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MoldMaking

TECHNOLOGY



Scan To Renew

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Through Tooling, Engineering and
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Mark Yurovsky and Vlad Rybchinsky, LC Mold Incorporated



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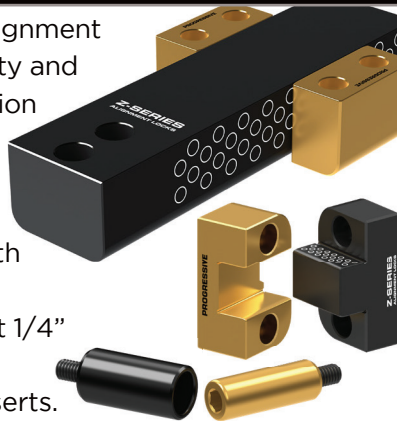
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- Ideal for forming contours with high surface finishes.





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Robotic polishing automates finishing across rotomolding, composites and other mold types, with plastic injection molds a natural next candidate.

ON THE COVER

Cover photo courtesy of Sheridan Mold & Engineering.

Precision at microscopic scale. A 30,000-rpm Makino D200Z cuts .010-inch sub-gates into a medical-grade LSR mold component at Sheridan Mold & Engineering. The image captures the craftsmanship, technology and relentless pursuit of precision that allowed a small Wisconsin mold builder to compete on a global stage and ultimately become part of a Fortune 500 life sciences platform. See feature on page 10.

Source (left to right) | Sheridan Mold & Engineering, Shibaura, Kallan

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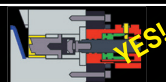
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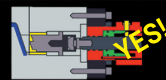
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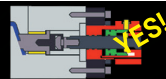


Mold OPEN
Core Out

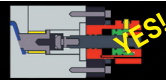


Mold CLOSED
Core OUT

CAN'T DO IT!



Mold CLOSED
Core IN



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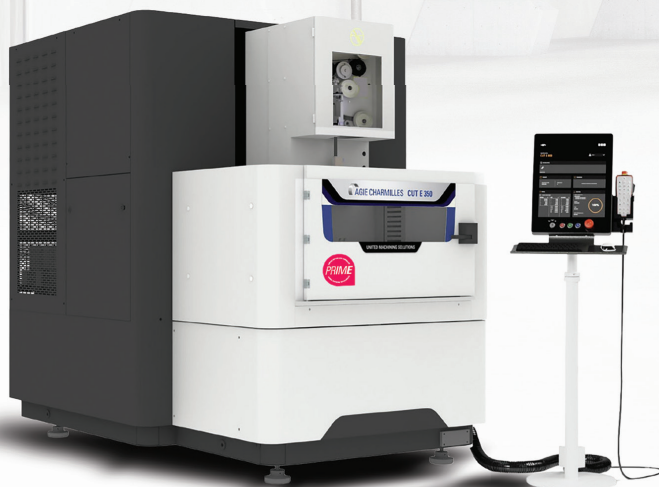
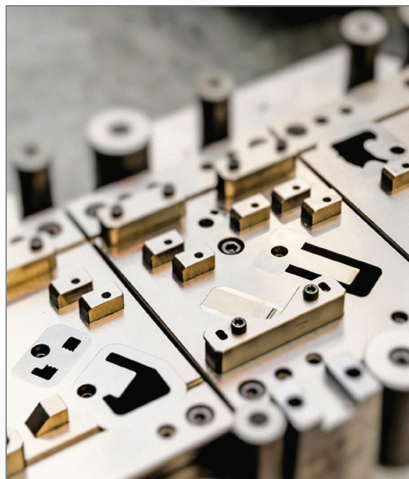
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Bravery and Focus: Navigating Moldmaking's Next Chapter



There was a phrase repeated during this year's AMBA Annual Conference that has stayed with me: *What would a brave person do?*

That question was posed by Troy Nix during his opening keynote, but in many ways, it became the underlying theme of the entire conference. Growth (at home or at work) often requires uncomfortable decisions, difficult conversations and the willingness to move forward even when things feel uncertain.

Sometimes bravery is taking the next step anyway.

That theme carried into keynote messages from Mike Lee and Mark Scharenbroich. Moldmakers are primarily focused on machines, technology, process improvement and solving technical challenges, but these speakers offered a reminder that high performance ultimately comes down to people and how they communicate, lead, respond under pressure and support one another through challenges.

Lee's message about focus and mindfulness felt especially relevant because today everyone is being asked to move faster and manage more responsibilities amid many distractions. Focus does not happen automatically; it is a skill that you must practice with intention. Mindfulness was presented not as another business buzzword, but as a way to slow down enough to think clearly, listen carefully and respond thoughtfully. Those abilities may become just as valuable as the technical expertise we are always talking about.

Scharenbroich's "Nice Bike" message reinforced another simple but important truth: people remember how you make them feel. Recognizing contributions, building relationships and creating meaningful connections remain essential to build strong company cultures and retain employees.

The conversation also shifted toward two topics creating considerable uncertainty for manufacturers right now: tariffs and AI. Discussions led by lobbyist Omar Nashashibi reinforced that tariff uncertainty is no longer a temporary disruption. It increasingly influences sourcing decisions, investment strategies and long-term planning.

At the same time, the AI panel I moderated shifted the discussion away from fear and toward action. The takeaway was that AI is not a one-time project. It is a continuous improvement journey, which many of us, including the MMT team, are navigating alongside you!

What connected these discussions was a larger realization that the future of moldmaking will not be shaped by technology alone. It will be shaped by how people choose to respond to change. Perhaps that begins by asking ourselves one simple question: *What would a brave person do?* **MMT**

Christina Fuges

Christina M. Fuges
Editorial Director

Follow MMT on: 

MMT TIPS

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TRICKS OF THE TRADE

Great Tips from This Issue

1. Cavity Capture

Nucleus, Atomic's proprietary AI software and hardware stack, uses custom-built shop-floor control boxes to capture real-time cavity data, tracking temperature, pressure and ejector pin force during every cycle.

PG. 18

2. Precision Pallets

Skip the manual unmount-remount step after jig grinding. A pallet system lets a robot move the pallet to the CMM for validation, then return it for more grinding if needed.

PG. 22

3. Edge Exactness

Traditional tool setters measure only length and diameter, missing the real cutting-edge geometry. High-speed optical measurement profiles the edge at 91 positions with 100 nm resolution for a truer contour.

PG. 26

4. Fast Fit

When cavity and core inserts drop straight into the mold, a standard mold base with precision pockets and alignment features cuts bench time.

PG. 30

5. Winning Work

An Ideal Opportunity Profile defines what work a shop is built to win, turning senior engineers' tacit knowledge into a shared framework sales can use early to guide customer tradeoffs.

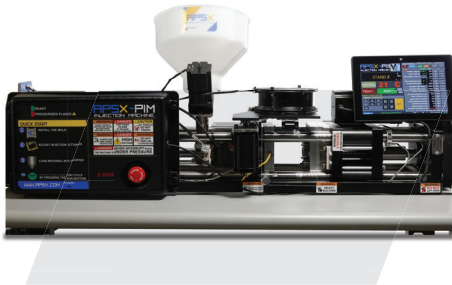
PG. 34

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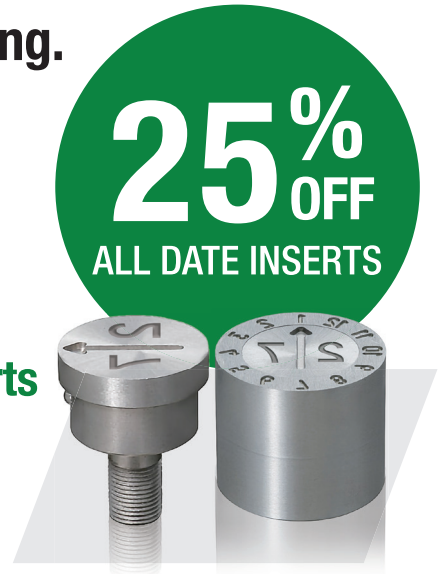
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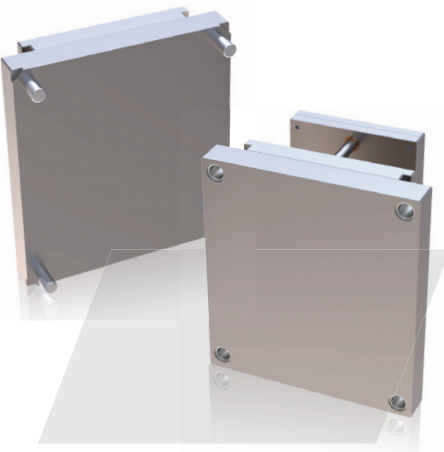
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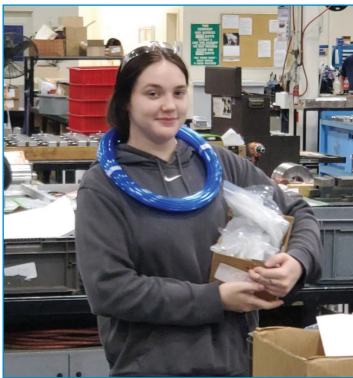
PCS is a 2025 Top Workplace! 3 Years Running.

