

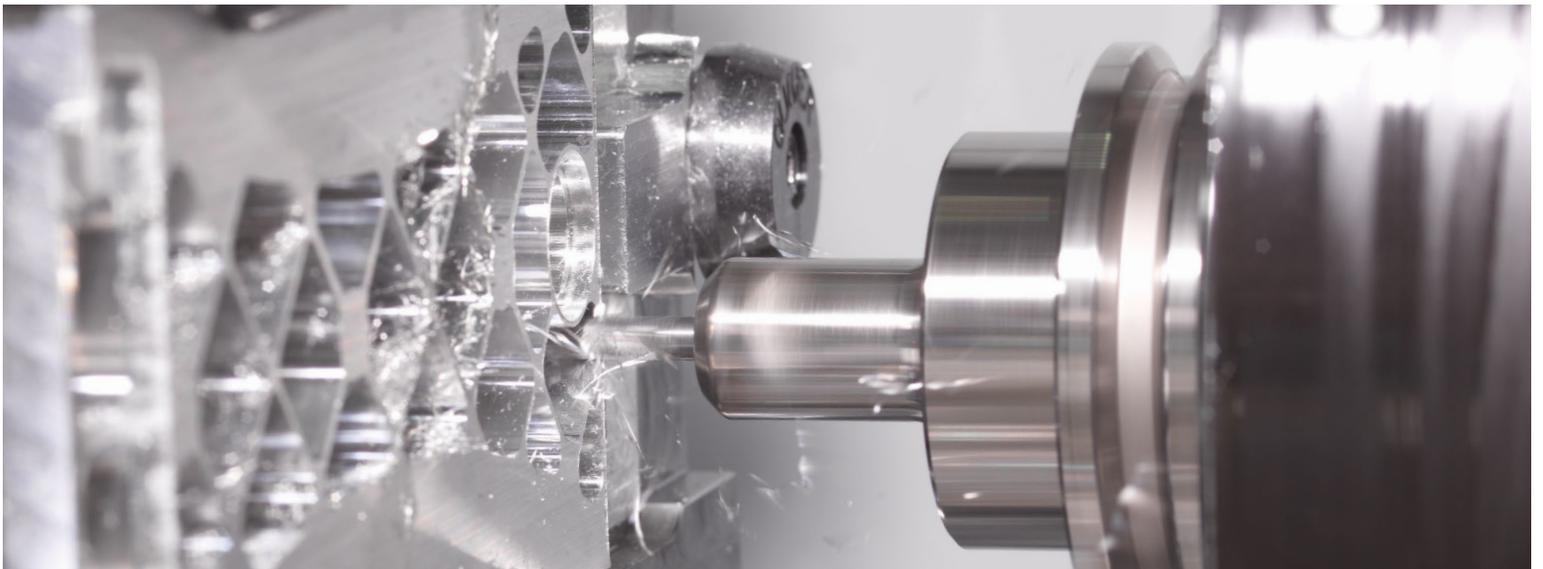
# COMPETITIVE PRODUCTION

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## INSIDE FEATURES

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**GROWTH DEMANDS**

**A FLEXIBLE MIND-SET**



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Today's manufacturers continue to balance the demands of aligning production requirements with customer demand, all while trying to increase spindle utilization. The challenge of producing a diverse product portfolio with shorter production runs and keeping inventories low requires higher spindle utilization and increasing process optimization.

Many companies are finding that conventional manufacturing methods are no longer sufficient for their current requirements. Many times the biggest challenge lies internally—and that is in getting over the discomfort related to changing a process. This is where a flexible mind-set and flexible-enabling technology can make that process a reality. Companies need this enabling technology for them to become efficient enough to keep up with the increasing and changing demands.

Implementing flexible automated technology can help a company standardize operations, push product out faster and achieve the kind of quality that helps them better compete against pressures from low-labor-cost countries. These companies thoroughly understand how their investment ultimately impacts their overall cost and their bottom line.

With less downtime (the result of a robust and reliable machine platform), increased capacity and enabling automation technology, the results translate into meeting customer demand.

The original equipment manufacturers (OEMs) featured in this issue of *Competitive Production* all have one thing in common: innovation. They innovated their machining operations with the kind of flexible technology that keeps them agile enough to switch between orders as their business situation changes. They were open enough to work with Makino engineers who understood how to help them execute their vision—whether that involved implementation of horizontal machining centers in flexible modular systems or achieving specific output quantities or a quality standard. Having that open mind has helped them meet mounting just-in-time requirements, no matter what the volume or variety, while providing reliability and tangible value.

Is your company willing to change its mind-set about its current manufacturing process?

CONTENTS



## HORIZONTAL MACHINING CENTERS BRING A NEW DEGREE OF PRODUCTIVITY AND RELIABILITY

Matt McPherson has been passionate about bowhunting all of his life. It began as a child, hunting deer with his dad and brother. They used bows because his mother forbade them from using guns, and McPherson ended up loving the sport. By age 6, he was assembling his own stick bows, and by age 13 was making compound bows. Today McPherson is still creating them at his company, [Mathews Inc.](#), where he aims for bringing continual improvement to the archery industry through innovation, impact and integrity.

Mathews is a household name in the bowhunting world. As the company's sole designer, McPherson strives to make his bows better while also making them simpler to use. He is committed to this continuous innovation, which is also one of the company's core values. He and his team are continually working to introduce new designs, technology and products. And they have been successful in doing so. Mathews revolutionized the industry with its Solocam® single-cam technology, making a bow that is lighter, faster, quieter and more accurate. McPherson has also created a parallel limb design, instead of an arch design as found in other products. These are the types of innovations that his company has implemented throughout the industry.

“When we're thinking about creating the ultimate bow, it has to have speed, a smooth draw-cycle, tack-driving accuracy and a dead-silent shot—all wrapped in a lightweight package,” said Bob Ohm, director of public relations at Mathews. “Technology is key to achieving this. It has enabled us to put forth new designs while bringing quality control fully in-house.”

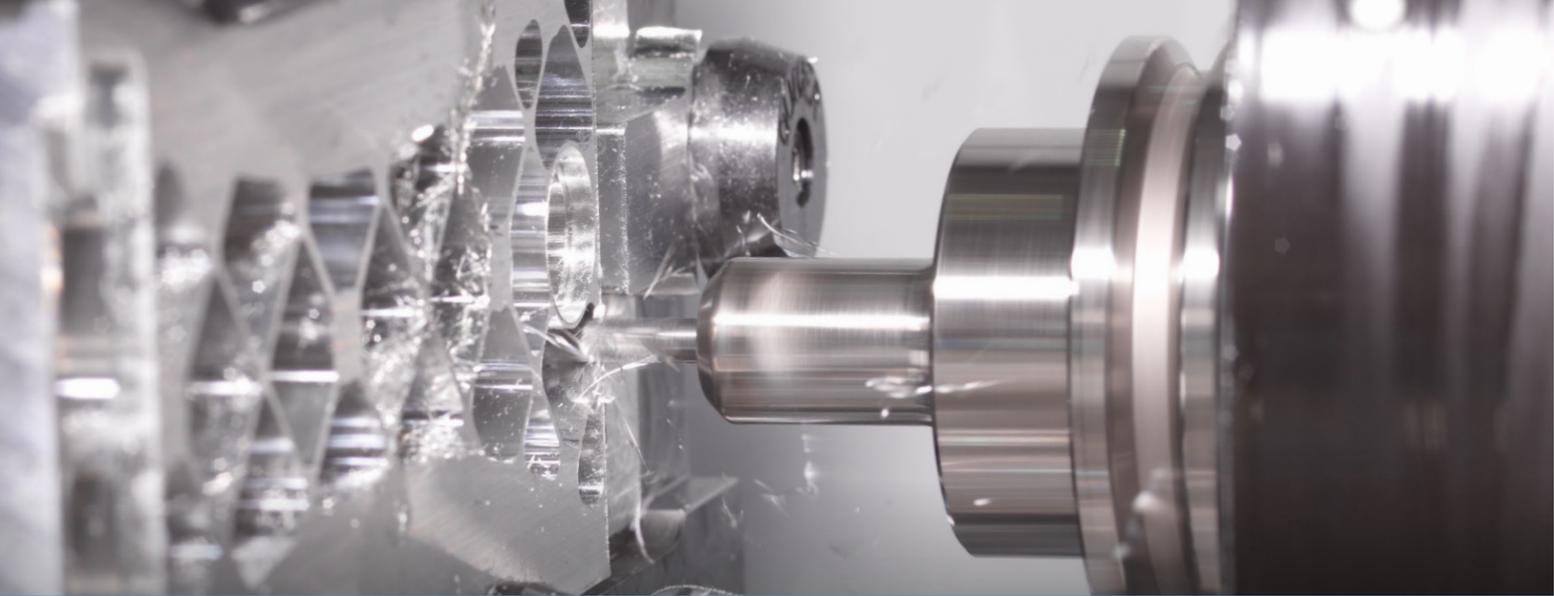
The company recently set its sights on its productivity and reliability by using a [Makino a51nx horizontal machining center](#) to bring as much as a 40 percent improvement in cycle times, helping it run more parts faster. This is just one aspect of the continuous innovation for which the company strives.

### STRAIGHT SHOT TO SUCCESS

Mathews sells a diverse line of archery equipment, components and accessories at independent retailers around the world. Its roots go back to McPherson's early passion for bowhunting that resulted from those hunting trips with family. In 1985 McPherson patented the InnerCam, a new type of high-letoff

**MATHEWS**

**SETS SIGHTS  
ON TECHNOLOGY**



Due to improved rapid speeds in drilling operations, Mathews saw a 36 percent cycle-time reduction in its riser component production.

eccentric bow, and started McPherson Archery. A few years later, he sold his controlling interest in the company, and in 1992 began Mathews Inc. in Austin, Minn.

“That first year the company had two employees and sold 175 bows,” said Ohm. “But by the next year, there were already 26 employees and 4,500 bows sold. Today there are over 400 employees; we are producing hundreds of bows daily, and are the largest grossing bow manufacturer in the world.”

The company moved to Sparta, Wis., in 1995. McPherson was originally from the area and spent a lot of time hunting in Wisconsin, so the location was a natural fit. Nearly all staff relocated, and McPherson credits a large part of the company’s success to these employees, who reflect the company’s core values of integrity, impact and innovation. The company always puts people before business as part of its core value of integrity. It strives to make a positive impact on its coworkers, customers and community, and the new designs and new products that Mathews produces

“Our productivity increased anywhere from 17 to 40 percent on some of our parts ... this level of performance changed the way we looked at our technology investments.”

is part of the company’s commitment to innovation.

#### TARGETING INNOVATION

Because of its ongoing innovation, McPherson radically redesigned the company’s main bow from a single into a split-limb configuration. As a result, the way in which the limbs are attached to the bow had to change. Previously, Mathews used a cup system made of aluminum. The new bow design required transitioning from a simple cup produced on a lathe to a more complicated cup system. Production needed to ramp up for this new limb cup, but Mathews didn’t want to outsource the job. The company first tried using its existing horizontal machining centers, but the machines just didn’t have

capacity. This led the company to evaluate machine tool manufacturers.

“Matt knew someone who recommended Makino machines for the job,” said Scott Jenkins, machine shop manager, equipment and design at Mathews. “Intrigued, we went to another company using Makino to check out the machines in action. We invited in our local Makino representative, Lynn Bachman, who made a solid case for the Makino machine by showing us a lot of test data. Frankly, we had a good relationship with the other machine tool company and had never really thought about changing machines before. But the reliability issues, coupled with the recommendation and company reputation, piqued our

interest, so we decided to evaluate Makino further.”

Still testing the waters, Mathews purchased three more of its existing machines and one [Makino a51nx horizontal machining center](#) to meet its production demands. The local SST dealer for Makino delivered this machine, and several Mathews operators participated in the in-house training that SST applications engineer Mike Johnson conducted.

