how to ship it, but not many people know how to make something." The Reils know how – which is why their ship keeps sailing the manufacturing seas.

Reil Industrial Enterprises Ltd.
905-670-1070

TAKING CONTROL

story and shop photos by **Scott Weersing**

photo courtesy NASA

photo courtesy NASA

WHAT DO CRASH TEST DUMMIES AND UNMANNED AERIAL VEHICLES HAVE IN COMMON?

At first glance, you might think they're worlds apart, but upon closer inspection, you'll find they share a very high-tech common thread: They each use position transducers to record specialized information. Once the exclusive realm of experimental aircraft, this technology is now used extensively in all types of industrial settings, from food processing to motorsports to automotive safety testing.

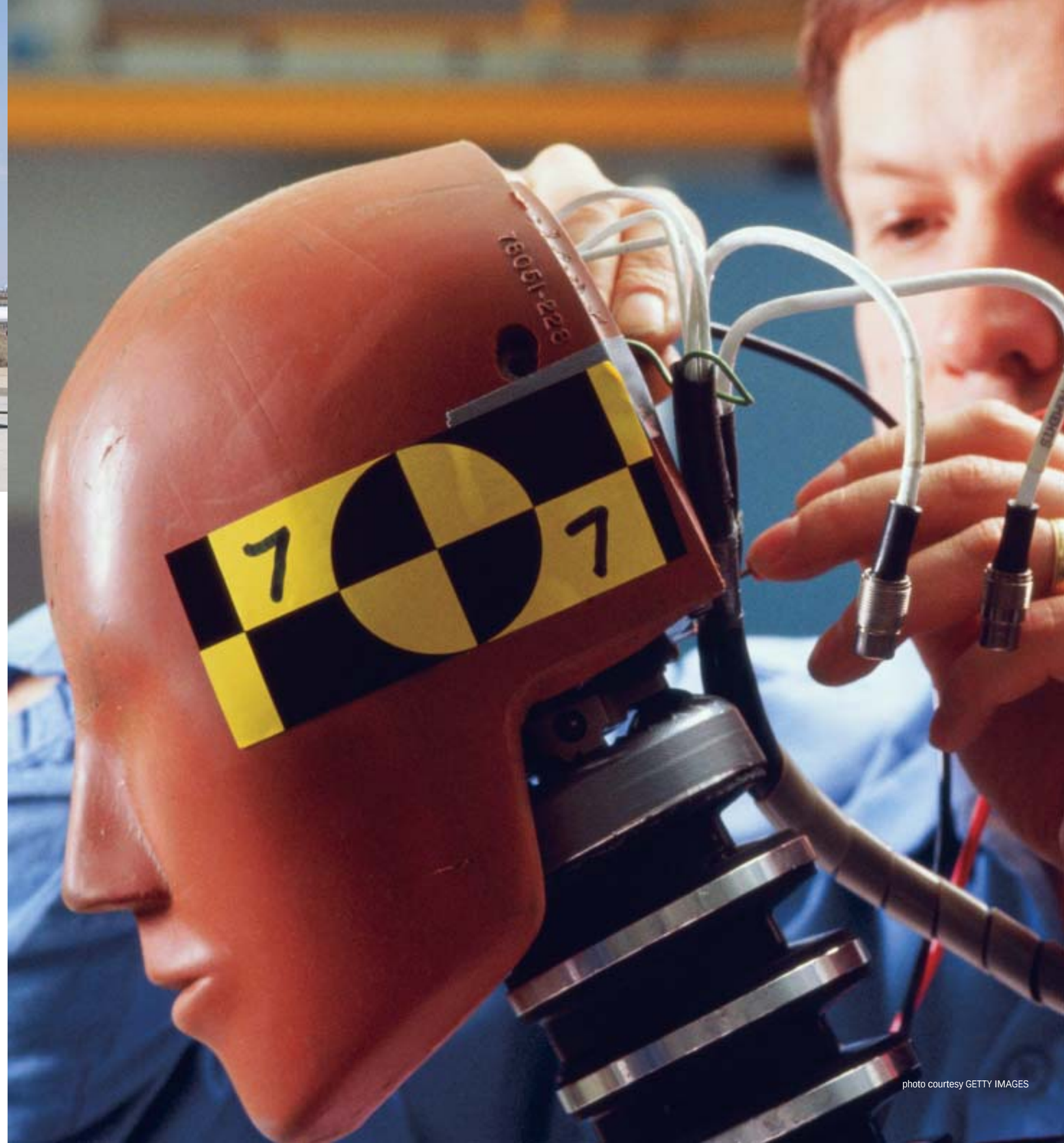


photo courtesy GETTY IMAGES

photo courtesy NASA

Position transducers convert mechanical motion into electrical signals that can then be measured, recorded or transmitted.