Editorial Advisors Bring Shop, Classroom and Workforce Expertise

By Christina Fuges

At just 21 years old, **Sarah Morgan** is already making a mark in the injection stretch blow mold (ISBM) industry as a manual machinist and toolmaker at R&D/Leverage in Lee's Summit, Missouri, a company recognized as a leader in ISBM and IBM manufacturing.

In this role, Sarah manages the full lifecycle of ISBM tooling through the shop, performing manual mill and lathe work, coordinating parts for plating and heat treatment and then shipping completed tool assemblies. With nearly three years of training, she has helped ship over 100 tool assemblies and serves as a trusted resource for fellow machinists when problems arise.



Sarah Morgan, R&D/Leverage.

Sarah's path into machining began with I-Tech and engineering classes in high school, followed by NTMA coursework and the start of a toolmaking certificate program. That foundation earned recognition in 2026 as SPE Mold Technologies' Apprentice of the Year.

Beyond the shop floor, she sits on the I-Tech advisory board for the Lee's Summit School District, speaks on the value of apprenticeship programs for local businesses, and participates in NTMA's *She Leads* initiative. Rooted in a blue-collar family and driven by a fresh perspective, Sarah brings both hands-on skill and a genuine enthusiasm for growing the next generation of industry talent.

Smorgan@rdleverage.com / adlertooling.com/our-network/r-and-d-us

Nicholas Vitelli is a lecturer in the plastics engineering technology program at Penn State Erie, The Behrend College, where he prepares students for careers in plastics part and mold design, project management and manufacturing. Vitelli brings over 20 years of industry experience, combining technical expertise with practical insights into mold design, tooling and project execution.

He began his career as a mold designer at a local tool and die shop, specializing in complex molds for thermoplastic and thermoset molding, as well as die casting. Over time, he transitioned into project management and technical sales, advising customers



Nick Vitelli, Penn State Erie, The Behrend College.

on part modeling best practices, material selection, moldability and cost optimization. He also provided tooling estimates, guided improvements to existing tool designs and coordinated closely with manufacturing teams to keep projects on schedule. Vitelli attended initial mold trials to help set up processes, evaluate process windows and ensure robust, high-quality molds before shipment.

At Penn State Behrend, he draws on these experiences to teach both technical skills and the "soft skills" essential to day-to-day success in industry. Vitelli shares insights on mold design, materials, components, disruptive technologies, software, culture and workforce development.

He looks forward to contributing to MoldMaking Technology's Editorial Advisory Board while learning from industry peers about how best to prepare the next generation of plastics engineers. Outside of work, he enjoys spending time with his family on Presque Isle during summer and pursuing outdoor activities in winter.

Npv102@psu.edu / Behrend.psu.edu

Marion Gilbert Wells is the founder and managing partner of Human Asset Management (HAM) and a recognized leader at the intersection of metallurgical engineering and workforce strategy. She has served on MoldMaking Technology's Editorial Advisory Board since 2019 and brings decades of experience transforming organizational culture, talent strategy and business performance in manufacturing.



Marion Wells, Human Asset Management (HAM).

Wells earned a bachelor's degree in metallurgical engineering from

the University of Wisconsin–Madison and gained extensive industry experience during 17 years at ArcelorMittal Steel, holding roles in production, quality, technical services, research and business development. She later founded HAM to help companies optimize their talent using Predictive Index science-based methodologies, emphasizing workforce culture, mentorship and long-term employee development.

A passionate advocate for STEM diversity, Wells sponsors programs such as the STAR Scholars initiative at UW–Madison, supports scholarships and serves on multiple advisory boards, including the Materials Science & Engineering Department and the SME Education Foundation. She is a frequent speaker at industry conferences, presenting on workforce readiness, talent optimization and bridging the generational gap in manufacturing.

Wells' 2026 focus emphasizes the value of the human worker as an appreciating asset, integrating advanced technologies while cultivating diverse talent pipelines and fostering mentorship to prepare the next generation of skilled professionals. Outside of her professional work, she mentors students, coaches young engineers and continues to champion inclusion and innovation in STEM and manufacturing.

mwells@humanassetmngt.com / humanassetmngt.com **MMT**

EDITORIAL ADVISORY BOARD (EAB)

The EAB enhances the standing of the publication and strengthens its professional integrity through the active involvement of its members.

The board represents all aspects of the mold manufacturing industry with a balance of moldmakers, molders, OEMs and academia, and various moldmaking segments and job functions. A member is selected based on his or her experience and knowledge of the moldmaking industry to serve a three-year term.

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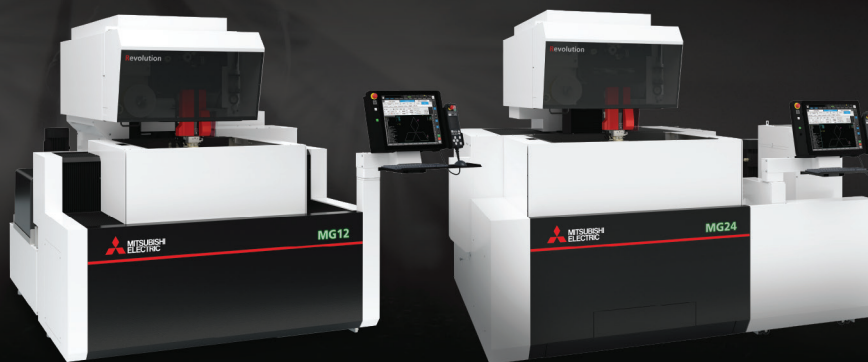
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A Conversation with ... Sheridan Mold & Engineering

By Christina M. Fuges

Q: With Ingersoll Rand's acquisition of Sheridan Mold & Engineering, how does Sheridan fit into Ingersoll Rand's (IR) life sciences business and Flexan's medical device strategy?

Luke Wagner, North America

Tooling Manager, Sheridan Mold & Engineering/Medical Device

Solutions (MDS): Life sciences is a primary growth platform for Ingersoll Rand, and Sheridan adds tooling and engineering capabilities that support that strategy. Sheridan's mold design and silicone processing expertise aligns directly with Flexan, a medical device contract development and manufacturing business.

This wasn't simply about adding a mold shop. It was about vertically integrating tooling, engineering, prototyping and production into a single medical device development platform. Sheridan now operates as Flexan's tooling and micromolding center of excellence, supporting the global manufacturing network. Bringing tooling in-house closes a gap in the product development lifecycle.

Tooling, molding and manufacturing teams can collaborate from the start of a project, instead of customers managing separate suppliers for tooling, molding, assembly and commercialization.

Flexan's capabilities span design-for-manufacturability, rapid prototyping, mold design and fabrication, extrusion, silicone and thermoplastic molding, assembly, packaging and commercialization support. Integrating Sheridan into that workflow gives customers earlier access to tooling expertise, which helps reduce development cycles and improve manufacturability.

For Sheridan's day-to-day operations, the integration adds resources rather than changing how the team works. Customers continue working with the same Sheridan team and processes, now with access to a larger organization's engineering resources, capital investment and complementary manufacturing capabilities across silicone, thermoplastics and rubber.

Q: Now let's go back to the beginning. When did you start in moldmaking, and specifically, silicone?

Wagner: I've been involved in moldmaking for nearly three decades. I started when I was 16 years old and still in high



Sheridan's original machining area totaled 4,000 square feet before a recent addition brought the facility to 10,000 square feet. The shop currently employs eight people, a number expected to grow.

Source (all images): Creative Technology Corp.

school. My father was a patternmaker and encouraged me to pursue something different, but I couldn't stay away from manufacturing. I was fascinated by the process of creating molds and seeing how ideas became physical products.

After graduation, I entered an apprenticeship instead of pursuing an engineering degree. I enjoyed working with my hands and learning the craft. When the company I apprenticed at closed in the early 2000s, I started building molds at a liquid silicone rubber (LSR) molder in southeast Wisconsin. That's where I became heavily involved in silicone manufacturing, and I've been working in silicone and medical applications ever since.

Q: What led you to decide to acquire Sheridan?

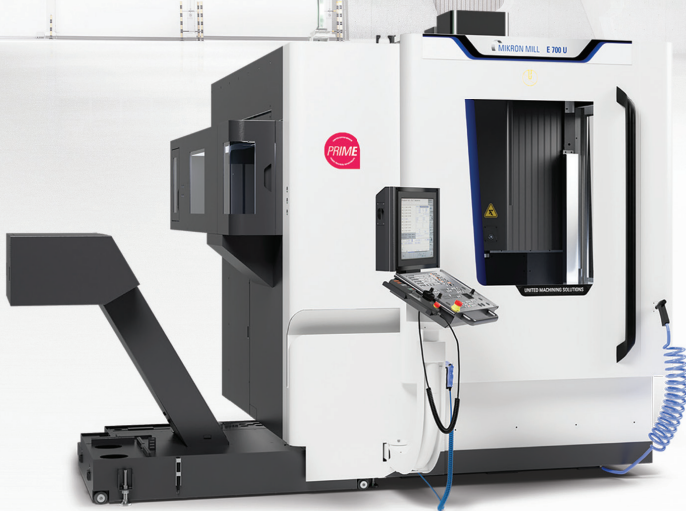
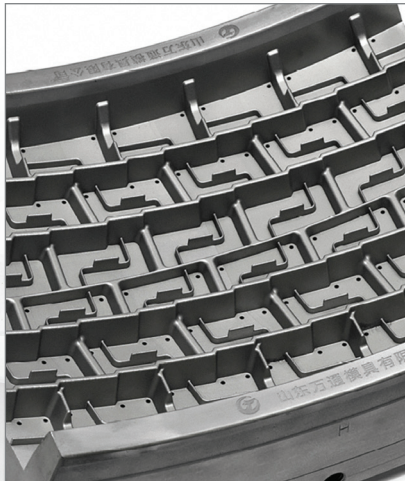
Wagner: Owning my own shop was always a goal. In 2017, my wife Nicole and I sold our house and purchased Sheridan. At the time, the company had been around since 1954 but had not kept pace with technology and modernization. There was very little modern equipment, no website and a lot of work ahead of us.