“For us it was an easy adjustment to the a51nx,” said Mike Schlagenhauser, machine shop production manager at Mathews. “We were already familiar with Fanuc-based controls, and the touch-screen interface was very intuitive and user-friendly. Right off the bat, we were very happy with the machine performance. We were hoping to see 85 percent efficiency and were quickly at 87 percent efficiency on the a51nx. Our productivity increased anywhere from 17 to 40 percent on some of our parts. Plus, our other machines



were still having issues. This level of performance changed the way we looked at our technology investments.”

#### HITTING THE MARK

The a51nx decreased cycle times right out of the gate, on one part going from 42 minutes on the existing horizontal machine to 32 minutes on the Makino. The machine has a 14,000-rpm spindle, but most of the time saved was in in-cycle, out-of-cut operations. Mathews was running the limb-cup part using window fixturing to get behind the part, which required frequent B-axis rotations. Because the a51nx machine simultaneously conducts its tool changes and the B-axis rotations, having faster in-cycle non-cut times makes a difference, especially as Mathews creates 224 of these limb-cup parts per day.

“On some of our parts, we are using 15 tools and up to 20 tool changes,” said Jenkins. “When we are making 16 parts per hour, this adds up. Having the combined movements of the tool changes and B-axis rotations was a big



timesaving. Additionally, the machine is built to be solid and reliable. We are able to speed up the Makino machine and have less tool breakage due to the rigidity of the machine, which translates to less vibration in the cut.”

Less vibration led to better quality surface finishes and tolerances on bearing holes of plus or minus 0.0002 inch. The reporting features of the Pro5 control also helped operators track this saving and make adjustments to further improve the productivity of the machine.

“We have the ability to see where cycle-time improvements can be made to reduce feed time on a part,” said Rich Jerome, prototype technician, fixture design at Mathews. “But on some parts, the saving was already obvious. We gradually began transferring other jobs to the a51nx. On a separate riser part that requires a lot of drilling, the improvements in rapid speeds, which comprised 50 percent of the movement, reduced machining time by almost a full minute per part. This resulted in a 36 percent reduction in cycle time, from two minutes, 32 seconds to one minute, 38 seconds per part, in the full run. Makino has eliminated time on wasted motions that can be used for other processes.”

Enjoying more capacity and productivity, Mathews purchased another a51nx for its shop in the spring of 2014 and began moving other jobs to this machine. One example was a quiver accessory that was transferred from its other vertical machining center to the a51nx when the vertical machine couldn’t keep up with demand.

Mathews has produced over 1 million bows in the 22 years since it began and has over 200 patented or patent-pending innovations.

“We know that it’s a no-contest situation when trying to make comparisons on parts transferred from a vertical to horizontal machining center, but at the end of the day, it’s all about productivity and meeting demand,” said Jerome. “By bringing these parts over to the a51nx, we increased throughput by 180 percent. We were able to fit more parts on the fixture, producing eight parts instead of two, and were able to push tooling and cutting operations to the manufacturer limit without any

over 100 patented or patent-pending innovations.

“McPherson is self-taught, studying metallurgy, composites, compression molding, plastic-injection molding, metal-stamping processes and engineering, all on his own,” said Ohm. “Many of his innovations have changed the industry. For example, he has consistently pioneered lighter and faster bows. His Harmonic Damper system introduced in 2000 has become an industry-standard accessory. The

a foundation for quality that is in keeping with company integrity. All products are American made and carry a lifetime warranty. Mathews does not sell its products in the big-box stores, preferring instead to preserve the brand experience by selling through 1,200 licensed dealers that are highly trained.

“This allows us to maintain quality control throughout the product cycle,” said Schlagenhauser. “We ensure that our retailers can deal with any issue that can arise and keep our customers happy. We aim to put quality into everything we do.”

Keeping that quality means having full control over everything in the manufacturing process, which starts in the machine shop, where everything is made in-house except the castings and camouflage film that is put on the product. Tools are designed based on solid models, fixtures are created and runoff is done on the machines before releasing a part into production. A prototype group designs the fixtures and custom carbide tooling. Then, the parts are run 24 hours a day, five days a week. They are finished and assembled in-house, before Mathews warehouses and distributes its products.

“Frankly, we recognize now that back in the beginning, when we bought three competitive machines and one Makino, we should have instead bought three Makinos.”

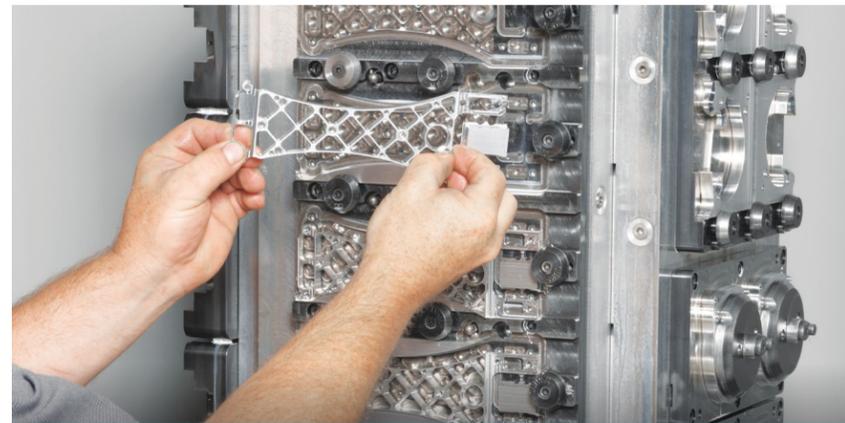
issues. We improved cycle time by 41 percent, going from seven minutes, 23 seconds to four minutes, 20 seconds per part, and meeting our production requirements. The Makino machines have more than proven themselves. We are most happy with the reliability of the machine and the extra capacity it brings. Frankly, we recognize now that back in the beginning, when we bought three competitive machines and one Makino, we should have instead bought three Makinos. Of the 46 machines on our shop floor, the two a51nx machines are the ones we don’t have to worry about.”

Helim cam produces speeds of up to 332 feet per second and weighs only 3.5 pounds.”

Investing in high-performance manufacturing technology has not only enabled Mathews to innovate, but it has also given the company

#### DRAWING ON CORE VALUES

All of this technology has helped to facilitate the innovation that McPherson strives for each day, making his complex designs come to life during production in an affordable and profitable way. McPherson’s company has produced over 1 million bows in the 22 years since it began, and it has



When machining the quiver part, Mathews can fit more parts on the fixture, producing eight parts instead of two, and can push tooling to recommended limits without any issues.



“The machine shop is the heart of the company. It is there that our innovations in technology are achieved, and this is in part due to quality vendors like Makino.”

“Everything starts in the machine shop,” said Jenkins. “It is the heart of the company. It is there that our innovations in technology are achieved, and this is in part due to quality vendors like Makino. They build equipment that is efficient enough to give us the capacity to handle record growth and to give us the freedom to pursue new and innovative designs.”

That kind of growth also has impact in the community. One of the company’s core values, impact, means giving back through many charitable organizations. The company has worked with the Department of Fish and Wildlife to form the National Archery in Schools Program (NASP). The organization involves students in grades 4 through 12 in archery through their physical education classes. It has reached over 11 million students in 47 states and five countries. CenterShot Ministries is another organization the McPhersons founded. It is similar to NASP but is conducted in churches. Mathews’ companies also support other organizations such as the Boy Scouts, Boys & Girls Clubs and 4-H Shooting Sports.

The McPherson family is very active in the company and its charities. McPherson’s three sons are involved

in Mathews, Brennan Industries and Mission Archery, which produces high-quality bows at a budget-friendly price. McPherson is also committed to running McPherson Guitars, where he is also passionate about and deeply involved in product design.

#### AIMING TO MAKE WHAT MATTERS

Due to box-office hit movies such as “The Hunger Games” and “Catching Fire,” there has been continued growth and popular interest in the archery industry. McPherson has already put an a51nx on the shop floor at Mission Archery, to increase capacity on its Genesis bows. These bows are geared toward those just getting into the sport, like young people and families.

“With this kind of growth, I see no reason why we wouldn’t put more Makino machines on our shop floor,” said Jenkins. “We want to continue being involved in growing the sport of archery. Whether it’s through our companies or through our philanthropic work, everyone is a part of this—from our employees, to our retailers, to our customers.”

Ohm agrees. “At Mathews, what matters most are people. In everything that we do and in everything that we sell, we want to have a happy customer base. That means putting

out the highest quality product that we can. It also means hiring with care. We want our employees around for life. We have never had a layoff in 22 years. We truly try to put people before business, and our employees work hard because they want Mathews to be the best.”

As Mathews continues to bring innovation to its bows, it strives to bring families together in the sport, just as it has done with McPherson’s own family.

“PERFORMANCE,” “PRODUCTIVITY,”  
“PROFITABILITY.”



Watch a free webinar to see more real-world examples of Makino technology in action.

[Click to view these webinars:](#)

# STRONG SUPPLIER RELATIONSHIP SUPPORTS NEW LEVEL OF MANUFACTURING

*“Strong supplier relationship is key in addressing project requirements, machine setup and training, and provides timely service long after the sale.”*

That learning comes from Bogdan Markiel, the CEO of [DV Systems](#) in Barrie, Ontario, Canada. Co-owners Markiel and Garth Greenough wanted new machines that would modernize their outdated operation, providing additional quality and competitiveness to keep their operations in North America. At the onset of the project, they couldn't have imagined that supplier relationship would help them rethink their entire machining process. Markiel and Greenough also didn't realize that replacing three older machines with just one [Makino a61nx horizontal machining center](#) would yield a higher number of quality parts in just 75 percent of its previous time. But it did.

The company's motto is “Built Better.” Backing this statement requires extreme confidence in producing parts for its air compressors. In order to build better, Markiel and Greenough are a testament to the fact that the company must have the right horizontal machining technology in place, with the service behind it, ensuring every part is produced accurately. For manufacturers trying to achieve this balance, it often feels like they are taking a leap of faith

to make the changes needed to get there. But change doesn't have to be uncertain.

“After working with outdated equipment for so long, we knew that an investment in new equipment would be a big step for our business, particularly our operations,” said Markiel. “That is where we have found that relationships matter—the right supplier can help you select reliable equipment with tight tolerances, allowing you to deliver the products customers want. [SST-Canada's](#) support is what led us to confidently replace our outdated equipment to improve our part quality.”

## REDEFINING A BRAND

DV Systems got its start in 1888 in Toledo, Ohio, when physician Allen DeVilbiss invented the spray atomizer, introducing an easier way to apply medicines to people's throats. Over the years the company's product line expanded. It developed the spray gun and eventually began manufacturing air compressors in Barrie in 1954. The air compressor division became an independent company in 1998, taking on the name of Devair. In 2006, Markiel and Greenough purchased the company and shortly thereafter renamed it DV Systems.



The a61nx replaced three of the company's previous CNC machines and some manual machines while operating at only 75 percent of the previous shift.

## DV SYSTEMS

# STRENGTHENS

## NORTH AMERICAN OPERATIONS

“We have found that relationships matter—the right supplier can help you select reliable equipment with tight tolerances, allowing you to deliver the products customers want.”

Today the company employs 42 at its headquarters in Barrie. It has a new facility in Mooresville, N.C., dedicated to serving a growing customer base in the United States, which currently comprises 20 percent of company sales.

Part of DV Systems’ rebranding and growth strategy includes becoming more competitive. It knew that moving production overseas to be more cost-effective—as many of its competitors were doing—was going to affect the quality of its products. Quality may be its number one concern, but it also places a high value on turnaround time. DV Systems manufactures four types of heavy-duty air compressor pumps and 500 different models of air compressors, and it must produce these quickly. It needs the ability to easily change

production from one model to another. When it considered product quality and turnaround time in addition to logistics, fuel prices and properly meeting voltage requirements for these compressors, DV Systems knew it had to maintain operations in North America. However, its equipment was severely outdated and unreliable.

“We had been using the same equipment for decades,” said Greenough. “It broke down often, resulting in part shortages. We knew it would take new horizontal machining technology to meet today’s needs. To be competitive, we needed to rework our processes in a way that would produce the best quality parts while accommodating lean manufacturing. This required finding the right partner to

help us plan for and get our employees, who had been working with the same equipment for decades, comfortable with new machine technologies.