SpaceAge Control, Inc., of Palmdale, California, has been manufacturing position transducers for more than 30 years. The company was founded in 1968 to design and manufacture pilot protection devices for space-based and high-performance test aircraft. Two years later, they were awarded a contract to produce high-precision, small-format position transducers for aircraft flight-control testing at NASA's Dryden Flight Research Center – a veritable hotbed of experimental aircraft testing conveniently located at nearby Edwards Air Force Base. The success of that first product led SpaceAge Control to develop and produce a complete line of position transducers that soon saw use by virtually all U.S., Canadian and European aerospace companies for research, development and testing.

Position transducers convert mechanical motion into electrical signals that can then be measured, recorded or transmitted. A typical transducer consists of a stainless steel extension cable, a spring-loaded drum and a precision rotary sensor. The cable is wrapped on the drum (much like fishing line on a reel), and the drum is attached to the rotary sensor. The body of the transducer is mounted in a fixed position and the extension cable is connected to a moving object. As the object moves, the cable extends and retracts, rotating the drum. This causes the precision rotary sensor to produce an electrical output that is proportional to the distance the cable travels. The measured electrical output reflects the position, direction or rate of motion of the moving object.

Collecting such information during flight testing allows engineers and designers to "see" – through measured and recorded data – exactly what an aircraft's individual components and subsystems are doing during the test. But transducers paint only part of the picture. It is also necessary to know what's happening aerodynamically: What external forces are acting upon the aircraft during testing? This information is collected by measuring airflow data. Since SpaceAge Control was already well established as a supplier of high-precision transducers, it was only natural for the company to expand its scope and develop flight test air data products.

Commonly know as air data booms, these devices attach to the nose or wing of an airplane or helicopter to provide airflow information – speed, pressure, angle, etc. Most air data booms contain pickups to measure total and static pressure, and have vanes to measure angle of attack and sideslip. The vanes, also called airflow direction transmitters or flow-angle sensors, are coupled to precision potentiometers to provide an electrical signal indicating airflow direction relative to the air data boom's longitudinal axis.

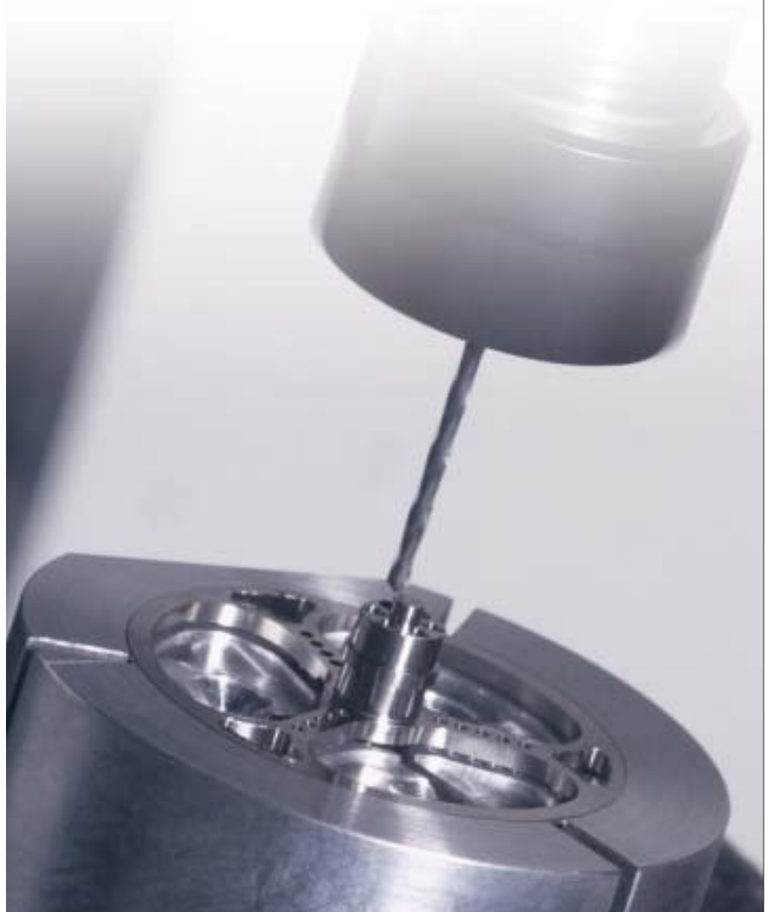
While initially designed for use on aircraft, position transducers and air data booms have also found their way onto Indy, CART and NASCAR racing cars. By analyzing data collected during track and wind tunnel testing, race teams can modify their vehicles to improve performance.