It was a risk, but we believed there was tremendous potential. Buying an established company gave us a foundation and credibility while allowing us to build something new. We invested heavily in equipment, technology and processes because we wanted Sheridan to become a leader in precision medical tooling.

Q: What was the first thing you changed?

Wagner: The first significant investment was a CNC machine with a tool changer, which was the beginning of our transformation. Since then, we've added advanced machining

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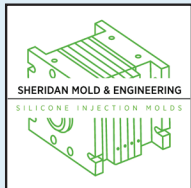
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Precision matters tremendously in our industry. When customers are developing products that may be implanted in a patient or used in critical procedures, quality and consistency cannot be compromised. Equipment, maintenance, environmental controls and process discipline all contribute to that outcome.

Q: What does Sheridan look like today?

Wagner: We've grown from 4,000 square feet to 10,000 square feet since I acquired the business, and our staff of eight is expected to grow. We're expanding our facility, adding an LSR sample press to our turnkey area and investing in automation equipment. That includes tooling, automation and validation support.

What's especially exciting today is how Sheridan's specialized expertise connects to the broader Flexan platform. While we remain focused on high-precision LSR tooling and micromolding, customers now have access to a broader organization that can support engineering, molding, extrusion, assembly and commercialization.

Instead of simply delivering a mold, we're helping customers navigate the entire journey from concept to finished product.

Q: Sheridan has carved out a niche in medical and micromolding. Why focus there?

Wagner: Medical applications are a natural fit for our capabilities because they require an extraordinary level of precision. We've always gravitated toward highly technical projects where tolerances are tight and quality requirements are demanding.

Our expertise centers on flashless LSR tooling and micromold construction, which requires holding flash to 0.0003 inch. We use micron-level indicators and a vision system for measurement, and we're adding a Zeiss O-Inspect coordinate measuring machine in the fourth quarter. The facility is held at a constant 72°F year-round, supported by an oversized HVAC system that stabilizes ambient temperature. Our machines incorporate built-in thermal stability, and we use CAM Tool software for die and mold work.

Many of the products we support are used in implantable and minimally invasive medical applications where reliability and repeatability are critical. That's where our attention to detail creates the most value.

Q: What types of medical technologies does Flexan support?

Wagner: Flexan supports some of the most demanding applications in the medical device industry, including cardiac rhythm management,



Sheridan's hard milling department includes Makino machines, part of the equipment lineup the shop added to support complex medical tooling applications.

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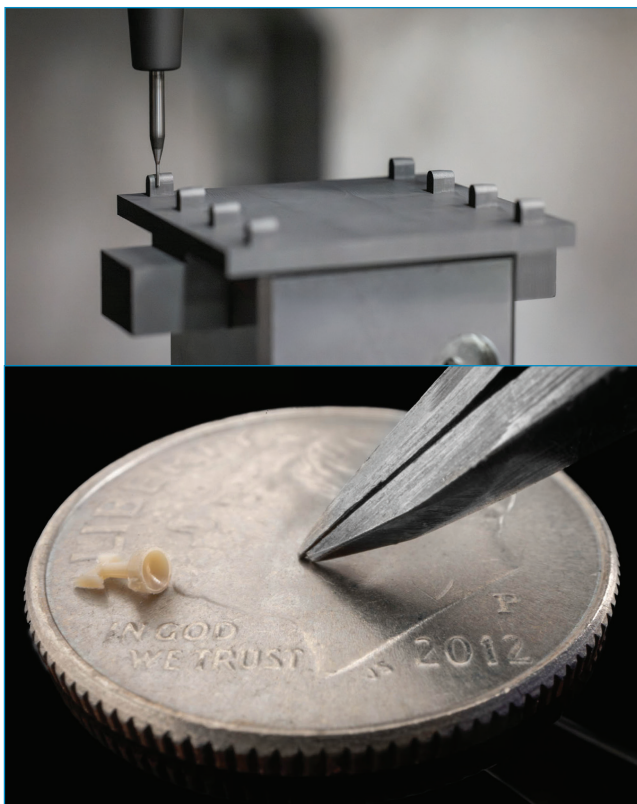
Believing that our pioneering developments and solutions are the key technologies that drive the plastics industry, we are actively engaged in making changes to bring a healthy future and leading the value of innovation.

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(top) The Makino V22, running at 40,000 rpm, is used for graphite machining as part of Sheridan's expanded equipment lineup. (bottom) A micromolded part produced with flashless LSR tooling, built to the tight tolerances Sheridan targets for implantable and minimally invasive medical device components.

neuromodulation, electrophysiology, structural heart therapies, peripheral vascular technologies, neurovascular applications and advanced drug delivery systems.

These are not commodity products. Many are implantable or life-sustaining devices where process control, consistency and quality are absolutely essential. Across Flexan's network, components are manufactured for technologies ranging from neurostimulation systems and dialysis catheters to hearing aids, hydrocephalus shunts and advanced catheter-based delivery systems.

For Sheridan, that's a perfect alignment. The precision required to produce a flashless LSR mold is the same precision required for medical technologies where failure simply isn't an option.

Q: What sets Sheridan apart in the industry?

Wagner: We're often the company customers call when a project is considered too challenging or when other suppliers decline to quote it. We enjoy solving difficult engineering and manufacturing problems. For example, we built a mold for a part measuring 0.09 inch long that required three slides to form its features. In another project, we replaced a mold for a

catheter component that had required two operators working two months to complete a production run. The new mold runs the same order in four days, operating around the clock with full automation and no operators required.

One of our biggest differentiators is early collaboration. In many cases, the molder handles all customer communication before handing the project to an outside mold shop. Involving an LSR subject matter expert on sales calls from the start eliminates part designs that can't be molded. Including department heads on those calls has cut weeks from the project timeline.

Q: Why is vertical integration becoming so important in medical device manufacturing?

Wagner: Medical device companies face increasing pressure to launch products faster while navigating complex regulatory requirements. Traditional development models often involve separate suppliers for tooling, molding, assembly and production. That approach can create communication gaps, delays and unnecessary risk.

Flexan's strategy is to create an integrated process where engineering, tooling, molding and manufacturing teams collaborate from the beginning. When potential challenges are identified early, customers avoid costly redesigns and can accelerate commercialization timelines.

Q: How does Sheridan support Flexan's global manufacturing footprint?

Wagner: Sheridan may be based in Wisconsin, but its impact reaches much further. Flexan operates manufacturing facilities across North America and Asia, providing silicone molding, thermoplastic molding, extrusion, assembly and packaging capabilities within FDA-registered and ISO 13485-certified quality environments.

Sheridan strengthens that network by providing captive tooling expertise that improves development speed, expands engineering collaboration and creates a smoother transition from prototype to production. Customers can begin with an idea, move into tooling and validation, launch production and eventually scale globally while remaining within the same development ecosystem.

For example, a customer developing a wearable drug delivery device was behind schedule. Having our moldmaker work directly with the customer's project designer streamlined the path to tooling. The teams discussed design hurdles for each part and collaborated on a design that sealed against a needle while remaining easier to automate for production. The result was a two-shot part combining polyetheretherketone (PEEK) and LSR materials with a diameter of 0.15 inch.

Q: What are Sheridan's short-term and long-term plans?

Wagner: In the short term, we're adding a precision five-axis mill with multiple pallets and hundreds of tooling positions.



Luke Wagner discusses electrode details for Sheridan's Mitsubishi EA8 EDM sinker, part of the equipment lineup the shop uses alongside its graphite machining capabilities.



The recent 6,000-square-foot addition brings Sheridan's total facility to 10,000 square feet. The space is held at a constant 72°F year-round, supported by an oversized HVAC system that stabilizes ambient temperature for precision tooling work.

We now have the space to bring LSR presses in-house and perform full turnkey mold automation for projects molding upwards of 1 million parts. Our prepping area will be converted into an automated cell for prepping cavity steel.

Long term, the industry is moving toward complete turnkey

solutions where tooling, molding, automation and validation are delivered together. With Sheridan's specialized tooling expertise and Flexan's global medical manufacturing platform, we're uniquely positioned to support that future and help customers bring innovative medical technologies to market faster. [MMT](#)

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THE MOLDMAKING CYCLE: What the Data Reveal

Four decades of metalworking machinery data show investment cycles that often diverge from National Bureau of Economic Research recessions, offering manufacturers an early signal.

Metalworking machinery, which captures industrial mold manufacturing, offers a different view of the business cycle. Production can accelerate before broader activity turns upward and investment can weaken well before a downturn becomes apparent, making it a useful complement to the chronology maintained by the National Bureau of Economic Research (NBER).