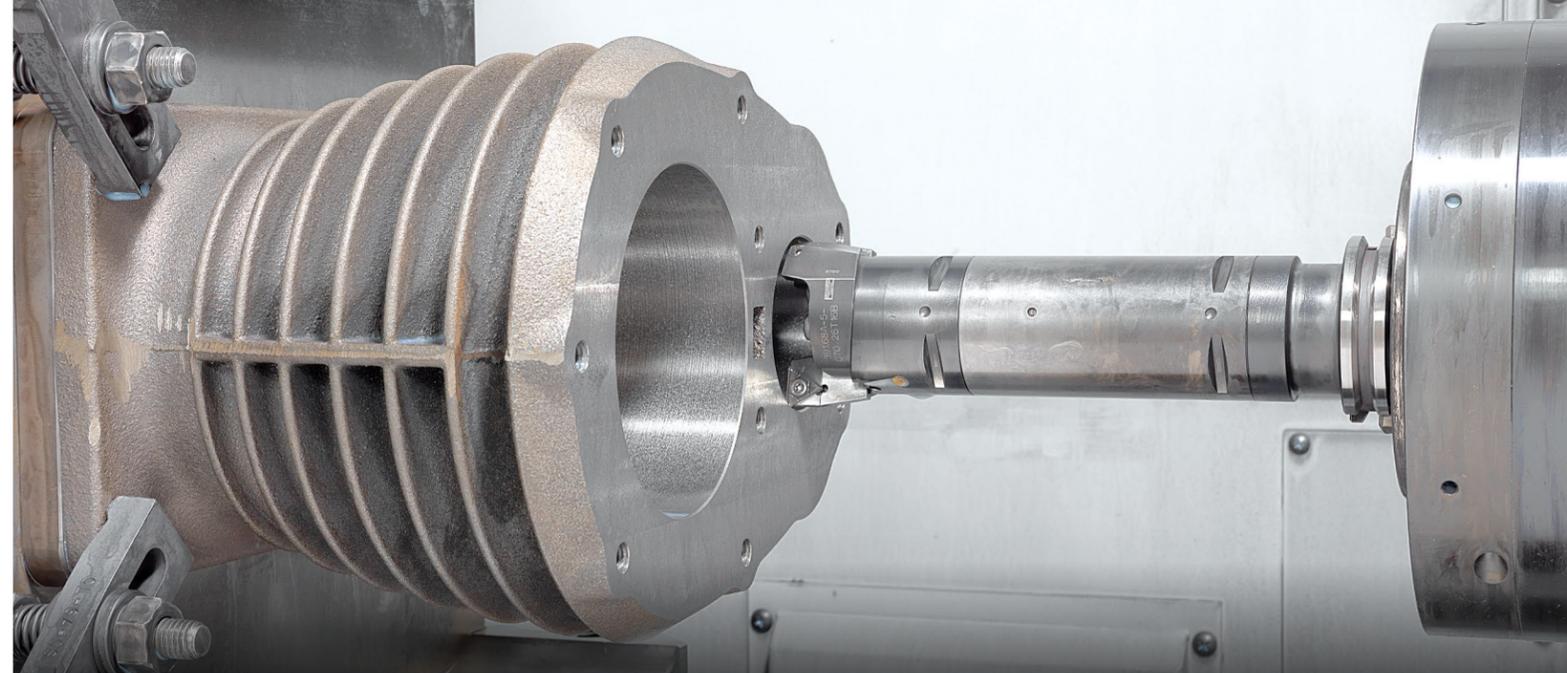
“With most of our previous equipment, it would take four to six days to get someone out for service, which meant delayed orders and lost profits. However, when it came to our older LeBlond Makino, SST-Canada would be on site within a day to get the machine up and running again, despite its age. This led us to reach out to them when we needed new equipment. Their responsiveness is what really stood out from the other suppliers we considered.”

#### RELATIONSHIPS MATTER

Understanding DV Systems’ need for strong support, SST-Canada application engineers engaged the company at a high level right from the beginning in order to develop a solution. Their approach involved spending several days at DV Systems, evaluating current processes and performing time studies.

“We originally looked at the [a71 horizontal machining center](#) as a solution to upgrade our technology,” said Markiel. “It had a 50-taper spindle, just like our old equipment. We thought we’d retain the fixtures, 500-mm pallet configuration and tooling that we already had. But then Makino released its nx-Series machines, and we realized that our original vision was like putting old tires on a new car. We needed to reconsider what our operation would look like. Despite having a 40-taper spindle, we learned that the a61nx could supply everything we needed. It, too, had a 500-mm pallet and would cut better and stronger using the latest advancements in tooling technology and fixture design, so it became part of our considerations.”

For a year, SST-Canada and DV Systems worked together to develop an implementation plan. In addition



The positional accuracy of the a61nx has enabled DV Systems to hold cylinder roundness tolerances of plus or minus 0.0005 inch and squareness tolerance of plus or minus 0.0004 inch.

to analyzing shop processes, they paid special attention to improving machining methods.

“After studying our current process, SST-Canada had innovative ideas for revamping our operation,” said Greenough. “One of the best parts of my job is getting involved in the early stages of new product design and development. Going through the creative stages of developing a new part, and then seeing it take shape in the factory, is very rewarding. That is exactly what happened here in planning our new process. It was a true partnership that led us to change our vision about how we were producing parts.”

“When we chose the 40-taper machine instead of the 50-taper, we were concerned about not having enough torque for a 4.5-inch bore, but ... the 40-taper machine works better than our 50-taper did.”

Its new processing method would help DV Systems machine all components of an air compressor—an entire set of parts at once—on each fixture, so that each could be assembled complete. With the old method, the company had dedicated fixtures for each part and would machine identical parts on the same fixture, running large volumes at a time before switching fixtures to produce the next set of parts. This process would result in having dozens of parts from different families sitting idle in work-in-process inventory until all part families were complete. With this updated lean method, DV Systems could make products to order and acquired the ability to quickly change from one model of compressor to

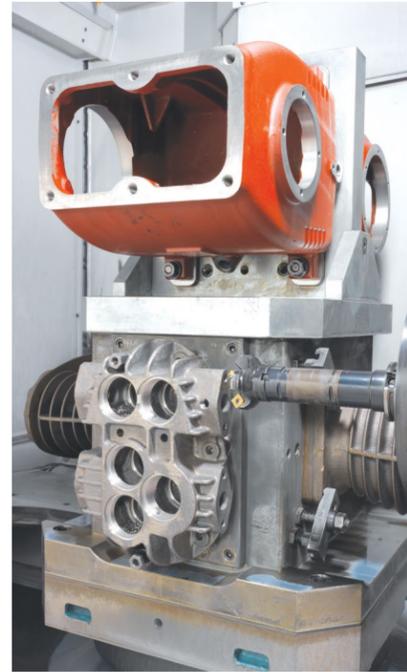
another. To accomplish this goal, SST-Canada brought in Sandvik to develop a tooling package, and ABA Machining & Welding to develop new fixtures.

“We knew that we didn’t have the knowledge or expertise in-house for the tooling and fixtures,” said Warren Henley, plant manager at DV Systems. “But through SST-Canada’s recommendation, these three companies developed this new process into a complete solution, ultimately making our vision happen. They truly worked together to get the solution we needed. If we had a meeting with one of these companies, all of them would show up. There were no egos—everyone worked for the common good.”

“Sandvik and ABA were also able to confirm the capabilities of the a61nx. The president of SST-Canada also told us that we absolutely would not fail. These strong endorsements helped to seal the deal for this solution. We knew that both the technology and the strong supplier relationships would set us up for success, so in 2013 we purchased the a61nx.”



With the engineering support of SST and the capabilities of the a61nx, DV Systems has been able to execute its vision of producing a full set of parts complete.



The 40-taper a61nx can easily cut through this material and achieve tolerance requirements of plus or minus 0.0002 inch, with cylinder roundness of plus or minus 0.0005 inch and squareness of plus or minus 0.0004 inch.

“When we chose the 40-taper machine instead of the 50-taper, we were concerned about not having enough torque for a 4.5-inch bore, but we don’t need to worry about vibration,” said Henley. “In fact, the 40-taper machine works better than our 50-taper did. Because of the machine’s accuracy and rigidity, we have virtually no scrap. With this new process, we no longer live in fear that a machine on our production line may go down or compromise the precision parts it produces; we are more accurate than ever.

“Because of our new processing, machine capabilities and workflow efficiencies, on one particular product, we have gone from producing four parts per day to eight per day. This type of savings has allowed us to do more manufacturing in-house and has enhanced our profitability year over year. Our horizontal machining technology allows us to not only produce more parts but to design new parts, expanding our product line. And we now have the space on our floor to accommodate that expansion.”

The a61nx replaced three of the company’s previous CNC machines and some manual machines. It also operates using only 75 percent of the previous shift. No changeover time is required, because each fixture produces all components necessary to assemble a new compressor. This improved efficiency has provided operators with extra time to take on additional roles.

“Part of our new process solution was to create a more flexible team of workers,” said Markiel. “For example, Sean is one of our a61nx operators. Until recently, he worked primarily in our shipping

Knowing it would be using this new horizontal machining center, DV Systems also began digitizing the machine programming process. It went from drawing parts and programming at the machine to using advanced software to create its intricate fixtures in three-dimensional models. Its approach enabled DV Systems to put its part models right into the Makino environment for production.

“With our old process, all our drawings were on paper and we did manual programming,” said Luke Thrush, product engineer at DV Systems. “The paper trail was difficult to navigate when we needed to retrace changes to the latest version. A lot of work went into transitioning from the old technology to

new, and the SST-Canada applications team really helped get us here. Now documentation is a snap. Using the a61nx and our new CAM processes, we are able to design quality into our parts right from the beginning. For instance, we can do collision detecting during the design phase and ultimately eliminate machine downtime that we previously spent while proving out parts. This system has truly brought our manufacturing capabilities up to modern standards.”

What has resulted from all of this new technology is DV Systems’ ability to execute its vision of producing a full set of parts complete on the a61nx. It can now produce a new compressor with each completed fixture.

### A NEW LEVEL OF MANUFACTURING

The new method helps the company reduce work-in-process inventory. In addition, its ability to machine a full set of parts means that if DV Systems receives an order on Monday, it can ship a completed compressor by Friday.

“We never would have been able to do this, had we shipped our production overseas,” said Markiel. “Right from the beginning, we realized that the capabilities of the a61nx were better than we could have ever imagined. It has not only removed our previous stress about downtime but also contributed in achieving a new level of manufacturing.

“At DV Systems, we are serious about both the timing in which our customers get their product from us and the quality of that product. Our new horizontal machining technology has allowed us to make significant improvements to both.”

Challenging bore features are easily achieved. DV Systems is producing parts from gray iron with a Brinell hardness ranging from 187 to 241.

“As a result of our new capabilities, we can confidently operate in a lean environment, building the best product possible with the best equipment we could have asked for.”

DV SYSTEMS AIR COMPRESSORS

“BUILT BETTER”



Heavy-duty, durable and dependable, compressed air solutions from DV Systems are built to withstand the most demanding industrial environments and are used in a variety of applications—from mechanical bays and garage areas to HVAC controls and lab stations.

The company is Canada’s leading designer and manufacturer of energy-efficient air compressors. It also produces refrigerated compressed air dryers and air filters. A dedicated team of engineers at DV Systems focuses solely on R&D efforts, whether designing a new line of 200-horsepower air compressors or developing products with noise levels as low as 63 decibels.

The company’s heavy-duty industrial (HDI) series piston air compressors range from 0.5 to 30 horsepower (HP), and are backed with an unprecedented seven-year warranty. Built to last for decades, these compressors are known as the workhorses of the industry and boast extra-heavy cast iron design, oversized components, and the ability to run at very slow speeds while providing high air delivery at 75 to 80 percent duty-cycle operation.