In the early 1990s, it became apparent that SpaceAge Control's products had potential applications for other industries as well, so the company began marketing its position transducers outside of aerospace. "We started a program called the Evaluation Position Transducer Program," relates Tom Anderson III, general manager. "Many people weren't certain that a transducer would serve their application, and I wasn't in the position to guarantee that it would. But I would ship one out to you for free: If it doesn't work, then ship it back, and if it does, then purchase it." The free evaluation program helped the company grow, as new industries – entertainment, trucking, medical and more – discovered uses for position transducers.

Today, five of the world's seven largest auto manufacturing companies and all seven of the world's largest aerospace companies make extensive use of SpaceAge Control products. It's a statistic the company is proud of: A world map hanging in the office shows the 40 countries where their products are in use. "What do you think this dot high above the map is for?" Anderson asks. "Well, it's for outer space. We have position transducers monitoring a bellows system on the International Space Station."

While the company's products are decidedly high-tech, their manufacturing processes were decidedly low-tech in the beginning. In the early days, the company had 15 manual mills that were used to make the transducers and air data booms. But as more and more companies began using their products, it became necessary for SpaceAge Control to reconsider its operations. "We got to the point with the manual machines that we couldn't keep up with production," says Anderson. "So we chose to subcontract work to nearby job shops, while using the manual machines for prototyping and custom work.

"There is no way you can measure the headaches we've avoided by having our own machine shop. The fewer people you have to deal with, the fewer problems you're going to have."



"In about 1998," Anderson continues, "I was looking at the books and noticed we had spent more than four hundred thousand dollars on outside machined parts. We decided then to get our own CNC machines in here. The bottom line is that having our own modern machine shop saves us money."

It has also saved production time and eliminated a number of problems, says Anderson. "We were complying with ISO 9001 standards, which made it hard to work with some job shops. We had to get three quotes, so I would have to call the shops and ask them when we were going to get their quote. There is no way you can measure the headaches we've avoided by having our own machine shop. The fewer people you have to deal with, the fewer problems you're going to have."

It didn't take long to realize substantial savings of both time and money. "Before," says Anderson, "it would sometimes take up to 90 days to get parts, because our vendors had larger orders to fill. If they got an order for a thousand parts from someone else, then my parts would get set aside. Now, parts production better matches the demands of assembly."

The decision to switch to CNC was a no-brainer for SpaceAge: It was necessary to keep up with demand and remain competitive. The decision to purchase Haas CNC machines, Anderson says, was just as easy. First, he talked with the people at the job shops that were already making his parts. Then he did further homework by visiting trade shows. The Haas name kept coming up. "We were Haas fans before we had our own, because the job shops we used all had Haas machines. We did some research and continued to hear good things," Anderson relates. "No matter who you are or what you make, there is often a little dirt some place, but I've never heard anything bad about Haas."

“We have multiple programs loaded into the memory, and since our parts are very similar to one another, we often do the editing right at the control.”

SpaceAge Control’s first purchase was a VF-2 in 1999, and four more Haas machines were added over the next three years. “It was important to standardize the machines,” says Tom Anderson IV, application development manager and son of the general manager. “We might have been able to save money by buying used machines, or machines from different manufacturers, but we wanted to standardize the controls.”

That turned out to be a good choice, notes the elder Anderson. “Haas has demonstrated time and again that if we have a technical problem, we pick up the phone, call them and get an answer. If it’s a mechanical problem and we can’t correct it ourselves, they’re out here in a heartbeat,” he says. “I’ve become a firm believer. If I need more machines, I don’t have to look anywhere else.”

The shop began with two machinists and two machines, and has since grown to its current size of 9,000 square feet with five Haas machines, including an SL-20 lathe. “By having our own shop, we can prioritize our own work; we can control our own destiny,” says Tom Anderson III.

Although the CNC machine shop is still in its infancy – its most veteran member has worked there for just 13 months – the user-friendly Haas control has allowed the company to maintain production levels, despite a turnover in machinists. “People who have previous experience with CNC don’t have any problems picking up the Haas control,” says Sergio Allain, who is the veteran of the shop. “When they say friendly control, they mean it; the Haas is a friendly control.”

Machine shop manager Robert Curtis, who has only six months experience on the Haas machines, echoes Allain’s opinion. “My background was with Japanese machines and Fadals,” he says. “It was an easy conversion for me to come in here and start using the Haas machines. The programming is in many ways easier than on other machines, and the editing is a piece of cake. We have multiple programs loaded into the memory, and since our parts are very similar to one another, we often do the editing right at the control.”

“We all like using the Quick Code to program,” adds Allain, “because sometimes you don’t remember everything. It gives us all the information we need right there at the control.” He also likes the background edit feature. “With long cycle times, I’m able to edit one program while another is running. That feature keeps me ahead.”

Although some of the more complex parts are programmed offline using CAD/CAM software and loaded into the machine through the floppy disk drive, many parts, such as the drum for a position transducer, are programmed right at the control.