Quarterly data on U.S. industrial production of metalworking machinery from 1972 through the second quarter of 2026 reveal a highly cyclical industry, generally related to the broader U.S. business cycle but considerably more volatile. The latest data suggest the cycle reached a trough in the first quarter of 2025 and has since risen for five consecutive quarters, moving from -3.2 in Q1 2025 to 3.4 in Q2 2026.

The question now is whether this is the start of a sustained

capital-goods expansion or another temporary recovery in an industry known for pronounced swings.

A Cycle Within the Business Cycle

Companies purchase machinery when they expect future demand to justify expanding or modernizing capacity, so orders depend on expectations about sales, financing, technology and capacity utilization, not just current production, making machinery investment inherently cyclical, as shown in **Figure 1**.

During the strongest expansions, machinery production has moved well above its underlying trend; during downturns, it has fallen substantially below it, with the largest negative deviation occurring during the Great Recession, when the measure fell to -24.6 in Q3 2009.

These movements do not always correspond one-for-one with NBER recessions, which reflect declines spread across the whole economy lasting months. The metalworking machinery series, by contrast, captures manufacturers' investment intentions more directly.

The Early 1980s and 1990s

The NBER dates the first recession from January to July 1980 and from July 1981 to November 1982. The machinery series showed a pronounced contraction over the same period, peaking around Q2 1981 before plunging to approximately -21.7 in Q1 1983, a downturn far greater than the recession alone would suggest.

The early 1990s show how the machinery cycle can lead the broader economy: the NBER dates

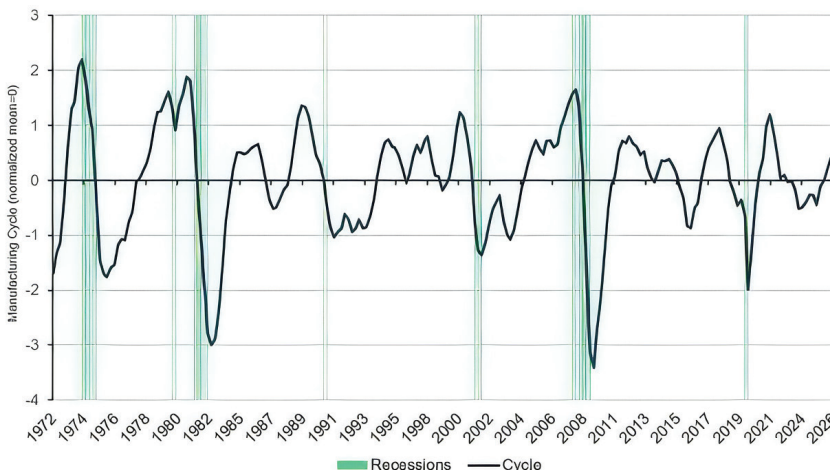


FIG. 1: U.S. recessions and metalworking machinery manufacturing cycle. Quarterly, Q1 1972 to Q2 2026. Source: National Bureau of Economic Research and PLASTICS' Analysis of Federal Reserve System Data

A Note on Industrial Molds

The metalworking machinery data offer useful perspective on investment cycles but should be interpreted with caution for individual mold-making companies. Industrial mold manufacturing sits within the broader metalworking machinery classification, which covers a diverse range of manufacturers, so the aggregate series may not fully capture the market conditions, demand patterns or business cycles of individual mold makers. For mold manufacturers, the broader machinery cycle is best viewed as an indicator of underlying investment conditions, not a direct measure of mold-industry performance.

the economy-wide peak to July 1990 and trough to March 1991, but the machinery series peaked in Q2 1989, roughly five quarters earlier, with its trough coming later, around 1991-92. Manufacturers can cut capital spending when they sense weakening demand before it becomes broad enough to register as a recession.

The 2001 Recession and the Great Recession

The NBER dates the 2001 peak to March and trough to November. The machinery series peaked in Q2 2000, about three quarters earlier, with its trough in Q4 2001 essentially coinciding with the NBER's, as tech-boom spending weakened before the broader economy peaked.

The strongest correspondence occurred during the Great Recession: the NBER dates its peak to December 2007 and trough to June 2009, while the machinery series peaked in Q2 2008 and collapsed to -24.6 in Q3 2009, the deepest contraction in the series, as businesses facing collapsing demand, financial stress and restricted credit had little incentive to commit to new equipment.

The machinery cycle is not the NBER business cycle. It is something more specific and, for manufacturers, potentially more revealing: a window into how businesses are positioning themselves for the economy that they expect to see next.

That recovery proved temporary. The machinery cycle declined almost continuously from its Q4 2021 peak, moving below zero in 2023 and staying negative through 2024, reaching a trough of -3.2 in Q1 2025. The NBER has not identified a recession during this period, so the episode is better described

as a prolonged capital-investment downturn, one in which manufacturers kept producing and employing workers while postponing new equipment purchases.

2025 May Mark the Start of a New Machinery Cycle

The most recent data suggest the cycle has turned: after -3.2 in Q1 2025, the measure improved to -0.9 in Q2 and near zero in Q3, then moved decisively positive, reaching 1.7 in Q4 2025, 2.9 in Q1 2026 and 3.4 in Q2 2026, five consecutive quarters of improvement. The recovery has been gradual, first stopping its deterioration, then stabilizing and moving above trend. The current reading remains well below prior peaks, suggesting an early recovery rather than a mature investment boom.

What the Comparison Tells Us

Five decades of data reveal a clear but imperfect relationship between the two cycles. The relationship was strongest during the early 1980s, the Great Recession and COVID. In other episodes, machinery turned substantially before the broader economy, as it did before the 1990-91 and 2001 recessions. Some downturns, including the mid-1980s, the early-to-mid-1990s, 2013-16, 2019 and 2022-25, do not correspond to NBER recessions at all.

That is what makes the series useful, not a weakness. The NBER cycle measures the broad economy; the machinery cycle measures manufacturers' investment decisions, which are more sensitive to expectations, financing conditions, capacity utilization, technology and uncertainty.

The Cycle Has Turned: How Far Can It Run?

The important development is not that production has returned to historically strong levels, it has not, but that the direction has changed. The machinery cycle appears to have bottomed out in Q1 2025 after roughly three years of declining momentum from its 2021 peak, moving above trend in late 2025 and continuing higher through the first half of 2026.

Whether this recovery broadens into a sustained expansion depends on manufacturers growing confident enough to move from maintaining capacity to investing in new capacity and technology. Machinery cycles are volatile and recoveries can be interrupted by interest rates, trade policy, industrial demand, inventories or business confidence. However, the current trajectory is encouraging: the machinery cycle is a more specific, potentially more revealing window into how businesses are positioning themselves for the economy they expect next. **MMT**

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What Comes After the Test Bed

Atomic Industries has spent a few years proving its technology works. Now they're scaling it.

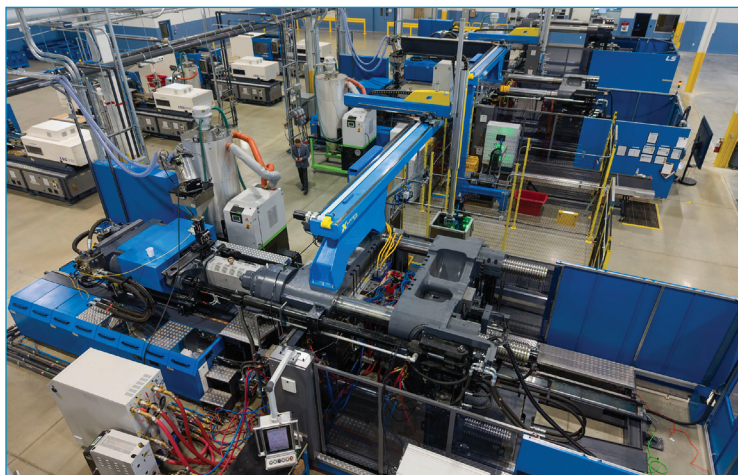
When Atomic Industries first appeared in these pages in January 2026, the story was about ambition. The startup, backed by investors, established itself in Michigan with a clear idea: to let physics, rather than people, guide decisions in injection mold design. Co-founders Aaron Slodov and Lou Young dedicated six years to create the test bed facility at the Warren location. They assembled a team of software engineers, mathematicians and moldmakers to develop software that could autonomously design molds with improved waterlines, gate locations and ejector pin placement.

That story was about what Atomic was building. This one is about what it's becoming.

When I visited recently, the team was busy getting ready for a ribbon-cutting ceremony, setting up a booth for the upcoming Reindustrialize summit, and the focus has shifted from the test bed to the production of parts using the data they have begun to collect from their Nucleus software and hardware stack.

What the Sensors Are Telling Them

Every mold Atomic builds goes into production with sensors embedded in the cavities (temperature, pressure, ejector pin



These robotic molding cells at Atomic's Shelby Township, Michigan, facility reflect the company's scale-up from testing to full-production part manufacturing. Source (all images): Atomic Industries

force and plastic flow force). One production tool has 60 sensors per cavity, and all of that data streams back in real time.