High-efficiency rotary screw compressors operate at 100 percent duty cycle—ideal for continuous-use applications, where reliable, dry and clean compressed air is required. These products range from 5 to 100 HP, and are backed with a five-year limited warranty. These air compressors are available in stand-alone base, tank-mounted or packaged configurations, complete with air receiver, dryer and air filters.

**Products from DV Systems maintain U.S. and Canadian certifications and have been “Built Better” for over 100 years.**

The 40-taper a61nx enables DV Systems to easily cut through gray cast iron, achieving tolerance requirements of plus or minus 0.0002 inch.



## Capital Financing

By Tom Scherpenberg  
Manager of Makino's Capital Services

# WHICH CAPITAL FINANCING OPTION IS RIGHT FOR YOUR BUSINESS?



department and had never run a machine. But one of our goals was to make employees more valuable by cross-training them in different roles. The more skills they have, the better pay they receive. For instance, Sean works part of the day as an operator, and because the machine does most of the work, he has time to work the other half of the day in shipping. The same applies in engineering—the design engineers can do a variety of tasks, including roles traditionally managed on the shop floor.”

This situation is a win-win for everyone, especially because at DV Systems, what matters most is recognizing its people.

“Company direction comes from our employees—they are the ones making

things happen,” said Greenough. “By giving them the best training and technology, we are building confidence and developing products that are reliable and strong in the marketplace, driving company growth and exceeding customer expectations.”

This combination of skilled employees and precision machinery has enabled DV Systems to remain competitive and keep jobs in Barrie. With strong growth in Canada, the company can now focus on U.S. expansion, where it expects to triple sales in the coming years.

“As a result of our new capabilities, we can confidently operate in a lean environment, building the best product possible with the best equipment we could have asked for,” said Markiel.

“In five to 10 years, we know we will be moving even more product out the door. Working with SST has made us realize the value and importance of building strong and trustworthy partnerships with a supplier. This, combined with exceptional technology, has allowed us to do things we’d never even dreamt of before.”

“PERFORMANCE,” “PRODUCTIVITY,”  
“PROFITABILITY.”



Watch a free webinar to see more real-world examples of Makino technology in action.

Click to view these webinars:

“[The a61nx] not only removed our previous stress about downtime but also contributed in achieving a new level of manufacturing.”

For businesses thinking about financing an equipment purchase, there is good news. The resurgence in manufacturing means that more lenders are supporting this sector. Interest rates remain low, and with more capital in the market, more financing options are available. Potential buyers with good credit are enjoying flexibility through longer terms, often with no money down.

Companies that couldn't secure loans a few years ago are starting to have financing options open up to them, even if the terms are not the best. This is a significant change from 2010, when very few options were available for these buyers.

### PAY CASH OR FINANCE?

There are two ways to pay for equipment: with cash or through various financing vehicles. Paying cash enables a business to own the equipment immediately upon payment. The company can amortize the cost of the equipment over its economic depreciable life. However, purchasing equipment up front can also reduce the purchaser's availability of cash for other investments, such as plant expansions or improvements, marketing or purchasing future equipment.

The ability to pay cash is unique to each customer. True cash buyers are few and far between. Typically, only 25 percent of all capital equipment transactions are done through cash. Financing is a much more common approach, accounting for 75

percent of all equipment investments. It's easier to finance equipment than inventory or an acquisition, so people tend to save their cash for those other investments. Financing also enables a company to better match the monthly cash flow being generated from the equipment to the obligation of the monthly payment due under the financing vehicle.

There are two primary ways to finance a purchase: through a traditional loan or by leasing the equipment.

With a traditional loan, the borrower is immediately the legal owner of the equipment and uses it as security or collateral to borrow the funds to pay the seller. The borrower then pays monthly principal and interest payments to the lender until the loan is fully repaid.

Leasing equipment is an alternative capital acquisition strategy that can lower the operating cost of high-performance equipment. Of all the financing options, leasing offers the most flexibility to meet a company's unique capital expenditure needs. In leasing equipment

Only 25 percent of all capital equipment transactions are done through cash.

versus buying, the lessee (the company paying the lease) is paying only for the value of the machine being consumed during the lease term. The asset continues to have a “residual value” after the term of the lease, which the lessee is not required to pay for unless he or she decides to purchase the asset at the end of the lease term. Typically, the better the quality of the equipment being leased, the higher the residual value will be on that equipment and, as such, less of the value is paid for during the lease term.

Leasing gives businesses the opportunity to match incoming and outgoing cash flows. Usually if a term loan is handled through a bank, the bank will require a down payment of 10 to 15 percent, which is paid up front. In the monthly payment under a term loan, borrowers pay either even consecutive monthly installments of principal and interest (mortgage style) or even principal payments with interest added on top of the principal (which means the monthly payments are higher at the beginning of the lease versus monthly payments toward the end of the lease). In either scenario, the payments required by the loan do not offer any flexibility that may

**Borrowers can usually finance up to 110 percent of the acquisition price, 100 percent of the equipment cost, plus 10 percent of soft costs.**

be needed to match anticipated changes in the purchaser’s cyclical cash flows, such as seasonality.

The monthly payment under a lease is more like a mortgage—the same payment is due each month throughout the lease term. This amount, however, can be tailored to accommodate for anticipated changes in a customer’s cash flows due to seasonality, adjustments in contractual output or other issues.

With a lease, borrowers can usually finance up to 110 percent of the acquisition price, 100 percent of the equipment cost, plus 10 percent of soft costs such as tooling, rigging, shipping or installation. In some circumstances, lease terms allow for upfront payments to be deferred, giving companies the

flexibility to defer making payments until the machines start producing and generate additional revenues needed to make the monthly lease payment. This option again provides better opportunity to match cash flows.

### LEASING OPTIONS

There are two main classifications of leases:

**CAPITAL LEASE:**  
A Pathway to Long-Term Ownership

**OPERATING LEASE:**  
Meeting Demand with Lower Overhead

A capital lease is very similar to a term loan. The asset and lease liability are carried on the company’s balance sheet, with monthly depreciation and interest expense being recorded. In a capital lease, the company is typically paying for the entire cost of the machine through the lease term (including any bargain purchase option at the end of the lease term) and, as such, owns it at the end, just like a traditional loan.

An operating lease is an agreement to use or rent the machine over a specified period of time. The monthly payment obligation is expensed in the lessee’s operations and shows up only on the profit and loss statement. An operating lease usually gives a company the lowest monthly payment obligation, as the company is paying only for the value of the equipment being used during the term of the lease. The value of the equipment at the end of the term is the most compelling cost driver for determining the monthly payment obligation. However, at the end of the operating lease, the lessee does not own

**A high-performance machine typically produces more parts faster, with less downtime.**

**Approximately 65 to 75 percent of businesses choose a capital lease over an operating lease.**

the equipment, but instead has the option to either pay the then fair-market value to purchase it, return the equipment to the lessor or extend the lease. For situations where a manufacturer’s production contract may not be extended beyond the initial term of the lease and the equipment may no longer be needed, this option can be helpful as businesses decide what to do next.

In the manufacturing industry, our experience has been that approximately 65 to 75 percent of businesses choose a capital lease over an operating lease; however, each business’ financial situation is different. It is important for purchasers to work with a capital services organization that can make recommendations based on a company’s current and projected financial situation while taking into consideration their asset management strategy. This approach requires collaboration between the lessee and lessor so the lessor can gain an understanding of the lessee’s goals and objectives relative to their equipment purchase needs and its impact on the success of the business. Choosing a capital financing group that understands the manufacturing industry is typically the best scenario.

### FINANCING A HIGH-PERFORMANCE MACHINE

Many businesses think they cannot afford a high-performance machine, but don’t realize that it can be a better value over time, especially when financed correctly. While the initial purchase price might be higher for a high-performance machine, the residual value typically is also higher at the end of the lease term than a lower quality machine.

Using a car analogy, someone has the choice to either lease a \$50,000 high-performance car or lease a lower cost \$30,000 car over the same period of time, such as three years. Due to the nature of the lease, the monthly payment requirement is primarily driven by the value of the car utilized (depreciated) during the lease term. The more

value remaining at the end of the lease, the less the lessee is required to pay during the lease term relative to its original cost. The value of the higher cost car at the end of the three-year lease is 60 percent of its original value (\$30,000), while the value of the lower cost car is 40 percent of its original value (\$12,000). Using the higher cost car for the three years was effectively \$20,000 versus the \$18,000 cost to use the lower cost car over the same period.

It is also important to remember that purchasing the machine itself is only part of the equation. It does not include the cost of operating and maintaining the machine. It’s important to weigh the entire return on investment (ROI) for the capital equipment purchase, including operating costs, cycle time, tool life, part quality and equipment maintenance. A high-performance machine typically produces more parts faster, with less downtime, while a cheaper solution can result in higher part costs, shorter tool life, increased scrap, unplanned downtime and higher maintenance costs.

Finding a financing solution that meets your unique business needs is the most important factor in determining which financing vehicle you should use to grow your business.

### ABOUT THE AUTHOR:

As manager of Makino’s Capital Services, Tom Scherpenberg works with manufacturers to deliver customized financing solutions to keep their business running efficiently and profitably. His 30 years of experience in the financing industry demonstrates a deep understanding of the market and the unique needs of manufacturers. For questions or financing recommendations, email [Financing@makino.com](mailto:Financing@makino.com).

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High-Performance Machining Center ROI:  
True Value Revealed

**“ SINCE INVESTING IN MAKINO EQUIPMENT, OUR REVENUE HAS GROWN MORE THAN 14 TIMES.”**

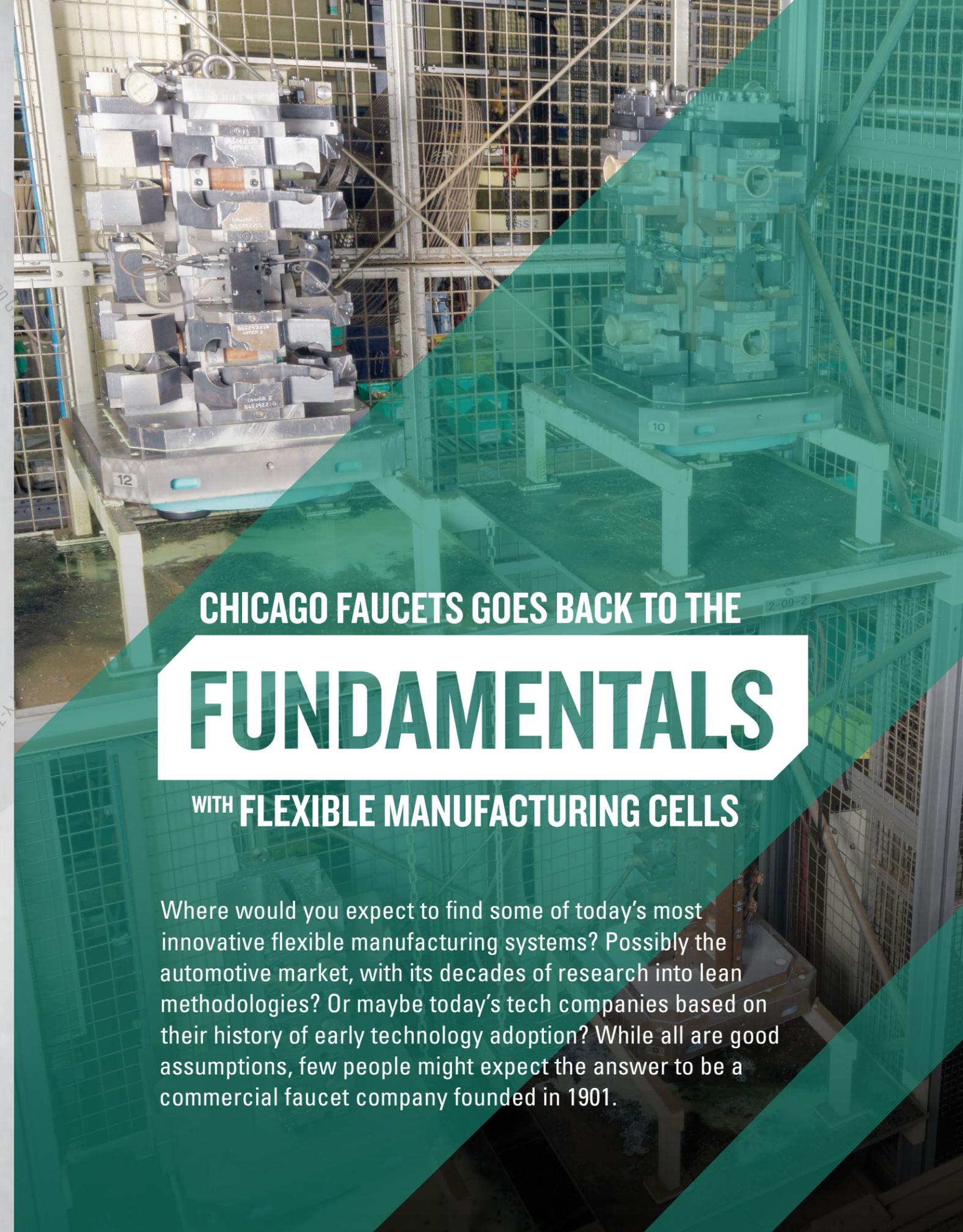
**“ TO SUM IT UP, WE’RE RUNNING MORE PARTS WITH BETTER QUALITY, FASTER THAN AT ANY OTHER POINT IN THE COMPANY’S HISTORY.”**