“The drum is the part of the transducer that the cable wraps around,” explains Curtis. “The other end of the cable is then attached to whatever you want to measure. The drum has two sets of identical pockets – three large and three small – that have to be milled around the center. With the Haas control, I’m able to program just one of the pockets in each set, and then use the G68 rotation feature to move the pocket to the two other positions without having to write all the code over again. The G68 just makes the programming much easier.”

“With the Haas control, I’m able to program just one of the pockets in each set, and then use the G68 rotation feature to move the pocket to the two other positions without having to write all the code over again.”

Machined out of 303 stainless, the finished drum is only 0.080" thick at the 1.5" outer diameter. It is first turned to size on the SL-20 lathe, and then moved to a VF-0 for the milling operations. The larger pockets are roughed out first, using a 3/16" endmill. Then a 1/16" endmill cuts the three smaller pockets before a number of 0.041" diameter holes are drilled.

Curtis says he’s pleased with the positioning accuracy of the Haas. “The machines at my previous job had a bit of a problem holding the accuracy; I don’t have that problem with the Haas.” He’s also pleased with the change from working in a job shop to managing a machine shop in a production environment. “It’s wonderful for me to be able to walk over and talk with the inspector and the engineer about any problems we might have in machining a part,” he says. “The feedback is great.”

This not only improves the quality of the parts, but also makes handling special jobs quick and easy. “If we get a call from a customer who needs something right now, even though we have a backlog, we can shut down the current order and hammer out the parts we need the next day,” says Anderson. “We couldn’t do that when we were sending parts out to a job shop.”

The same is true of prototype parts, especially with the newest addition to the company’s machine tool arsenal: a Haas Mini Mill equipped with a Haas 5C collet indexer. “The original reason for the Mini Mill was that it would be nice to do prototype work on,” says Anderson, “but we’ve used it for production work, too.” And as the demand for the company’s products continues to grow, the added capacity is welcome.

Position transducers from SpaceAge Control are used by countless industries in countless ways. Railroads are now using transducers to monitor displacement and vibration. The collected information is used to design better suspension components and to troubleshoot reliability issues. A recreational equipment company has used transducers to monitor the effects of high winds on its tents, to determine their structural integrity under extreme conditions. And transducers have been used to monitor flight control surfaces on today’s latest unmanned aerial vehicles, such as the Northrop Grumman Global Hawk and Fire Scout.

NASA has also used the company’s air data booms and position transducers since 1993, to improve thrust redirecting of engine exhaust on the F-15, as well as for other programs. “A new project they’ll be using our components for,” says Anderson IV, “is an investigation into reducing the noise level of sonic booms, so that business aircraft can be made to go supersonic without disrupting surrounding communities.”

“Last year, aerospace was our biggest market for transducers,” adds Anderson III, “but the year before that it was the automotive sector.” Which brings us back to the crash test dummy. “We have all seen the ads with a car hitting a barrier. They set up transducers on the chest cavity of the crash test dummy to check deflection of the rib cage. We also have units in the knees and shoulders.” The transducers are able to convert the movement from the jarring crash into electrical signals for detailed analysis, allowing engineers to improve the safety of automobiles.

While it’s unlikely you’ll ever see a position transducer or an air data boom from SpaceAge Control, there’s little doubt that you’ll benefit from their use. The data collected from these high-tech devices has helped test some of the most innovative machines of the past, the present and the future.

SpaceAge Control
661-273-3000

Stanford University:

Improving Communication Through Hands-On Experience

Story & Photos
Scott Weersing

Most students get their start in the lab with an undergraduate engineering course on manufacturing.

In machine shops across the country, a jarring communication gap often exists, yet it goes largely unnoticed.

"I need this part made out of this material," says the engineer.

"How do you want me to mill this?" asks the machinist, not expecting a response.

"I don't know, I just need it as soon as possible," whines the engineer.

"What tools do you want me to use?" asks the machinist, already thinking of the possibilities.

"I don't know, I gotta go. I have more important things to do," says the engineer, abruptly ending the conversation.

To some, this scenario might sound frustratingly familiar, but it doesn't have to be this way. At least one learning institution is working to bridge the communication gap between those who design and engineer parts and those who machine them.

At Stanford University, future engineers and product designers are moving out of the classroom and into the machine shop in order to get a better grasp of manufacturing processes, design methods and, most of all, communication. On the school's Northern California campus is the Stanford Product Realization Lab (PRL), a unique machine shop where students use the latest vertical machining centers from Haas Automation to make their own parts – and find out first hand just what it takes to bring their designs to life.

"Some schools do a great job with the analytical," says David Beach, PRL director and teaching professor of the Design Division at Stanford's Department of Mechanical Engineering. "But very few schools do things that lead to judgment and instinct about the manufacturing process. Students here have a real edge."