"We've seen crazy correlations that people have never seen before," co-founder and president Lou Young says during the visit. The example he gave was precise: zone 4 of a heater band on the nozzle varied by 5°C, and parts consistently came out 0.005 inch smaller every time it spiked. This is not just a theory; it's an observation supported by numerous data points collected during the production run.

The practical implication is immediate. "We could probably run these cycles five seconds faster if we tightened up the temperature range on the press," Young says. Parts were floating in and out of spec because the process window was wider than it needed to be. Tighten the window and more parts stay in spec and cycles run faster.

That's what separates Atomic from other mold shops putting sensors in tools. The data feeds back into their models. Every mold they build and run makes their software and hardware stack more efficient for the next customer program. "If you aren't doing the thing you're creating the tech for, that's how long it takes to get meaningful results," Young says, pointing to the 30 to 40 years it took simulation software to earn



Atomic Industries' new production facility in Shelby Township, Michigan, houses the company's current production molding operations and represents the first of what will be a multi-site US manufacturing footprint.



Atomic's proprietary AI software and hardware stack, Nucleus, gathers real-time production data via control boxes that Atomic has designed, built and implemented directly on its shop floor. The system collects real-time sensor data from mold cavities, tracking temperature, pressure and ejector pin force during production.



Aaron Slodov, Atomic co-founder and CEO, shows Michigan Lieutenant Governor Garlin Gilchrist II real-time production data during Atomic's recent ribbon-cutting ceremony at their new production facility in Shelby Township, Michigan.

industry trust. "But when you're getting actual feedback from running production on how the mold your system designed and built performs and you're streaming data back from all of these, we're able to accelerate that tech development and provide immediate value to our customers."

A traditional tool shop receives customer feedback along the lines of, "Your mold's good." Atomic gets the actual process data, and since they are also the molder of the parts, they can immediately incorporate these data-driven feedback loops into mold and molding operations. This provides a dynamic feedback loop that tool builders and molders haven't had access to before and allows Atomic to shorten the lead time to launch new parts by an average of 12 weeks for their customers.

The Proof Is in the Cycle Times

The numbers support the case. Atomic has molds in production that were designed using their software and built in-house. For one project, they achieved cycle times of 53 seconds, while competitors quoted the same project at 70 seconds. It's the difference between a tool that makes money and one that doesn't.

In January, the 30% to 50% cycle time improvement from optimized waterlines and ejection was still theoretical. It's not anymore. "We're proving the economics of what we're building now," Young says. He acknowledged the company still faces challenges.

The certification path is its own challenge. Breaking into automotive as a new supplier requires IATF certification, which

requires 12 months of audit data. "We want to go faster than that," Young says. They're going as fast as the process allows.

The Mega Facility

The next phase of growth involves plans for a million-square-foot facility with hundreds of injection presses and enough tool-building capacity to launch 30 to 40 tools a month into production. The goal is vertical integration: mold design through part production, all under one roof.

"There isn't a plant like this in the world for making plastic parts, especially with tool building under the same roof," Young says. The site hasn't been chosen. Michigan, Ohio and New Mexico are all on the table. "Those are the conversations we're having now," Young says. The customer mix spans automotive, consumer, defense, industrial and drone applications.

The business model is the same one I described in January, just at a much bigger scale. Atomic doesn't sell molds and doesn't license software. It builds tools using its own technology and then runs those tools to make parts. The tooling cost gets rolled into the piece price.

"Future state, not charging customers tooling," Young explains. The customer gets a competitive piece price, with no separate line item for the mold. The mold is Atomic's problem and Atomic's advantage. However, they recognize that some OEM customers will still want to own their own tooling.

"We can and do work with each OEM based on their internal supplier policies and procedures, so from that perspective we are flexible and adaptable," Young says.



Engineers at Atomic's Warren location work alongside machining equipment used to build molds designed by the company's proprietary software.

Expanding Beyond Injection Molding

One piece of news that hasn't been public is the planned expansion into high-pressure die casting. The physics of high-pressure die casting are similar enough to injection molding to make the technology transferable (fluid flow, thermal management, conformal cooling and cavity pressure).

Young points out that conformal cooling is already widely used in die casting than in injection molding, partly because the stakes are higher. Scrap rates in high-pressure die casting can run as high as 50%. Better tooling means a real dent in those numbers.

The January article mentioned die casting as a potential market. After this visit, it's clear it's no longer a future consideration; it's part of the current strategic roadmap.

The Talent It Takes

When the January article was published, Atomic had approximately 16 software engineers. That number is now approaching 30. That's roughly the same size as the manufacturing side of the operation, making for about 80 employees total.

The software engineers aren't coming from traditional manufacturing backgrounds. They are coming from companies like Google, Apple and Pixar. These experts in computational geometry have spent their careers focusing on rendering algorithms and image recognition. Now, they are applying their skills to mold parting line automation and cooling system optimization. The underlying mathematics, such as geometry recognition, physics simulation and machine learning has more practical applications than you might think.

"If I'm bidding against somebody who has to also turn in a quote for a mold, I could quote someone \$2.50 for a piece price and Company B quotes \$2.50 piece price plus a \$300,000 mold," Young says, emphasizing the competitive advantage the technology enables. "That's disruptive to the whole industry."

What's Still Hard

Young wasn't exaggerating the current situation. The sensor work is providing useful data, but distinguishing the signal from the noise is still a challenge in engineering. The sensors pick up vibration and frequency from the machines themselves, not just the mold. He explains that getting a clean read on something like 15 pounds of ejection force against thousands of pounds of injection pressure takes both the right hardware and the right software to filter out what doesn't matter.

The IATF certification clock is running and can't be rushed. The team is putting together its first trade show booth at IMTS this fall, and NPE is also a target for the injection molding customer base. There is a lot for the Atomic team to focus on in the second half of 2026.

The production successes and results are starting to grow, but some customers aren't ready to go on record yet. A company in Elkhart, Indiana, running 800,000 parts per year on an Atomic-built tool declined to be named. More announcements are coming, but the case studies for public consumption are still a work in progress. Atomic is aggressively looking for more molding work and opportunities to prove its technology at scale in its 73,000-square-foot state-of-the-art molding facility in Shelby, Michigan.

The Bigger Frame

Reindustrialization kept coming up in the conversation. It's a term that's quite common in discussions about manufacturing policies these days. Young pointed out the scale of the issue clearly: there are cities in China with 10,000 tool builders, and capacity has moved overseas over the years. Atomic aims to become the largest part producer in the world, with facilities that could eventually be set up in various locations across the country. "That capacity needs to move back," Young says. "We're doing that."

Reaching that point depends on several factors, including the decision about the next facility, the certification timeline, customer letters of intent and the data from the 60 sensors per cavity.



An America 250-Year Special Edition Wrapped Milacron molding machine was on display during the company's recent ribbon-cutting ceremony.



Atomic's shop floor houses injection presses producing parts from company-designed molds embedded with sensors that stream data in real time.

It all needs to come together.

But the test bed has proven successful; the cycle times are real; the software is running production; and real parts are shipping to customers. So, the question has shifted from whether the technology works to how fast the production will scale given all

the momentum and the OEM customers who have started to take notice of what Atomic Industries is doing.

That's a very different story than the one I told in January. **MMT**

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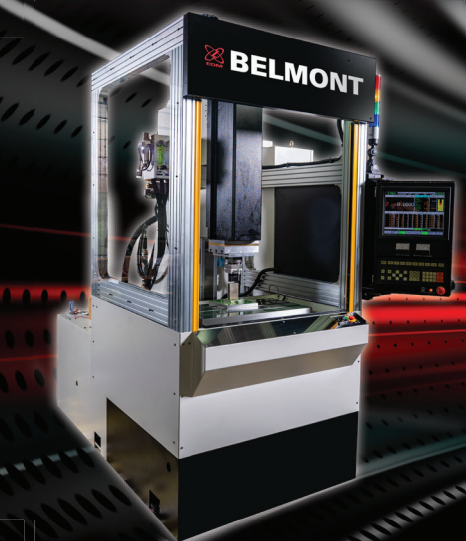
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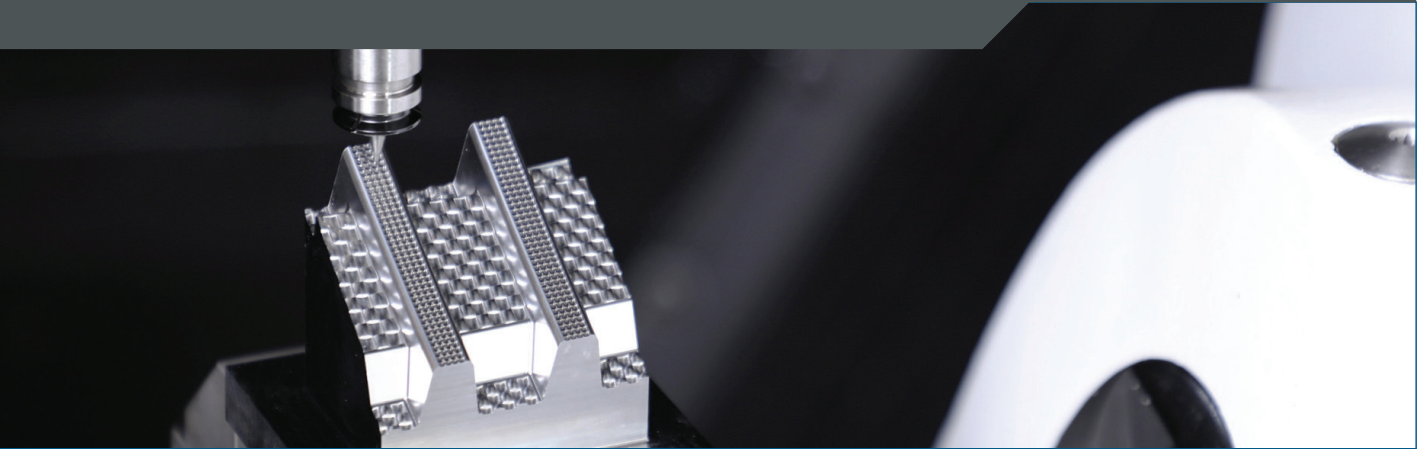
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Five-Axis Milling Platform Adds Jig Grinding for Streamlined Moldmaking

One machine combines five-axis milling and jig grinding, streamlining production, enabling automation and adding capacity without a dedicated jig grinder.