**“ [MAKINO] HAS GIVEN THE COMPANY A 200 PERCENT INCREASE IN SALES PER EMPLOYEE.”**



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**CHICAGO FAUCETS GOES BACK TO THE**

# **FUNDAMENTALS**

**WITH FLEXIBLE MANUFACTURING CELLS**

Where would you expect to find some of today's most innovative flexible manufacturing systems? Possibly the automotive market, with its decades of research into lean methodologies? Or maybe today's tech companies based on their history of early technology adoption? While all are good assumptions, few people might expect the answer to be a commercial faucet company founded in 1901.

Sometimes the greatest innovations come from fulfilling the most basic needs. It may not seem that way in a time period oversaturated with countless business reports and consumer research studies, but according to Thomas Schlaefer, general manager at [Chicago Faucets](#) in Milwaukee, Wis., the fundamentals for customer satisfaction have remained largely unchanged since the company's founding in 1901.

"At the most basic level, customers want value, durability and reliability from a commercial faucet. We got

that right in 1913 with the invention of the Quatern cartridge, and that design has been a core competency in the development of every faucet since. What has changed, though, is how our business must operate to meet customer demand. Globalization has fostered a surge in market competitiveness. As one of only two companies that still casts lead-free brass faucets here in the U.S., we realize that our manufacturing processes needed to be highly adaptive and productive to deliver cost-competitive products with the highest degree of customer satisfaction," said Schlaefer.

Headquartered in Des Plaines, Ill., Chicago Faucets operates out of several facilities throughout the Midwest, including an assembly and distribution facility in Michigan City, Ind.; a precision turning facility in Elyria, Ohio; and the manufacturing facility in Milwaukee, where Schlaefer and his team are based. It is here that a major shift in manufacturing capability drove company-wide process changes, helping Chicago Faucets promote and enhance the fundamentals of customer satisfaction.

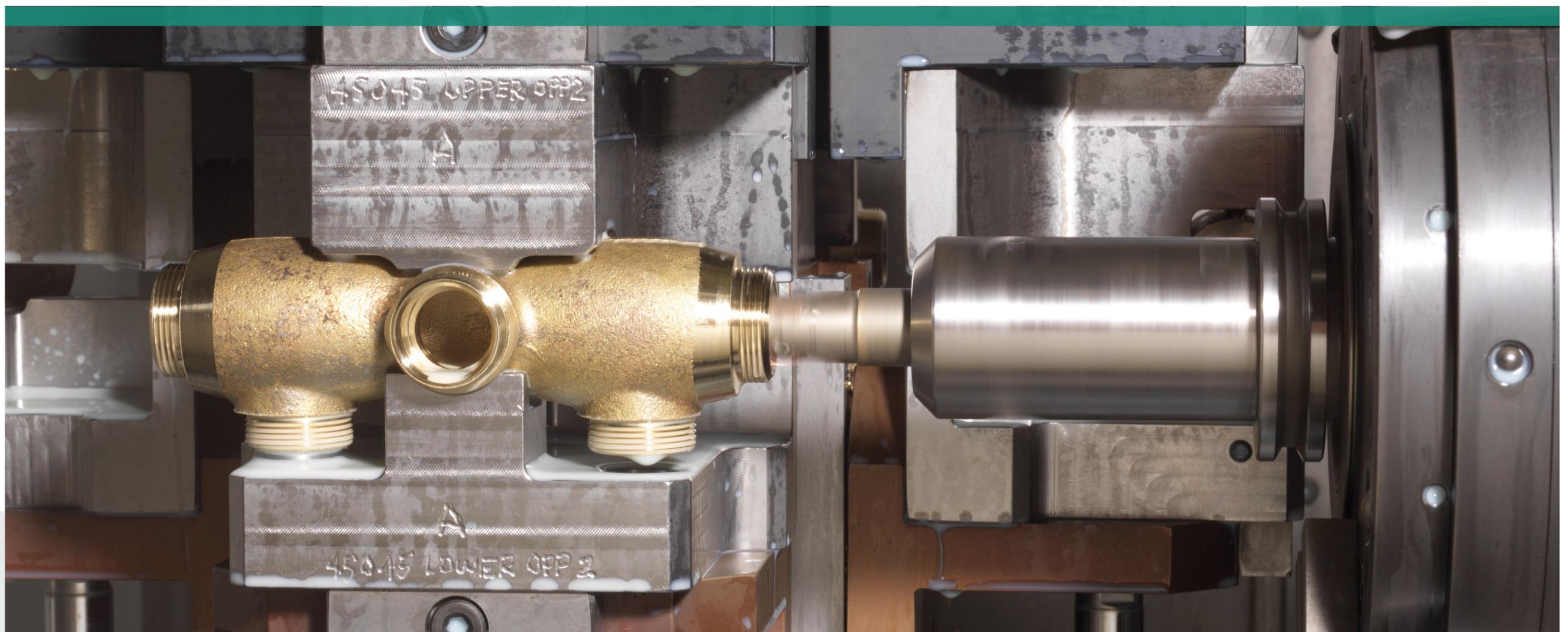
"For a long time, manufacturers have known the solutions: small batch

"Implementing this technology has changed our mentality from reactive to proactive and has enabled us to replace dozens of manual machining centers with just five high-performance horizontal CNCs."

sizes, short runs, minimal setups and so forth," said Schlaefer. "But these outcomes could not be achieved in a cost-effective manner. Today there are real, affordable solutions for companies to accomplish this.

Traditional, inflexible manufacturing is simply no longer viable in our type of industry [low-volume, high-product mix], which is why we've invested in two automated pallet-handling cells from Makino. Implementing

The rigidity and stability of the [a51](#) and [a61](#) horizontals have helped extend tool life by 25 percent while simultaneously reducing cycle times.



“To us, it was common sense—go with the single-source provider to avoid any potential obstacles that come from working with multiple companies.”

this technology has changed our mentality from reactive to proactive and has enabled us to replace dozens of manual machining centers with just five high-performance horizontal CNCs.”

**BUILDING A VISION**

Like Schlaefer, Chris Schlessinger, Chicago Faucets’ engineer manager, is no stranger to the machine shop. Entering manufacturing at age 16, Schlessinger has now worked in production machining for 26 years. For a time, he thought his knowledge of machine types and styles was pretty thorough. One day, about 10 years ago, all that changed.

“The first time that I saw an automated machining system, I knew it was a game-changer. The capabilities were clearly beyond what any manual system could achieve. But turning that vision into reality has been a long, challenging process with plenty of obstacles along the way,” Schlessinger said.

Like many manufacturers, Chicago Faucets over time found itself increasing competition against products produced in low-labor-cost countries. Its internal processes were typical of that time period—setup intensive, manual equipment that required lead-times of two to three weeks. Low-volume parts could take far longer.

Unpredictable customer demand was a constant issue. A shift in product mix or volumes would drive more frequent setups, hurting output and productivity. For the sake of efficiency, the plant attempted to run similar parts back to back, which required only minor tooling changes between these comparable parts rather than a full setup. But this setup added even more restraints to part selection.

The plant-modernization process shifted into high gear with the purchase of four horizontal machining centers from Makino. These HMCs significantly improved daily output, mostly by shifting higher volume

products off smaller, older machining centers. However, they did not entirely solve the issue of setups.

“Technology is driving a real-time, data-driven environment,” said Schlessinger. “In the manufacturing world, this means producing parts just in time. We tried to achieve this on our stand-alone machines, but we were never satisfied with the speed of reaction—we always got caught in the dilemma of needing multiple parts from one machine, while an adjacent machine sat idle or produced low-priority parts.

“I came to realize that the missing piece of the puzzle was flexibility. But I couldn’t figure out how to justify an investment based on something so intangible. There’s no ‘flexibility’ box in a traditional ROI spreadsheet.”

The issue was of critical importance for Chicago Faucets, which has a highly diverse catalogue of products. While all of the company’s castings are created from lead-free brass, the size of casting and machining requirements vary widely. There really was no “standard” part.

Determined to create a highly flexible machine shop, the plant leadership team set out to identify a machine tool provider with proven expertise. They worked the list down to three qualified suppliers

and ultimately chose Makino, based largely on its all-inclusive approach to automation. [The Makino Machining Complex \(MMC2\) pallet-handling system](#) was selected for its strength in high-mix applications, precisely what Chicago Faucets needed to accomplish.

out there, and many well-known machine tool companies, but Makino was the only supplier we looked at that had a ‘wall to wall’ solution. To us, it was common sense—go with the single-source provider to avoid any potential obstacles that come from working with multiple companies.”



The enhanced spindle power and expanded work zone of the PS95 has enabled Chicago Faucets to reduce cycle times by 50 percent, taking and producing both mating cavities of a tool in one setup.

Improvements in flexibility and productivity from Chicago Faucets’ first MMC2 led to a faster than expected ROI of under two years.



“Within the first few months of operating the cell, our analysis revealed that the return on investment was much shorter than indicated by our original assumptions—less than two years.”

**CHANGING THE MIND-SET**

Typical of manufacturers, Chicago Faucets requires a three- to four-year payback on factory equipment investments. Despite the struggle to fully “monetize” the benefits of flexibility, the project met the company’s financial requirements through increased machine performance and improved utilization rates. Flexibility, in the end, was largely an unquantified benefit that came along with the rest of the package.

The first MMC2 system was installed in 2010 and incorporated two existing Makino horizontal CNCs.

The installation was well organized and timely. The system went into use quickly and was set up as a work cell for one operator.

“We knew there was more there, but we couldn’t quantify it on paper,” said Schlessinger. “Within the first few months of operating the cell, our analysis revealed that the return on investment was much shorter than indicated by our original assumptions—less than two years. That change in derived benefit was the added value of flexibility. Due to our broad catalogue of products, improvements in flexibility were driving dynamic changes in efficiency.”

The much-debated value of added flexibility was now settled. Though hard to quantify in advance, the daily and hourly benefits of a flexible build capability were now clear to everyone in the organization. The discussion shifted from “if” there would be a benefit to how best to capitalize on the improvements.

“On-time deliveries [to the downstream process] increased significantly, enabling greater output of the exact products needed that day.”

One clear benefit was a reduction in direct labor content. Although cycle times had not changed, the efficiencies of a multi-unit work cell and greatly reduced setup times created an environment where the operator could make better use of their time and experience fewer delays.