"Stanford is very research oriented and very theoretical," says Katherine Kuchenbecker, a Stanford graduate engineering student. "And there are some people higher up who don't realize the value in learning the practical training. It is so important to come into the lab and mill something before you go off and try to design something."

One feature that attracts students to the PRL is its location. Situated right in the center of the Stanford campus, it brings in students from all walks of life. There are the expected ones, of course, such as the mechanical engineering students taking required lab courses. Then there are the graduate students who are specializing in manufacturing engineering. But there are also those who just hear that great things are going on at the PRL and decide to give it a try. "Students walk by and wonder what those crazy engineers are doing in here," says Kuchenbecker. "They hear about what we're doing, and before you know it, they're signing up for classes."

"For the students, this lab is an attractive place," says Beach. "It's right across the street from the student union. There's a lot of natural light in here, and there's a strong sense of community, with students working together to solve problems and create things."

While most universities have a machine shop for engineering, it is often hidden away in a basement and used only by students taking labs. But the PRL is open 6 days a week for anyone to use, as long as they're willing to learn and have gone through the safety-training course.

"The lab time is divided into structured activities and open lab," explains Beach. "During open lab, we essentially invite the whole university to come here and play." The PRL is equipped with a Haas VF-0 and two Haas Mini Mills; there are also manual knee mills for traditional machining, as well as woodworking, foundry, plastics molding, welding, finishing and metrology tools. Students get even more practical experience with the lab's laser cutting machine and injection molding machine.

While Stanford is known today as a pre-eminent research university, it was not always that way. "It wasn't until after World War Two that Stanford became a research institution," says Beach. "But there have always been professors who wanted to maintain the machine shop."

The school's first machine shop was actually a blacksmith's shop. In 1876, Leland Stanford, who made his fortune building the Central Pacific railroad, bought 650 acres south of San Francisco and established the Palo Alto Farm. It was here that blacksmiths created horseshoes for the trotters raised on the farm.

When Jane and Leland Stanford's only son, Leland Jr., passed away at the young age of 15, the couple decided to open a university in his memory. Leland Stanford Jr. University opened its doors in 1891.

“The imagination needs to be cultivated and developed to assure success in life. A man will never construct anything he cannot conceive.”

Machine shops were part of the university from the start. Not only did the founders want students to learn, they wanted students to make things; it had been one of young Leland’s main interests. Before his death, Leland Jr. wrote in a letter, “Mama and Papa have promised to give me a complete machine shop at Palo Alto.” When Jane Stanford visited the machine shop on one occasion, she remarked, “If my boy were still alive, this is where he would be.”

One of the objectives of Stanford university is to “train students for personal success and direct usefulness in life.” This mission is still carried out in the PRL, as students take what they have learned in the classroom and apply it to machining and manufacturing. “The imagination needs to be cultivated and developed to assure success in life,” Leland Stanford wrote. ”A man will never construct anything he cannot conceive.”

The machine shop was under-used until machining caught up with computers and CNC controls. “Our first CNC machine was a Japanese model which had little memory and didn’t hold cutting fluids very well. You practically had to wear a raincoat if you wanted to stand in front of it,” reports Beach. “But then one of our former students, Ken Martin, bought a new Haas VF-2 and asked if we wanted his old VF-0. We had a grant that would match donations dollar for dollar, and the university accepted the value of the VF-0, which gave us the matching funds to buy two Haas Mini Mills in 2000.

“Since the Haas machines have come in, we’ve been able to increase the enrollment in labs and courses,” notes Beach. “Everybody feels that the Haas machines are user-friendly and more accessible. As the word got out on the street, the demand started to build, and so the popularity of the lab has gone off the charts.”

Most students get their start in the lab with an undergraduate engineering course on manufacturing. After that brief taste of machining, many return to take ME 213: Computer-Aided Prototyping and Design. In this class, students attend a lecture twice a week from Professor Beach, and then a 4-hour session in the PRL, where they design and make a variety of things, such as bottle openers, bicycle parts and mold inserts.

For the design stage, the PRL has a loft equipped with personal computers running the latest software. Students use the SolidEdge CAD program, as well as a digitizing device from Immersion Corporation, to input their designs to the computers. The lab also has 12 seats of GibbsCAM 2000. The finished programs are then fed into the VMCs through the RS-232 ports.

Guiding the students is a team of teaching assistants, better known as TAs, who oversee the lab and teach the lab sections. “The TAs want to be heroes for the roughly 500 students a year who use this facility,” says Beach. “They want to be their design coach, mentor, consultant and manufacturing tutor. Our success in getting students excited about imagining something and then creating it physically is largely because of the TAs.”

“We aren’t grading papers like other TAs,” says Kuchenbecker. “Instead, we’re trying to keep students from breaking tools and crashing machines.” In the ME 213 course, students learn to use the machines by first cutting a license plate out of plastic sign stock. The unique license plates decorate the walls of the lab and qualify students to “drive” the Haas machines.