Consolidating multiple operations into a single machine provides several benefits. Removing steps from the production process streamlines throughput and makes a moldmaker more responsive to customer needs. Eliminating work transfer from one machine to another lessens the risk of human error from unmounting and remounting the workpiece. Machines capable of performing varied processes can eliminate the need for specialized equipment for each operation.

Some processes are more easily integrated than others. Jig grinding and five-axis machining have historically been difficult to combine on a single machine platform because of their different requirements. One machine tool platform has combined jig grinding and five-axis milling on a single machine, integrating existing and new technologies to enable grinding on a five-axis milling machine.

Technologies Working in Tandem

Bringing jig grinding into a high-performance five-axis milling machine requires adding significant capabilities. Some can be achieved through integration of existing technology while others require entirely new solutions. Here is a look at nine key components:

- **Diamond dressing wheel spindle.** Although not new technology, fitting a diamond dressing wheel spindle into the

An ultra-high-speed, five-axis simultaneous CNC milling machine delivers intricate detail and production-ready mold components directly from the machine, minimizing post-processing while ensuring consistent part quality. Source (all images): UNITED MACHINING

existing machine workspace requires design consideration. Mounting it on the B-axis housing provides access to the spindle without interference from other components.

- **Acoustic sensor.** Integration of an acoustic sensor detects when the dressing wheel makes full contact with the grinding pin and when the pin has been fully dressed. Custom software within the machine's control makes this possible.
- **Laser measuring system.** To ensure accurate grinding once a pin has been dressed, a laser takes measurements that are then fed into the machine control, which adjusts offsets, yielding precise results.
- **Thermal control.** The machine's polymer concrete base resists thermal change and incorporates coolant passages. An optional Ambient Robust package uses the same chiller to control temperature across the entire machine bed rather than only the primary components. A separate thermal coolant control system manages the temperature of the coolant itself.
- **Thermal compensation software.** Changes in cutting loads can cause thermal variance in the workspace, even when machine temperature is controlled. Left unchecked, this

variance can affect precision and surface finish. The machine uses software with algorithms that compensate for thermal deviations that cannot be eliminated through hardware alone.

- **Advanced filtering.** Grinding generates additional fine particulate that requires a higher level of coolant filtration to protect machine components. A “candlestick” filter uses two layers to remove material: coolant flows through a paper filter with 50- μ m filtration, then through a sock filter before returning to the machine.
- **Linear guide protection.** Because of the fine particulate resulting from the jig grinding process, these machines require more than standard splash guards to protect their linear guide rails. The machines feature a physical seal on the front of the guide rails, backed by positive air pressure, with another physical seal on the back.
- **Coolant flushing.** Six coolant nozzles are located 360° around the spindle nose to ensure adequate flushing of the workpiece.
- **Mist extraction.** To handle the additional mist generated by jig grinding, a dedicated mist extractor was built into the machine design.

Optimization Options

Traditionally, many jig grinders use an acoustic sensor on the workpiece to track when passes are no longer removing material. An optional software upgrade allows these milling/jig grinding machines to use their existing sensors to verify contact between the grinding pin and part. As long as the machine brakes are active, the control can sense if material is still being removed and dynamically adjust the machine's feed rate through the table and fixturing.

When working with the precision levels jig grinding produces, mold-makers usually transfer parts to a coordinate measuring machine (CMM) to verify tolerances. This requires unmounting and remounting the part, a manual process that creates

Bringing jig grinding into a high-performance five-axis milling machine requires adding significant capabilities. Some can be achieved through integration of existing technology while others require entirely new solutions.

an opportunity for error. An optional pallet system can automate this process: a robot removes the entire pallet from the machine, transfers it to the CMM for validation then returns it to the machine if additional grinding is required.

Improved Results

According to the company, combining existing and new technologies for jig grinding integration allows these machines to produce surface finishes under Ra (Roughness



With spindle speeds up to 50,000 rpm, feed rates exceeding 3,000 inches per minute and acceleration over 1G, every element of an ultra-high-speed, five-axis simultaneous CNC milling machine is engineered for performance.

Leuthold Mechanik Boosts Output With Five-Axis Milling/Jig Grinding

Leuthold Mechanik AG, a Swiss specialist in high-precision toolmaking (Werkzeugbau), metal processing and special machine construction, with accuracies down to 2- μ m, adopted the Mikron Mill X with grinding capabilities to produce high-precision dies for its presses. The company credits the machine with boosting output and responsiveness to customer needs, while also enabling lights-out automation. Technologies developed specifically for the new machines make these benefits possible.

Leuthold's adoption was simplified because the company had already standardized on Mikron Mill machines for both three- and five-axis milling, allowing it to integrate the new technology quickly.

"For our work, three benefits stand out," explains Benjamin Schroth, head of hard machining at Leuthold Mechanik AG. "The integrated two-in-one design for jig grinding and hard milling, the machine's outstanding dynamics and its unmatched precision."

The machines' five-axis capabilities enable grinding of locating features in shapes difficult to produce with three-axis movement. Using cones, diamonds or other shapes, moldmakers can ensure their mating components fit consistently.

Software within the machine control also affects grinding performance. Z-axis movement for oscillation grinding can be generated by a cycle within the control, and embedded cycles simplify operation of the redressing spindle to maintain grinding pin condition.

For moldmakers currently cycling between flat grinding, hard milling, jig grinding and part measurement on separate machines, combining five-axis milling and jig grinding on one machine reduces the number of process steps and supports full automation. For moldmakers facing capacity constraints, these machines also allow for expansion without a dedicated jig grinder investment. **MMT**

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Closing the Loop on Ultra-Precision Mold Machining

Real-time measurement, compensation and process validation are transforming ultra-precision hard milling from skilled craftsmanship into scalable, repeatable production.



Closed-loop machining with aerostatic spindles, linear motors and thermal stabilization enables stable, unattended hard milling with exceptional precision and repeatability.

Source (all images): Shibaura Machine

of contour error can become directly visible on the finished workpiece. This is where closed-loop machining systems are beginning to change the economics of precision moldmaking.

Precision Hardware Is Only the Starting Point

The machining industry often focuses on headline specifications such as spindle runout, axis resolution and positioning accuracy. Those capabilities matter

because stable motion is essential for high-quality hard milling.

For example, ultra-precision machining platforms combine aerostatic bearing spindles, linear motor drive systems and thermal stabilization technologies to minimize vibration, backlash and heat generation.

Unlike conventional ball-bearing spindles, aerostatic spindles operate without physical contact between bearing surfaces, reducing vibration and eliminating bearing wear. Likewise, linear motors eliminate ballscrew friction and backlash while generating smoother axis motion.

These technologies create the mechanical foundation required for stable hard milling in difficult materials and long unattended cycles. However, at nanometer-scale positioning levels, machine specifications alone no longer determine results. A machine capable of moving in 10 nm increments still cannot automatically produce a perfect mold if it does not understand the true condition of the cutting tool during machining.

A new ball end mill may already contain several microns of

For decades, precision hard milling has depended on the familiar workflow of: machine the part, remove it for inspection, identify error, adjust offsets or CAM data, then cut again. Even in highly advanced mold shops, this cut-check-adjust-recut cycle remains common practice. Yet an important question is rarely asked:

Does the machine actually know the true shape and position of the cutting tool during machining?

In most cases, the answer is only partially. Modern CAM systems generate highly accurate toolpaths and conventional tool setters measure overall tool length and diameter with impressive speed. However, neither necessarily captures the actual cutting-edge geometry of the tool after it is mounted in the spindle or how that geometry changes due to runout, wear, thermal growth and cutting load over time.

At conventional tolerances, these deviations may be acceptable. But when machining hardened molds with micron-level ribs, shutoffs and optical surfaces, even a few microns

contour deviation relative to its nominal geometry. During machining, thermal growth, spindle runout, tool wear and cutting load further alter the effective cutting edge. The machine may know where it commanded the tool to go, but that is not necessarily where the cutting edge actually cuts material. Without compensation, much of the machine's theoretical precision is effectively lost.

Measuring the Real Tool Instead of the Catalog Tool

One of the most important shifts in ultra-precision hard milling is the ability to measure the actual cutting-edge geometry of the tool directly on the machine. Traditional tool setters typically measure only overall tool length and diameter. While sufficient for many applications, they do not fully capture the real cutting profile of a ball end mill or micro tool.