“Breaking down the internal discomfort for change was a big challenge, but it was a critical step forward in helping others see and understand the bigger vision,” explained Schlessinger. “Once the flexibility was there, we spent a lot

less time chasing individual orders and more time managing the total flow of product through the shop. With the MMC2, the machines were no longer waiting on castings, and operators better managed work queues. Machine utilization increased and priorities could now be changed with two clicks of a mouse. On-time deliveries [to the downstream process] increased significantly, enabling greater output of the exact products needed that day.”

#### BREAKING DOWN BARRIERS

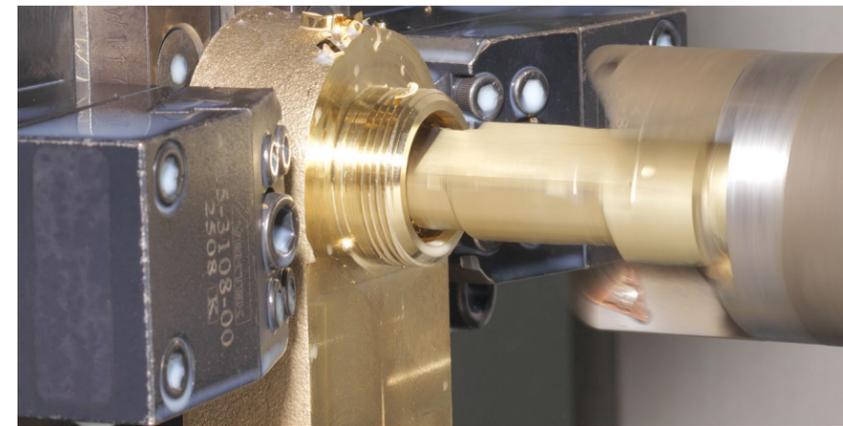
The next big step in 2012 was the installation of a second MMC2,

adjacent to the first unit. This machine shop “city” brought together the many production elements that previously were spread all over the plant into a compact, efficient space. Everything needed for efficient machining was now in close proximity.

This consolidation of disparate parts had many additional benefits including improved visual management, reduced walking and quicker parts retrieval. It also sparked a new mantra on the shop floor: “If a part *can* run in the cell, it *will* run in the cell.”

“The first MMC2 cell was relatively easy because we used all of the same fixtures and tooling,” said Schlessinger. “However, the next stage of implementation required us to break down barriers of conventional processing methods that some of our operators had been doing for decades.”

This effort required machine-shop leadership to alter operator



Since investing in automation, Chicago Faucets has been able to add 90 percent of all part numbers to its MMC2 pools, exceeding its initial goal of 75 to 80 percent.

“We made it our goal to standardize processing methods by limiting the variety of tools, fixtures and setup operations necessary to produce our full range of parts,” said Pat Hoff, machine shop supervisor, Chicago Faucets. “We also wanted to show operators that there was a way to be agile and still keep up with volume without processing large batches.”

Schlessinger. “So we developed a universal jaw system. Eventually, we’re hoping to have only one set of jaws, requiring no setup changes between part orders at all.”

“Today there are only a small number of parts not running in the pool, and our goal is to add these by the end of this year,” said Hoff. “Our original goal was to have 75 to 80 percent of



Investments in automated machining capabilities have had a company-wide influence at Chicago Faucets, leading to the development of a corporate order-tracking system that monitors the progress of all orders, from casting to final delivery.

“Tools are lasting about 25 percent longer, and better tool life has also led to average cycle-time reductions.”

expectations and practices. For example, some items had a lathe operation in their routing because essentially that’s the way it had always been done. But in fact, much of the traditional lathe work could be accomplished on the horizontal CNCs with the proper tooling. The issue was less about cycle time than about part processing—effectively combining operations could eliminate a routing step, a major saving in any manufacturing operation.

The company was already highly skilled at designing and manufacturing custom tools and fixtures. In fact, nearly 20 years earlier, the company developed, for its own use, a workholding fixture with interchangeable upper and lower fixture jaws. The limitation of the design was that each part required a different set of jaws.

“I couldn’t understand why we would have a unique setup for every part number, especially those that we only produce in low volumes,” said

our parts in the pool. So far, we have already achieved over 90 percent. There are still some parts that require secondary machining operations, but we’re working to eliminate that need completely. It’s possible that a few might not fit, but we won’t give up until we try.”

Standardization of production processes extends to the company’s tool catalogue as well. Prior to its investment in flexible manufacturing cells, the company had nearly 300



Through its efforts to standardize processes across the a51 and a61 cells, Chicago Faucets has been able to reduce its tool variety by over 30 percent with a goal of 50 percent by the end of this year.

tool varieties running on the Makino horizontals. By designing custom combination tooling, Chicago Faucets has since reduced that number by more than 100 and is working to be down below 150 tools by the end of the year. Once at this level, the “standard” tool set can be incorporated into each CNC.

“The performance capability of the Makino equipment has given us an opportunity to be creative with our approach to tooling,” said Hoff. “Tools are lasting about 25 percent longer, and [better tool life](#) has also led to average cycle-time reductions. These capabilities are just a small sample of some of the unexpected benefits and efficiency improvements that have resulted from our move to flexible manufacturing cells.”

### REALIGNING WORKFLOW EFFICIENCY

Another unanticipated benefit of the Makino MMC2 equipment has been improved workflow efficiency. In a recent example, operators noticed a load imbalance with long runtime and short runtime components between the two cells. This disparity impacted the machine utilization, especially where one or more of the machines is starved for parts, idly waiting. The solution came from a thorough review of part cycle times and a reallocation of parts between the two cells to achieve a more uniform average cycle time. The rebalance has resulted in tangible productivity gains.

“Since purchasing the MMC2 systems, we’ve learned that automation is a

project with no completion date,” said Hoff. “Operator experiences and automated reporting features are helping us identify areas where we can further improve efficiency. We’re amazed at the long list of small improvements that add up to big gains in productivity.

“Without Makino automation, we would have never identified many of these product flow issues. Everyone here can now see these improvements hit the bottom line.”

### DRIVING COMPANY-WIDE IMPROVEMENTS

Within the last year, Chicago Faucets has deployed a barcode-based order-tracking system generated with its ERP system to monitor and react to customer purchases. This software

supports the closed-loop system for product manufacture and assembly from casting to final order delivery.

“Within minutes, we now see customer demand [consumption] and can react quickly to large increases or decreases,” said Schlessinger. “The MMC2 cells are at their best in this environment because they can provide both flexibility and horsepower we need to mirror output with demand. When we need

to be aggressive about producing high volumes of a few parts, we can. When we need to produce a wide variety of low-volume parts, we can. These capabilities work seamlessly with our order-tracking system.

“The warehouse doesn’t focus primarily on inventory levels because the shop can generally react quickly enough to satisfy demand, typically delivering [shippable] products within 24 hours. Stock levels are thereby

“Our ‘killer app’ is a rapid response to customer demand. This is something that no overseas competitor can match.”

kept small. When a shortage does occur, the event triggers a review of stocking levels to determine if the outage could reasonably have been prevented. Even the most flexible systems eventually reach an outer limit.”

An integral part of these improvements is the company’s tool and die department, which supports the MMC2. Rick Straszewski, tool and die maker at Chicago Faucets, discussed the department’s recent acquisition of a [Makino PS95 vertical machining center](#) that has helped the company increase capacity for casting development.

“We saw the evolution of the production machining area and felt the resulting increase in demand,

so we had to develop a means for greater throughput in the tool room,” said Straszewski. “Our new PS95 has given us the rigidity to handle more aggressive cuts in hard materials as well as the work-zone capacity to produce both halves of a tool in one setup. The combination of these features, as well as enhanced speed and power, has made processes significantly faster at the same or better quality.”

Of the new features available through the PS95, the tool and die department expressed particular appreciation for the machine’s through-spindle coolant technology. Straszewski and others have used this feature to

### MADE IN AMERICA

Despite Chicago Faucets’ innovative approach to company-wide integration of automation, the staff maintains that it’s not reinventing lean, but simply fulfilling the long-standing ambitions of many companies in the manufacturing industry. Reflecting on how difficult it once was to align production with customer demands, Schlessinger offers other manufacturers some experiential advice: “Think about how different your machine shop would run if you could make any part on any day with minimal setup.”

He explained, “Flexible automation requires an upfront investment—this

compete on hourly wages, nor do we want to,” said Schlafer. “We’re proud of the dedicated, long-tenured employees at this plant. They make a good living, and the company benefits from their focused contributions every hour of every day.

“Our ‘killer app’ is a rapid response to customer demand. This is something that no overseas competitor can match. Makino automation is one of the building blocks of a manufacturing system that is designed to have as few part restrictions as possible, to clear away obstacles to on-time delivery and to create high-quality products at the exact moment required.”

Schlafer and his team attest that the Makino MMC2 is a platform that creates the opportunity for success. He explained, “Automation alone solves nothing. Real, lasting improvement demands a complete system of machines, operators, technical support, control systems and plant leadership. But the absence of high-quality equipment is a show-stopper. We can’t take credit for the brilliance of the machines themselves, but we put a whole lot of work into everything else that makes them effective.”

“Be open to change, look for secondary benefits and optimize the system rather than the machine. Everything else will come with effort and perseverance.”

improve the production of straight through-hole features, eliminating previous pecking operations for faster production. In one corebox component, cycle times were reduced more than 50 percent.

“The standard features of the PS95 are exceptional, and the more we become accustomed to them, the more we find ways to improve processes,” said Straszewski. “Makino’s engineers have also been supportive in walking us through new features and answering questions immediately. So while the technology has required a slight adjustment, the support we’ve received has made the process much easier to manage.”

cannot be denied. But instead of spending months or years trying to analyze every nuance of the system to a 100 percent confidence level, we’ve learned to accept that there are many unknowns and also accept that a 100 percent confidence is truly unrealistic. Be open to change, look for secondary benefits and optimize the system rather than the machine. Everything else will come with effort and perseverance.”

The efficiencies gained through automation have helped Chicago Faucets compete effectively with offshore producers. The company has adapted to globalization by improving speed of response, flexibility and labor-to-equipment ratios. “We can’t

“PERFORMANCE,” “PRODUCTIVITY,”  
“PROFITABILITY.”



Watch a free webinar to see more real-world examples of Makino technology in action.

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# ProVis REMOTE DIAGNOSTICS

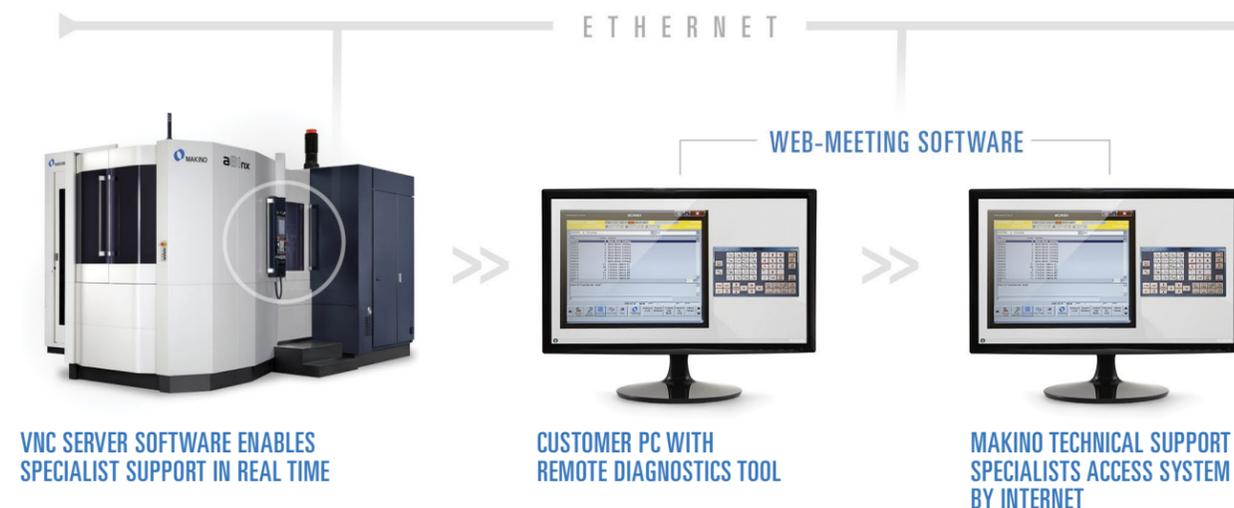
## NEW PROVIS REMOTE DIAGNOSTICS PROVIDES REAL-TIME TROUBLESHOOTING—ANYWHERE, ANYTIME

Every shop has deadlines that can’t afford to be interrupted by machine downtime. At no cost to its Pro5 control customers, Makino offers [ProVis Remote Diagnostics \(RD\) technology](#) to ensure maximum uptime. This new utility puts a Makino subject matter expert in your shop in just a few minutes ready to help solve any machine issues that might arise. Compatible with [Makino Professional 5 \(Pro5\) enabled](#) machining centers, ProVis technology makes it possible for manufacturers to share a live display of their machine control with Makino technical support specialists for real-time troubleshooting and support. This remote diagnostics capability provides more efficient troubleshooting and faster problem resolution to minimize machine downtime at any time of day or night. This often means machine issues can be resolved without the dispatch of a field service engineer.