“Students learn communication in these classes,” says Beach. “Those who are becoming design engineers and manufacturing engineers now might have enough sense and experience to talk with whoever is going to build what they have designed. And these students will have respect for the machinists and pay attention to what they have to say. Students coming out of this class should be able to interact with machinists to both create parts and have meaningful discussions,” he adds.

But the engineering students aren’t the only ones using the Haas machines. Students in the graduate design program are also learning to manufacture their creations using the Haas machines, and other classes have developed a variety of products, including medical devices, model yachts, bikes and jewelry.

Stanford has always had a tradition of providing electives to broaden the education of students. “We even offer a wood shop class,” says Beach, “because many of our students didn’t have an opportunity to work with their hands while they were in high school.”

It’s this hands-on training that is key to improving the communication between engineers and machinists. By knowing what it actually takes to machine a part, engineers and designers are much more able to tell the people on the shop floor what they need.

But communication doesn’t, and shouldn’t, stop there. Stanford is also working to improve communication on the business side of things. To bridge the gap between the entrepreneur and the engineer, the school has developed a course entitled Integrated Design for Marketing and Manufacturing, where business students work with engineers to plan and implement the manufacture of a product. “The program is great in that engineers and business people get to know each other’s values,” says Beach.

So, while the students at Stanford may never machine another part once they enter the business world, their practical experience in machining will serve them well. Understanding the process will allow them to communicate better with production managers and machinists.

Stanford Product Realization Lab
650-723-3917

Haas Mini Series Expands with Mini HMC

When Haas Automation, Inc., first introduced its line of Mini machines – the Mini Mill, Super Mini Mill and Mini Lathe – it took the industry by storm. These innovative products provided a previously unheard-of combination of high capabilities, compact footprint and affordable price. Haas continues that trend with the latest addition to the Mini line – the new Mini HMC.

The Haas Mini HMC is a compact horizontal machining center with a generous 15" x 15" x 10" (xyz) work cube, a twin pallet changer and built-in 4th axis capabilities. The machine is equipped with a 12,000-rpm, 40-taper spindle that features a unique inline, direct-drive system that couples the motor directly to the spindle rather than using belts. This results in less vibration, less heat and less noise than other drive systems, providing better surface finishes, extreme thermal stability and very quiet operation. Powered by a 30-hp vector drive system, the spindle yields plenty of low-end torque, as well as the speed necessary for high-speed machining operations.

High speed and extreme versatility were the key design criteria for this innovative machine. The Mini HMC features a twin pallet changer (300 mm pallets) that allows the operator to load and unload parts on one pallet while the machine mills parts on the other. Once machining is complete, a servo-driven changer swaps pallets in approximately 2 seconds to maintain nearly constant spindle time. A built-in 4th axis provides precise positioning for multi-sided parts and tombstones, or allows simultaneous 4-axis motion for complex geometries. Ultra-fast ballscrews and high-torque servo motors on all axes provide rapids up to 1,400 ipm and accelerations to 0.75 g to reduce cycle times, and a 24-pocket side-mount tool changer swaps tools in just 2.8 seconds.

While gravity helps clear the chips, there is also plenty of coolant available for any machining operation. The Mini HMC features a large-capacity coolant tank and a high-volume coolant pump. The user-friendly Haas CNC system provides seamless machine operation and is easy to learn and operate.

The new Mini HMC from Haas Automation, Inc., is a state-of-the-art horizontal machining center that provides high-speed milling capabilities in an affordable package designed to pump up a shop's parts volume.

Haas SL-40L Long-Bed Lathe Ready for Big Parts >>

Long shafts and tubing pose unique challenges for turning centers, especially when deep-hole drilling and boring are involved. To meet those challenges Haas Automation, Inc., introduces the new SL-40L Long-Bed lathe – a machine designed specifically to handle long parts, from oil field components to automotive drive shafts to machinery rollers.

The Haas SL-40L Long-Bed is an extended version of the company's shop-proven SL-40 turning center that provides a maximum cutting length of 80" (nearly twice that of the standard SL-40) and a maximum cutting diameter of 25.5". It also comes equipped with a fully programmable hydraulic tailstock.

In standard form, the machine features a 15" chuck and an A2-8 spindle nose that provides a bar capacity of 4.0". A 40-hp (peak) vector dual-drive system combines with a high-torque gearbox to yield 1,400 ft-lb of spindle torque for heavy cutting, and speeds to 2,400 rpm for finish work and high surface feedrates. On-the-fly wye-delta switching provides the high torque and wide constant-horsepower band necessary for constant surface speed cuts.