This limitation can be addressed with high-speed optical tool measurement capable of profiling the cutting edge at 91 positions across the tool radius with 100 nm resolution. This distinction is critical because the actual contour of the tool directly influences the final machined geometry.

Even a brand-new cutting tool can deviate several microns from its theoretical CAD geometry. In hardened mold applications involving shutoffs, micro ribs, microfluidic channels, optical surfaces, embossing dies and precision blades, those deviations become directly visible on the workpiece surface.

As cutting progresses, wear further changes the tool geometry. Traditionally, shops compensate manually by adjusting offsets, modifying CAM programs or recutting

components after inspection. Instead, closed-loop systems begin with measuring the real tool condition before and after machining.

From Measurement to Automatic Compensation

Tool measurement alone is not enough. The measured data must also be translated into usable compensation during the machining process itself. This is where a system that uses measurement data to generate compensation vectors, based on the actual cutting-edge profile of the tool, becomes particularly important. Instead of assuming a perfect theoretical radius, the software modifies NC program using the measured tool geometry.

In practical terms, the machine adapts to the actual tool rather than forcing the programmer or operator to repeatedly adapt the CAM data. This forward compensation process helps correct tool contour error, spindle runout, tool wear, overcut conditions and localized geometry deviation. Importantly, compensation occurs directly at the controller level without requiring the operator to regenerate the CAM program.

For mold shops, this dramatically reduces recut cycles, setup interruptions, manual offset adjustment, inspection-related downtime and dependency on highly specialized operators. The result is a machining process that becomes significantly more repeatable over long unattended cycles.

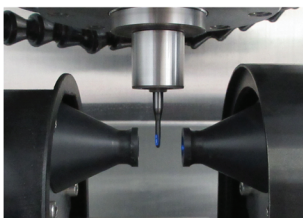
Verifying the Workpiece Without Breaking Setup

Even perfect tool compensation cannot guarantee final accuracy unless the machined workpiece itself can also be

CLOSED-LOOP PRECISION

Integrated measurement, compensation, and verification throughout the machining process to minimize the gap between CAD-designed geometry and machined reality.

① TOOL MEASURING

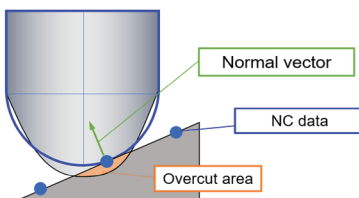


The real cutting edge is captured before it cuts.

100 nm

Resolution : 100 nm
0°–90° : 91 points

② COMPENSATION



A normal vector at every contact point cancels the error.

Forward

NC data rewritten in the NC controller

③ ON-MACHINE VERIFICATION



Measured on the machine, still clamped.

± 1 μm

Macro + Micro cameras
Touch probe

Integrated measurement, compensation and verification throughout the machining process minimizes the gap between CAD-designed geometry and machined reality.

ON-MACHINE WORK MEASURING SYSTEM

Measure machined features without removing the workpiece



KEY BENEFITS



HIGH MAGNIFICATION

Capable of measuring within $\pm 1 \mu\text{m}$



AUTOMATIC DETECTION OF EDGES

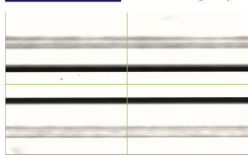
Lines, circles and arcs



HIGH MEASUREMENT WITH AUTO FOCUS

Advanced image processing technology

MICRO VIEW Measuring tiny features

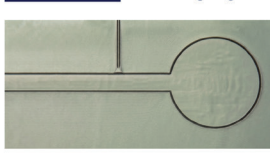


X 12.345
Y 8.765
Z 0.000 μm



AUTO FOCUS

MACRO VIEW Measuring larger features



X 45.678
Y 23.456
Z 0.000 μm



AUTO FOCUS

Measure machined features without removing the workpiece.

verified. Traditionally, this requires removing the workpiece from the machine for external inspection, then re-aligning it for additional machining if correction is necessary. Every setup change introduces additional opportunity for positional error. In-process part verification software addresses this issue through on-machine image measurement using both macro- and micro-cameras capable of measuring features within $\pm 1 \mu\text{m}$ resolution.

By measuring the workpiece directly inside the machining environment, the system eliminates fixture repeatability errors, thermal changes during transport, setup alignment variation and external inspection delays. This capability becomes especially valuable for precision blades, narrow ribs, micro holes, cutting dies and fine optical features.

More importantly, measurement results can be used immediately for corrective machining without removing the workpiece from the machine. The process shifts from: *machine remove inspect adjust recut* to: *machine measure compensate continue machining*. That difference has major implications for both productivity and consistency.

Reducing Benchwork and Polishing

One of the clearest benefits of improved hard-milled surface quality is reduced polishing and benchwork.

In many mold shops, polishing remains one of the largest labor contributors after machining. Yet polishing also introduces geometric inconsistency because manual finishing can alter edges, shutoffs and surface form.

Surface uniformity has a major influence on polishing time.

In automotive lighting mold applications, shops using ultra-precision hard milling systems have reduced polishing time from several hours to less than one hour simply by improving surface consistency and minimizing localized tool marks. The objective is not necessarily to eliminate polishing entirely. Certain optical and cosmetic applications will still require some finishing depending on material and customer requirements.

The more important shift is reducing polishing from a major corrective process into a minor refinement process. That distinction directly impacts labor requirements, lead time, process repeatability and overall mold quality.

What It Really Takes to Run Lights-Out

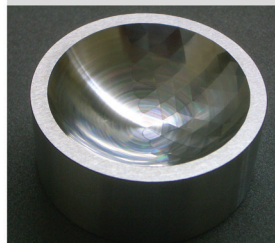
Reliable lights-out hard milling requires more than automation alone. Successful unattended machining depends on maintaining stability across multiple

EFFECT OF SURFACE QUALITY ON POLISHING REQUIREMENTS

Surface uniformity achieved in hard milling has a direct influence on the amount of subsequent polishing and benchwork required.

CONVENTIONAL HARD MILLING

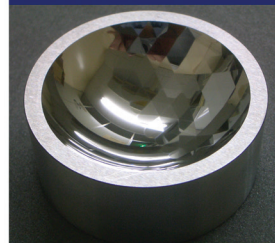
More visible tool marks and inconsistencies



- Visible tool marks and surface variations
- Longer polishing and benchwork time
- Greater dependence on manual finishing

HIGH-UNIFORMITY HARD MILLING

Fewer tool marks and more consistent surface



- Uniform surface with reduced tool marks
- Less polishing and benchwork required
- Improved consistency of final geometry



POLISHING TIME COMPARISON

CONVENTIONAL HARD MILLING

8

hours

HIGH-UNIFORMITY HARD MILLING

40

mins

REPORTED REDUCTION IN POLISHING TIME

Up to 90%*

(Application dependent)

* Results will vary depending on workpiece geometry, material, and process conditions.

Surface uniformity achieved in hard milling has a direct influence on the amount of subsequent polishing and benchwork required.

interacting variables simultaneously, including thermal behavior, tool wear, spindle vibration, axis smoothness, toolpath strategy, coolant application and compensation accuracy. If any one of these variables drifts beyond acceptable limits, dimensional consistency deteriorates quickly.

This is why machine structure and motion quality still matter enormously. High rigidity, low vibration and thermal stability create the foundation that allows intelligent compensation systems to function effectively.

At the same time, process knowledge still matters.

Tool selection, cutting conditions, material behavior and machining strategy remain critical engineering decisions. Technology can significantly reduce manual intervention and operator dependency, but it does not completely replace manufacturing expertise. Instead, modern closed-loop systems allow shops to embed more process intelligence directly into the machining workflow itself. As experienced moldmakers become increasingly difficult to replace, this ability to reduce variability while improving repeatability becomes even more valuable.

The Future of Precision Hard Milling

Faster spindles or smaller positioning increments no longer define the future of hard milling. The real advancement is the ability to continuously measure, compensate and validate the machining process in real time.

A decade ago, achieving sub-micron hard-milled accuracy often depended heavily on the experience of a small number of highly skilled machinists. Today, integrated systems combining machine stability, intelligent measurement and automatic compensation are making those results more repeatable and scalable.