Remote accessibility is facilitated via an Internet connection and Makino’s VNC server software. Without being on site, Makino technical support specialists can virtually navigate and guide users through recovery procedures. If a service technician is already on location for support or preventive maintenance, he or she can connect a laptop directly to the machine to collaborate with a technical support specialist.

ProVis technology accelerates the troubleshooting process. Problems can be diagnosed quickly, reducing machine downtime by providing greater visibility and real-time remote support for the machining center. This value-added service is available at no cost to all manufacturers using a Pro5 control, and to all distributor field and phone support technicians.

Setting up ProVis takes just a few easy steps that may require up to 20 minutes of machine time for setup. After this initial installation, activating ProVis for future service requests typically takes an average of two minutes.



For detailed instructions on how to install **ProVis** and to understand the requirements, contact Makino customer support at **1-888-625-4664**.



# EXTREME PRECISION

PULLS OUT ALL THE STOPS WITH  
4- AND 5-AXIS AUTOMATION

Matt Ellis is a motocross racer and enthusiast who thrives on high-speed competition. He has built the endurance to easily take on sharp turns, handle uneven terrain and get air whenever he can. Ellis also applies that adventure and enthusiasm to his work, as a machinist and shop owner who enjoys tackling challenging parts. He has built the technical skills necessary to handle any obstacle, both on the job and on the course.

Ellis' love for motocross and machining began in high school, when a natural aptitude for the mechanics of his bike, and a desire to improve it, led him to begin making parts.

"I enrolled in industrial arts during high school because I was interested in how all of the parts on my dirt bike were made and fit together," he said. "I was good at it [industrial arts], and received awards for my projects. This led to a job at age 16 for a company that made racing shocks. Soon I was producing the company's prototype parts and tools, working with various metals. It was the perfect work for me, and it was during this time that my interest in machining really took off."

Making parts grew into a passion that continues to this day. Ellis now machines them at [Extreme Precision](#), the production job shop that he owns in San Jose, Calif. Rather than just taking a seat behind his desk in the executive suite, he is very hands-on. Ellis regularly gets out onto the floor to machine parts.

"Right away, we saw a night-and-day difference in performance compared to our other so-called 'high-end' horizontal."

"The more complicated, the better," he said. "I enjoy knowing how each piece will function and where it will go."

Ellis knows that the right equipment is needed to produce excellent parts, and to be a value-added partner for his customers, he pushes that machining equipment for great results. It needs the same endurance he calls upon in motocross racing, which is what led Extreme Precision to obtain 4- and 5-axis automated machining capability to reduce cycle times by 50 to 70 percent.

## ADAPTING TO CHANGING TERRAIN

Extreme Precision got its start in 1994, in a manner not unlike many neighboring Silicon Valley companies—with only one employee, in a friend's garage. The company was founded on a true passion and admiration for manufacturing and, at the time, specialized in conceptual tooling and prototype manufacturing for the local disc-drive industry.

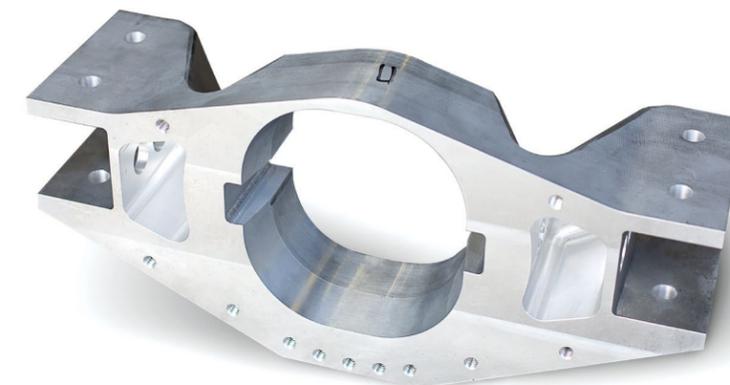
Today, Extreme Precision has grown to 20 employees and is housed in a 15,000-square-foot facility. What began with just a single Bridgeport has since transformed into a shop floor

covered in the latest high-performance manufacturing systems producing a diverse catalogue of both plastic and aluminum products for the aerospace, medical, electronics, racing and defense industries.

Like many job shops, Extreme Precision has recently experienced rising customer demand for just-in-time delivery of repeat, small-batch orders. The company was concerned about how these requirements could affect pricing and cash flow. In past years, Extreme Precision found itself continually doing setups on its vertical machines, which was not profitable, no matter how many parts were being run.

"Our dependency on vertical machining centers required a considerable amount of manual labor, resulting in extensive machine downtime and human error," said Ellis. "We needed a more efficient and productive manufacturing system, and identified horizontal machining technology as the ideal solution.

"Friends and colleagues kept telling me, 'Check out Makino. They have some of the best horizontals on the market,' but we ended up purchasing another high-end Japanese machine. In hindsight, this was a costly mistake. We found ourselves frequently adjusting offsets and running into tooling limitations.



Since investing in the automated cell, Extreme Precision has freed up cash flow by reducing raw inventory and WIP by approximately 50 percent.



With its investment in a 4- and 5-axis automated production machining cell, Extreme Precision has reduced part cycle times by 50 to 70 percent.

However, from this experience I learned quickly that price tags mean little, if you aren't getting the features and capabilities that you truly need."

To use a wider range of tools and obtain the speed, rigidity and accuracy it needed, Extreme Precision purchased a Makino A55E horizontal machining center.

"Right away, we saw a night-and-day difference in performance compared to our other so-called 'high-end' horizontal," said Ellis. "The A55E was stable, accurate and fast, producing better quality parts with average cycle reductions of 30 to 50 percent. It's cutting performance, efficiency and flexibility were exactly what we needed at the time to boost productivity, increase efficiency and reduce part cost."

### A WINNING COMBINATION

Over the next several years, Extreme Precision grew adept at horizontal machining, maximizing the capabilities of its machining processes. However, in 2008, the company observed a rapidly growing trend toward more complex, three-dimensional part designs featuring sweeping 5-axis contours. In addition, a growing number of customers were demanding small-batch orders ranging from 20 to 30 parts. This led Extreme Precision to expand its production capabilities in 2009 with the addition of automated 5-axis machining capabilities.

The company's positive experience with the A55E brought it back to Makino for a high-performance manufacturing system that could provide enhanced flexibility to manage these new production demands. Its solution was a [Makino Machining Complex \(MMC2\)](#)

automated pallet-handling system that incorporated a new a51 horizontal machining center, [D500 5-axis vertical machining center](#), and the shop's existing A55E.

"Our catalogue of parts was growing increasingly diverse; we never really knew where the next order would come from, or the type of design specifications that our customers would need," said Ellis. "By combining the horizontal machining benefits of the a51 and A55E with the 5-axis capabilities of the D500, we were able to obtain the necessary flexibility to manage any type of job that would come through our doors—no matter the complexity, quantity or quality."

For many manufacturers, this level of investment may have seemed risky during a period of economic uncertainty; however, Ellis and Extreme Precision knew that this level of 4- and 5-axis automation would place the company in an excellent position both during and after the recession. When the industry surged forward in late 2010 and most other companies struggled to ramp up production, Extreme Precision was picking up new orders rapidly without limitation.

"Our 4- and 5-axis automated cell was a big investment for us," said Ellis. "Being a smaller shop at the time, we were a little worried about how quickly we could see a full return on investment. In the end, we had the system paid off in a year, which was much faster than even our best-case projections."

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The capabilities of the 4- and 5-axis automation system not only enabled Extreme Precision to improve flexibility and grow capacity, but it also supported the company in maximizing workflow. Prior to obtaining the MMC2 system, Extreme Precision was required to keep large batches of inventory on hand in order to effectively manage repeat orders. Today this new system enables the company to manage fewer inventories while still satisfying customer demands.

"We only buy enough material to handle one week of production at a time, because that's all we need to deliver the parts that our customers need, when they need them," said Ellis. "As a result, we are minimizing inventory and work in process by approximately 50 percent, freeing up cash flow and mitigating the impact of fluctuations in material costs. But what our customers appreciate the most is our ability to maintain set per-piece part cost, no matter how many parts are ordered."

### MAXIMIZING EFFICIENCY

One of the biggest benefits that Extreme Precision saw in the 4- and 5-axis automated cell was its interchangeability of pallets between the vertical and horizontal machine platforms. This capability enabled the company to maximize the benefits and efficiencies of each machine, particularly the 5-axis D500.

It is possible to transfer pallets across machine platforms in this cell

environment because Makino has maintained a consistency with its four-cone clamping system. Four cones are found at the bottom of each pallet to clamp to the machine's table for a secure foundation. The straight-line distance between the cones is called the cone pitch. By keeping the cone pitch consistent on all of its machines—whether newer machines and older machines, or when mixing 4- and 5-axis machines in a cell environment—everything stays compatible.

"While we would love to keep things simple and machine our 5-axis parts complete on the D500, we have to keep in mind that it's our only 5-axis machine," said Ellis. "The cell's ability to transfer pallets across machine platforms alleviates this concern by allowing us to share operations between machines."

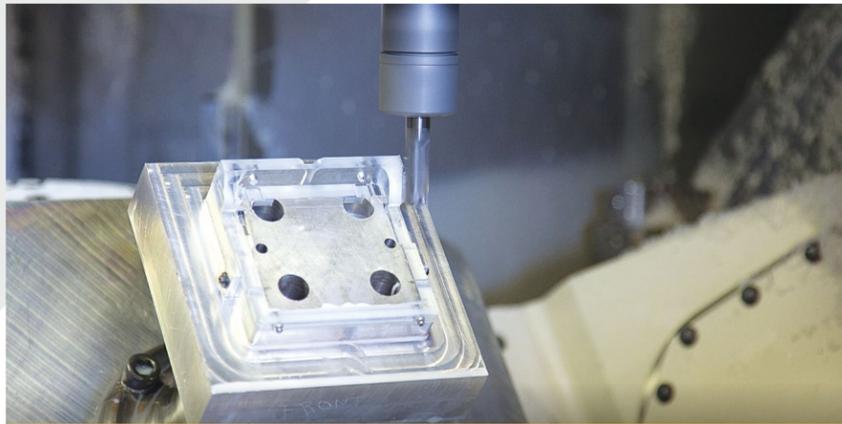
For most 5-axis applications, we program the cell to perform roughing operations on one of the 4-axis horizontals. Their speed, power and horizontal part orientation are ideal for this type of processing. Once roughing is completed, the part is then sent to the D500 for machining of 5-axis features and finishing operations, without having to take the part off of the fixture to complete this 5-axis work. It allows us to save money and open up capacity between machines."

According to Extreme Precision, these capabilities have also helped to support the company in its lean initiatives by reducing operator intervention. Where the company once required an operator to be assigned to each machine, it now has one person managing three machines simultaneously.