To accommodate large-diameter tubing, a Big Bore version of the SL-40L is also available. This option upgrades the machine to an A2-11 spindle nose and features a 6.75" through-bore (chuck, draw tube and hydraulic coupling are not included). To support extra-long parts through the bore, a rear chuck provision is available that allows an air chuck to be mounted to the rear of the spindle. An optional steady rest platform is also available to provide increased support for turning and boring long shafts. Hydraulic power for the steady rest is provided by the lathe, and the gripper (not supplied) is activated automatically via M code.

Other options for the SL-40L Long-Bed lathe include live tooling , full C axis, high-pressure coolant, a chip auger and a tool-presetter system. A number of control options are also available, including expanded program memory, Ethernet interface, user-definable macros and Haas' conversational Visual Quick Code programming system.

Like all Haas machines, the SL-40L features the powerful and user-friendly Haas control. Designed and built in-house, it is optimized specifically for Haas machines. The Haas CNC accepts ISO standard G code and is compatible with all major CAM systems.

Convert Your 3-Axis Mill to a 5-Axis Workhorse

Five-axis machining, once the exclusive realm of high-end machine shops and aerospace contractors, is seeing much more common use today as a means to reduce setup time and increase accuracy for complex parts. While the benefits are undeniable, investing in a 5-axis machine tool can be prohibitively expensive, especially for smaller shops.

The new TR160, TR210 and TR310 dual-axis trunnion rotary tables from Haas Automation, however, put 5-axis capabilities well within reach of the average job shop. These simple bolt-on solutions for machining complex parts can turn almost any 3-axis mill into a 5-axis workhorse – and at a fraction of the cost of a 5-axis machining center. They are ideal for such industries as model making, tool & die and aerospace, where complex shapes, multi-sided machining and 5-axis work are the norm.

Available in three sizes (160 mm, 210 mm and 310 mm platters) to fit almost any work envelope, the TR series dual-axis trunnions bolt directly to the table of a 3-axis VMC to provide 5-axis motion or position parts to nearly any angle for multi-sided machining. Yet, like all Haas rotary tables, they can easily be removed when not needed.

All three trunnion tables are driven by powerful brushless servo motors on both axes, and provide ±120° of tilt on the A axis and a full 360° of rotation on the B axis. Each features a precision-ground platter of heat-treated 4140 alloy steel, with six standard T-slots (0.625") equally spaced at 60 degrees for easy fixturing. Three servo control configurations are available, making the TR160, TR210 and TR310 easy to interface to almost any machine, whether it's a Haas or another brand.

The smallest of the TR series, the TR160, features a compact footprint of just 39" x 14", and has a maximum part capacity of 80 lb and a maximum part swing of 17.5". The TR210 features a 200 lb capacity and 23.5" swing, and the TR310 handles parts up to 500 lb and has a 31" swing. Platter speeds for the three models are 80°/sec, 60°/sec and 50°/sec respectively. Additional specification are available online at www.haascnc.com/products/rotary/.

Like all Haas products, the TR series trunnion tables are built entirely in the USA, from top-quality materials and to exacting specifications. This guarantees the exceptional accuracy and reliability Haas is known for.

If you're searching for an economical solution to 5-axis machining, look no further. The new TR series Trunnion Rotary Tables from Haas are the answer.

Dear Applications:

When I'm setting up a new job, is there a way to clear my offsets all at once? Right now I go through and zero each one separately, by pressing 0 and then F1 for each offset. I would like to be able to do them all at once.

Walter Stevens

Dear Walter:

Yes, you can clear all of your offsets at once, with a single button and with verification. To do this, go to the offset display you wish to clear – tool offsets, work offsets or wear offsets – and press ORIGIN. The control will ask "ZERO ALL (Y/N)?" to verify the change. If you press Y, then all the offsets in that section will be zeroed. If you have the Haas macro option, this will also work for clearing macro variables. (Haas mill control software version 10.02 and above; Haas lathe control ver. 3.00 and above.)

Sincerely,
Haas Applications

• • •

Dear Applications:

I was going through all the settings I have available to adjust on my new Haas VF-4 and noticed Setting 103, CYC START/FH SAME KEY. How do I use this setting?

Ralph Warren

Dear Ralph:

Setting 103 is really useful when you're carefully setting up and running through a program. When Setting 103 is on, the Cycle Start and Feed Hold functions are both controlled by the CYCLE START button. When CYCLE START is pressed and held in, the machine will run through the program; when it's released, the machine will stop in a feed hold. This gives you much better control when setting up a new program. This feature should be turned off when you're done using it. Setting 103 can be changed while you're running a program, but it cannot be on when Setting 104 is on. (Haas mill control software version 9.06 and above; Haas lathe control ver. 4.11 and above.)

Sincerely,
Haas Applications

• • •

Dear Applications:

Is it possible to enlarge the image on the Graphics display to show more detail when it is running through a program?