"We're constantly striving to do more with less time and labor," said Ellis. "The automated cell has enabled us to accomplish this while giving our operators better training and experience on newer, more capable equipment. Instead of standing in front of a machine all day just to load and unload new parts, our team is learning how to program for both 4- and 5-axis operations, understanding how to



Where the company once required an operator to be assigned to each machine, the MMC2 enables one operator to manage three machines simultaneously.



The Makino machines have enabled Extreme Precision to apply shorter tools at double and triple the feedrates of previous technologies, even in complex 5-axis parts.

operate automation systems, and taking charge of complex workflow schedules.”

The MMC2 system’s MAS-A5 cell control software offers a familiar Microsoft Windows CE operating system to manage production scheduling as well as equipment, program and tool monitoring. By using this software, operators can gain visibility into the cells’ processes and adjust for order changes on the fly.

“Operators appreciate the user-friendly nature of the MMC2 control software. It looks and operates similar to [Microsoft] Outlook, so just about anyone can feel comfortable with the interface. Loading programs and managing production schedules was never this easy in a stand-alone environment,” Ellis explained.

#### EXTREME PERFORMANCE

While lean processes and efficiency are critical to the flexibility, efficiency and workflow at Extreme Precision, Ellis is also a fanatic for raw speed and power. The enhanced design features of the a51 and D500 were too much for him to resist testing the machines’ limits.

“It’s never been my goal to try and crash these machines, but I have admittedly pushed them to a point where I began

to feel uncomfortable,” said Ellis. “Yet, every time that I begin to worry about pushing the machines too hard, I look up at the screen only to find out that they are only at 30 percent cutting capacity. It’s absurd how much of a punishment these machines can take.”

The enhanced design features of the a51 and D500 machines have enabled Extreme Precision to apply shorter tools at higher feedrates, even in complex 5-axis parts. In many cases, Ellis reports doubling and even tripling feedrates over previous technologies, providing significant boosts in both speed and quality.

“With these new technologies in-house, we’re holding tolerances of 0.0001 inch all day long while reducing cutting times with more aggressive processing techniques and seeing

“... we are minimizing inventory and work in process by approximately 50 percent, freeing up cash flow and mitigating the impact of fluctuations in material costs.”

substantial reductions in non-cut times through faster tool changes, rapid movement, and spindle acceleration and deceleration. Factor in the automation, and we’re looking at average cycle-time reductions between 50 and 70 percent compared to stand-alone equipment,” said Ellis.

While Extreme Precision’s investment in automation has clearly provided many benefits, Ellis did explain that his shop has created a new and very unique challenge: keeping the machines full.

“The cell is constantly hungry for more parts, and we can’t seem to keep it full,” joked Ellis. “That being said, we do appreciate the modular nature of the MMC2. We have peace of mind that there’s still plenty of room for us to grow within our current setup, and even more space to expand from there when needed.”

#### STAYING AHEAD OF THE PACK

The results of the 4- and 5-axis automated cell have been everything Extreme Precision expected and more. The company is able to handle short lead-times and reduce inventory, gaining a competitive edge in the global market.

“Manufacturers are now relying more and more on local companies like us to get this work done,” said Ellis. “In today’s manufacturing world, it’s all about cutting costs and saving the customer time. It’s no longer cheaper to make something overseas.

With our 4- and 5-axis automated cell, we haven’t found anything we can’t do. With our old processes, we sometimes had to send parts to someone else, but now we can easily accomplish what our customers want.”

Just like when he is riding motocross, Ellis strives to keep his company ahead of the curve, and its 4- and 5-axis automated cell has enabled it to take on anything that comes its way. The company knows that having the capabilities to do more with less is the key to staying competitive in North American manufacturing.

“We feel that having these flexible capabilities puts us 10 to 15 years ahead of most other manufacturers,” said Ellis. “What matters to us is having the ability to do something unique with our automated cell system. We have been able to reduce operations by completing parts in just one or two operations. That is where manufacturing is headed, and we’ve been pleased that we have been accomplishing this for a few years. We intend to lead by example.”

“PERFORMANCE,” “PRODUCTIVITY,”  
“PROFITABILITY.”



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### Brings Consistency to Data Collection

MTConnect is the common interface used for the exchange of information between shop-floor equipment and software applications. This platform gives manufacturers the ability to collect standardized data from their operators’ machines in real time in order to help provide more efficient operations, improve production optimization and increase productivity. One product on one device can be used to collect all this data.

With MTConnect, there is also consistency in data definition, which means that all machine tool manufacturers define terms like “in cycle” the same way.

The MTConnect initiative began as a result of lectures given by David Edstrom of Sun Microsystems and Dr. David Patterson, professor of computer science at the University of California, Berkeley (UCB), at the 2006 annual meeting of the Association for Manufacturing Technology (AMT) membership. Previously, machine tool manufacturers had proprietary interfaces on their machine controls. As support grew for a common interface, MTConnect.org was formed to advance and promote acceptance for this standard.

Makino’s MPMAX data management software supports MTConnect-capable machines by collecting, storing, analyzing and displaying high volumes of actionable machine data in real time across a variety of machines. Equipment must have Ethernet capability to use MTConnect. At Makino, such equipment includes horizontal and vertical machining centers with the Pro5, ProP, ProF and Pro3 Controls (dating back to the year 2000).

# a51nx-5XU 5-AXIS HMC



## NEXT-GENERATION PRODUCTIVITY FOR SMALL-PART 5-AXIS MACHINING

Manufacturers of medical, aerospace, prototype and complex multi-face parts have long understood the positive impact that 5-axis machining can have on productivity and quality, simply by consolidating operations. Makino's [a51nx-5XU 5-axis horizontal machining center](#) raises these capabilities to a new level, building on the quality, durability and reliability of the nx-series next-generation horizontal machining platform. With a newly designed 5th-axis table and work-pallet magazine, this new machining center enables manufacturers of complex parts to obtain the highest levels of utilization and efficiency.

When looking for a small 5-axis machining solution, companies are typically limited to single-pallet-load vertical machining centers. The a51nx-5XU stands apart with its horizontal orientation, integral cast 5th-axis table and integrated workpiece automation. Together, these features provide for a highly productive, highly reliable multi-axis machining solution that eliminates recutting of chips, stack-up errors and challenges in 5-axis part loading. It's the perfect blend of capabilities for the manufacturing of rotating cutting tools, aerospace, medical and prototype components.

The linear X-, Y- and Z-axes of the a51nx-5XU are built from the same proven structure as Makino's industry-leading a51nx horizontal machining center. Its rigid bed casting with three-point leveling system provides a solid foundation for all critical machine components. A tiered column design redirects machining forces and resists deflection even high in the Y-axis. These features are further complemented by high-performance linear guides for long-term reliability. Altogether, the a51nx-5XU design offers dynamic stiffness and exceptional vibration management for the highest degree of cutting stability.

### A 5TH-AXIS TABLE BUILT TO LAST

With increasing demand for small-part 5-axis machining, many companies are adding aftermarket 5th-axis rotary tables to 4-axis machining centers. However, these 5-axis retrofits frequently offer less rigidity and pose several challenges in cable interface management. The a51nx-5XU avoids these issues with a single casting design that houses and integrates the B- and C-axis' twin direct-drive motors. This single-piece casting provides ideal rigidity and a minimized profile that reduces interference between the spindle and worktable. All cables are concealed to the roofline of

## MACHINE SPECIFICATIONS

X	580 MM (+ DIRECTION 280 MM, - DIRECTION 300 MM) 22.8" (+ DIRECTION 11.0", - DIRECTION 11.8")
Y	640 MM (25.2")
Z	500 MM (19.7")
B	+180° ~ -90°
C	360°
SPINDLE RPM	14,000 RPM (14K HIGH TORQUE, 20K)
RAPID TRAVERSE	60 M/MIN (2,362 IPM)
MAXIMUM WORKPIECE [OPT]	ø300 MM X 300 MM (ø11.8" X 11.8") [ø200 MM X 300 MM (ø7.78" X 11.8")]
MAXIMUM PAYLOAD	30 KG (66 LBS)
ATC CAPACITY	313 TOOLS
WPM CAPACITY [OPT]	22 WORKPIECES [58 WORKPIECES]

the machine's splash guard and can be easily accessed and managed outside of the machining area. The a51nx-5XU rotary table design eliminates the stack-up errors, loss of rigidity and cable management challenges common to many table-on-table designs.

The design of the large, direct-drive motors within the B- and C-axes enhances the productive capabilities of the a51nx-5XU, providing rapid traverse rates of 75 rpm and 150 rpm to minimize non-cut times. Jacket cooling of the direct-drive motor stators and bearing perimeters eliminate all risk of thermal deformation to help maintain

repeatable, high-accuracy performance with exceptional quality. The C-axis also benefits from a BT-style 50-taper dual-contact (BBT50) interface and clamping mechanism that provides location and clamping of the workpiece within the 5-axis machine envelope.

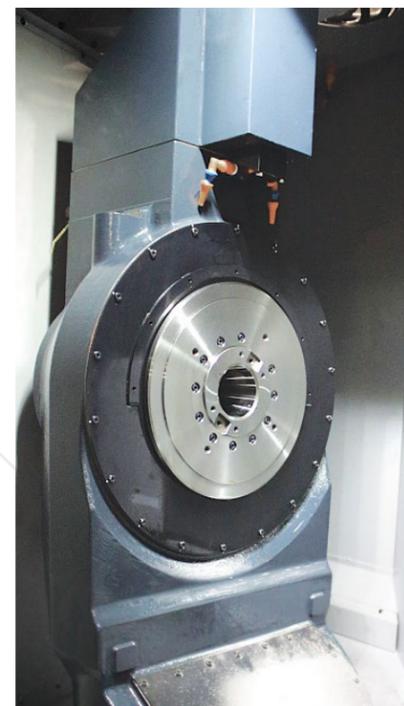
### INTEGRAL AUTOMATION EFFICIENCY

Traditionally, one of the biggest challenges associated with 5-axis part production has been automated capabilities. This is why Makino designed the a51nx-5XU with a unique work-pallet magazine (WPM) that simplifies pallet changes in horizontally oriented 5-axis applications, and facilitates unattended operation for more value-added labor demands.

The WPM takes the place of a traditional horizontal pallet changer, providing manufacturers with automated load/unload capabilities for maximum machine utilization. This technology follows a similar design to that of Makino's proven matrix tool magazine, ensuring quick and reliable transfer of workpieces between magazine and machine worktable. The standard WPM offers storage capacity of 22 different workpieces with sizes up to 300 mm in diameter by 300 mm tall. An optional, larger capacity WPM provides storage of up to 58 workpieces with diameters up to 200 mm. Parts are mounted directly to the 50-taper dual-contact tool holders (BBT50) and stored in the WPM matrix. This capability makes the a51nx-

5XU an ideal solution for continuous, unattended manufacturing in both high-mix, low-volume and low-mix, high-volume production environments.

The WPM system includes a dedicated work-setting station for loading and setup operations, providing convenient and ergonomic operator access. A nearby work data management panel allows operators to enter process data for each pallet. Priorities can be set and changed for each pallet, helping to accommodate for engineering changes or urgent one-off part orders. For advanced levels of scheduling control and machine networking, the a51nx-5XU can also be equipped with Makino's MAS-A5 control system.



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Monday, 9/8	Embracing Manufacturing Change	Learn how Build-A-Mold, a division of A.P. Plasman, rethought its manufacturing approach, ensuring its future business success.
Tuesday, 9/9	Looking Beyond the Spreadsheet	A discussion of characteristics that truly impact machine productivity and profitability, but are most often overlooked when making an equipment purchase.
Wednesday, 9/10	The Science of 24/7 Machining	Learn how Micro-Mechanics meets evolving global production needs on demand for challenging part applications through “the science of machining.”
Thursday 9/11	The Next-Generation Mold Builder	See how CS Tool Engineering is using today's leading technology to stay far ahead of the curve in the mold-building industry.
Friday, 9/12	A New Standard in Medical Manufacturing	Learn how Big River Engineering & Manufacturing employed automation for 24/7 medical manufacturing.