Jose Cruz

Dear Jose:

Yes, you can zoom in on the graphic image to enlarge the section that you're interested in (the graphics will also appear to run more slowly when enlarged). To do this, first run the program in Graphics, then press F2 and the PAGE DOWN and arrow keys to select the tool path portion you want enlarged. Press WRITE/ENTER to accept the zoom view, and CYCLE START to run the program again. You'll have a much better view of the area you selected.

You can also use the SINGLE BLOCK key to step through the program line by line, whether in zoom mode or overview. Press SINGLE BLOCK, then F3 (to display axis positions), then F4 (to display the program G code). Now, each press of the CYCLE START button will run one line of the program.

If Setting 104 (Jog Handle to Single Block) is turned on and you press SINGLE BLOCK, then each counterclockwise click of the jog handle will execute one program line. Turning the jog handle clockwise will cause a feed hold. (Note: You can change Setting 104 while a program is running, but it can't be on at the same time Setting 103 is on.)

If you don't need to see rapid paths and drill points, you can simplify the graphic image by turning off Setting 4 (rapids) and Setting 5 (drill points). (Haas mill control software version 9.06 and above; Haas lathe control ver. 4.11 and above.)

Sincerely,
Haas Applications

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Dear Applications:

Is there a way to use the Haas control to delete a program file from a floppy disk?

Gwen Drury

Dear Gwen:

Yes, Haas machines allow you to delete files from a floppy disk. *(Note: This requires the latest floppy driver EPROM chip version FV 2.11.)* Go to the LIST PROG display page and type "DEL <filename>" (where <filename> is the name of the file you want to delete from the floppy disk). Press WRITE/ENTER to delete the file. The message "FLOPPY DELETE" will appear, and the file will be deleted from the floppy disk. If you need to see the list of file names on the floppy, press F4 and then, when the "DISK DONE" message is displayed, press EDIT. (Haas mill control software version 9.63 and above; Haas lathe control ver. 3.00 and above.)

Sincerely,
Haas Applications

• • •

Dear Applications:

On another CNC machine, I am able to feed hold in the middle of a milling cut and handle jog away, to check the tool and/or the part, and then press Cycle Start to continue the program. The machine will continue on from that point I had pulled away at. Can I do that on a Haas mill?

Daniel Grisin

Dear Daniel:

Yes, Haas mills have a run-stop-jog-continue (RSJC) feature that allows the operator to interrupt program execution, jog away from the part to perform a desired task, and then return to the interruption point and resume program execution. Once RSJC is initiated, the operator is able to stop and start the spindle, jog the XYZ axes individually (axes other than X, Y, and Z cannot be jogged), or command a tool release. The following describes the RSJC procedure. (Haas mill control software version 11.20 and above.)

1) While a program is running, press FEED HOLD. This will stop all motion (after any canned cycle in process has been completed.)

2) Press X, Y or Z followed by the HANDLE JOG key. The control will store the current X, Y or Z position. Axes other than X, Y, and Z cannot be jogged.

3) At this point, the control will display the message JOG AWAY, and will tick once each second or so. The operator can use the jog handle, remote jog handle, the HANDLE JOG increment buttons (.0001/.1, .001/1., .01/10., .1/100.) or the JOG LOCK buttons to move the tool away from the part. Now you can use the COOLNT key to cycle the coolant, and CW, CCW, STOP to operate the spindle. You can also use the TOOL RELEASE button, and turn Through-Spindle Coolant (TSC) on and off using the AUX CLNT key. Note that using AUX CLNT requires that the spindle be rotating and that the door be closed. At this point tools can be swapped out and the associated length and diameter offsets adjusted. However, when the program is continued, the old offsets will still be used for the return position and any motion commands already in the queue. **It is therefore unsafe to swap out tools and adjust offsets when the program is interrupted during a cut.**

4) When you're ready to continue, jog to a position as close as possible to the stored position, or to a point where there will be an unobstructed rapid path back to the stored position.

5) Return to the previous mode by pressing MEM, MDI or DNC. The control will only continue normally if the mode that was in effect at the time of the interrupt is re-entered.

6) Press CYCLE START. The control will display the message JOG RETURN and rapid X and Y at 5% to the position where FEED HOLD was pressed; then it will do the same for Z. The rapid rate override keys have no effect during JOG RETURN. Note that the control will not follow the path the operator used to jog away. Instead, it will perform simple moves without regard for obstacles. Therefore, a crash is possible. If FEED HOLD is pressed during this motion, the control will go into a feed hold state and display the message JOG RETURN HOLD. Pressing CYCLE START will cause the control to resume the JOG RETURN motion. When the motion is completed, the control will again go into a feed hold state.

7) Press CYCLE START again and the program will resume normal operation.

Sincerely,
Haas Applications

Rough. Contour. Finish. Next.

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