The breakthrough is not simply nanometer positioning capability. It is closing the loop between the intended CAD geometry, the actual tool condition and the final machined surface. That is what transforms ultra-precision machining from a specialized craft into a reliable production process. **MMT**

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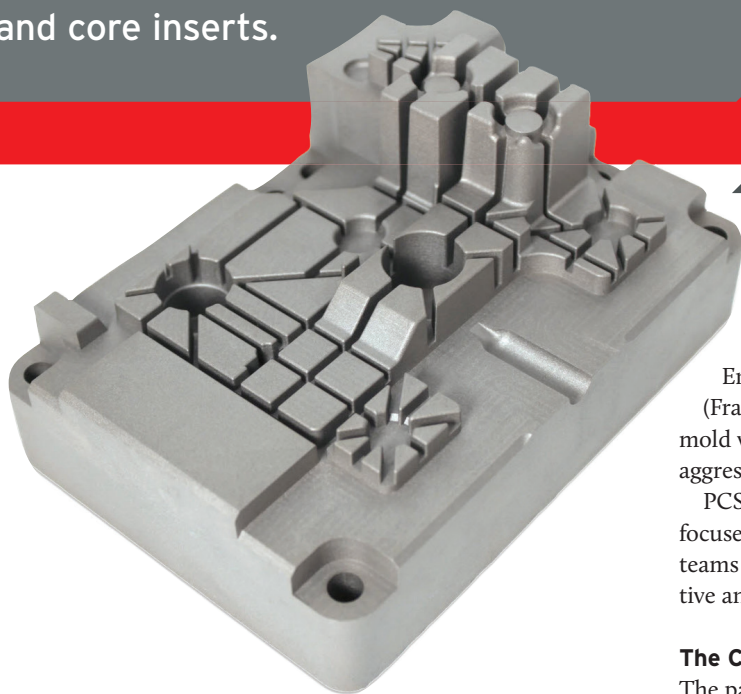
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ONE STEP AHEAD.

Hybrid EV Bridge Mold Cuts Estimated Lead Time by Approximately 30%

Elite Mold & Engineering and PCS Company partnered to deliver a production-capable hybrid bridge mold incorporating additively manufactured cavity and core inserts.



Elite Mold & Engineering used a Mantle 3D printer to create this metal mold insert for a production-capable hybrid bridge mold it developed, along with PCS Company. The insert was designed with internal conformal cooling channels and installed into a PCS mold base. Source (all images): Elite Mold & Engineering

The demand for complex, high-performance plastic components continues to grow across automotive, aerospace, electronics and industrial applications. More specifically, due to issues with tariffs and offshore tooling, the electric vehicle (EV) and OEM markets are seeking creative solutions to bring parts to market locally rather than relying on offshore partners.

Even with the current uncertainty in the EV market, suppliers must quickly iterate on new designs using advanced techniques as overall vehicle structures improve. EV connectors and housings are especially critical, so providing them at a competitive cost grows more important as budgets tighten across the EV sector.

In one recent project, a Tier 1 supplier required a prototype mold for an EV harnessing component for electrical wires and connectors with complex geometries and needed it delivered in just three weeks. Collaboration between Elite Mold &

Engineering (Shelby Township, MI) and PCS Company (Fraser, MI) delivered a production-capable hybrid bridge mold with 3D-printed cavity and core inserts ahead of that aggressive timeline.

PCS provided a high-quality mold base solution, while Elite focused on advanced mold design and manufacturing. Both teams aligned around speed, precision and integration of additive and subtractive manufacturing technologies.

The Challenge

The part in question was a 3¼-by-4¼-inch harnessing component for electrical wires and connectors, which included deep, narrow rib features that required a mold that would be difficult to cut with traditional machining. “The part also used abrasive, high-glass-filled nylon, which increases tool wear, so the mold required durability beyond that of typical prototype tooling,” says Daniel “D.J.” Mandeville, sales engineer for Elite Mold & Engineering.

Elite and PCS built a 12-inch-by-12-inch bridge production mold using Mantle-printed H13 cavity and core inserts, installed in a precision-machined PCS mold base, capable of supporting extended production runs. An insert-based architecture allowed for flexibility and quick changes while maintaining durability.

“The part’s nylon composition would quickly wear out an aluminum mold, so we chose H13, which can last for hundreds of thousands of cycles,” PCS Company director of engineering and manufacturing strategy Joe Esposito says.



Mantle's 3D printers deposit a proprietary metal paste in a layer-by-layer process similar to stereolithography, or SLA, followed by in-process CNC machining to shape the geometry.

Ultimately, the prototype mold was completed days ahead of the customer's aggressive deadline of several weeks. "The accelerated timeline was possible because we had parallel workflows between insert production and base machining, eliminated the need for EDM electrodes, which require extensive burn time and decreased CNC setup and programming time," Mandeville explains.

The Solution: Breaking Down the Build Process

The prototype mold required several deep, narrow and hard-to-reach features that traditionally rely heavily on EDM electrodes to achieve the necessary geometry. On top of that, the geometry and material made thermal management critical, so Elite designed cooling channels to follow the part geometry. This improved heat extraction in deep-rib areas, reduced hot spots and resulted in better part consistency and dimensional stability.

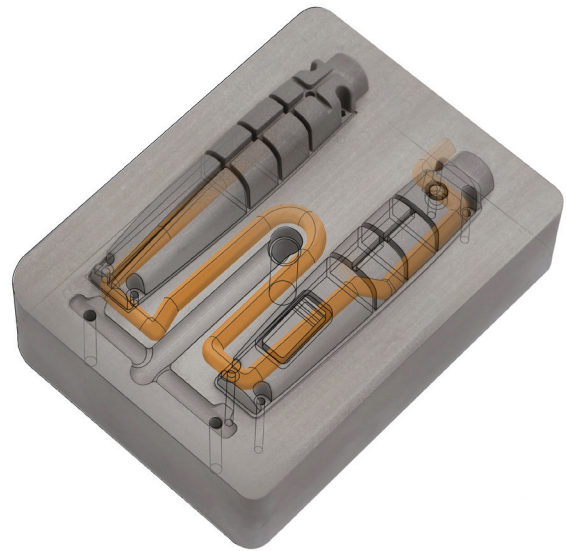
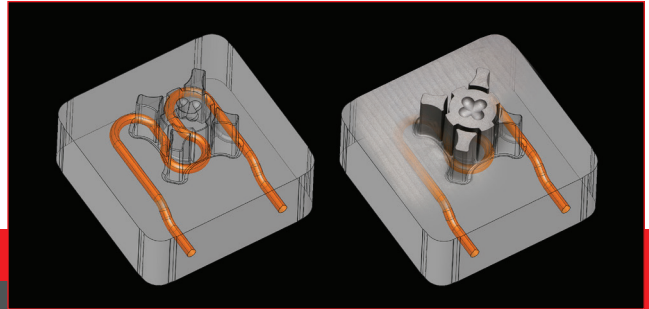
Elite Mold & Engineering

PROBLEM: Managing an aggressive timeline to produce a mold with complex cavity and core insert geometry, including internal conformal cooling passages.

SOLUTION: 3D-printed inserts integrated directly into a traditionally machined mold base.

RESULTS: Approximate 30% lead time reduction with less machining, setup and benching.

Elite's design department created the mold and insert geometry using standard CAD/CAM platforms. The files were



With additive technologies, moldmakers can manufacture internal conformal cooling channels with complex geometries that would be impossible to produce using traditional, straight-line machining and drilling processes. These conformal channels deliver effective cooling right where it's needed. These sample images show how conformal cooling is incorporated into inserts made on the Mantle machine.

then imported into Mantle's proprietary software, which automatically generated the additive and subtractive tool paths used by the printer. Elite's workflow included SolidWorks, AutoCAD, Mastercam and Mantle's software. SolidWorks and AutoCAD were used for design and engineering work, Mastercam supported the machining processes and Mantle's software supported the additive manufacturing portion of the cavity and core inserts.

The system deposits its proprietary flowable metal paste layer by layer, periodically machines the deposited material to refine the geometry and surface finish and then sinters the part into dense tool steel. "The result is fully dense H13 tooling with high accuracy, improved surface finish and production-level durability," Mandeville says.

Because the cavity and core inserts were to be dropped directly into the mold, Elite and PCS developed a method that



used a standard PCS mold base while reducing fit-and-finish time at Elite. Printing the mold inserts, which measured 4 inches by 6 inches, cut the time spent benching to remove some surface material.

"In less than a week, PCS supplied a custom-machined mold base with precision-machined insert pockets, alignment features and plate sizing.

In the end, the hybrid approach reduced the estimated tooling lead time by approximately 30% compared with the conventional manufacturing approach originally considered for the project.

These modifications ensured accurate integration and fitment of the additively manufactured inserts," Esposito explains.

PCS used wire EDM to create the mold's pocket based on the geometry of the cavity and core inserts, ensuring a precise fit within the base. The inserts were then dropped into the standard base.

Using Elite's CAD model, PCS wire-EDM-cut the insert pockets and tight internal corners in the mold base. PCS then CMM-inspected the sizes and locations of the pockets before the additively manufactured inserts were installed.

The Results

The hybrid approach reduced the estimated tooling lead time by approximately 30% compared with the conventional manufacturing approach originally considered for the project.

"To be clear, hybrid tooling is not just about speed; it's about delivering production-capable molds with flexibility as designs

Elite Mold & Engineering partnered with PCS to meet a customer's aggressive tooling timeline, leveraging decades of moldmaking expertise and advanced machining and molding capabilities.

evolve. It's also about eliminating traditional bottlenecks like EDM electrode work and long CNC setups to shorten timelines while maintaining durability," Mandeville says.

The success of this project gave birth to and proved Elite's long-term strategy for quickly implementing printed inserts into a standard base. Plus, multiple iterations with the Mantle machine uncovered new ways to speed print time and create a more robust tool.

Since this EV project with PCS, Elite has used its process on other jobs. Two of which have run up to 500,000 cycles with a single eight-cavity mold; other EV components that resulted in customers launching a new vehicle in less than a month, despite a last-minute engineering change on a production mold; and a mold built in a week-and-a-half that supported production for the first three months of one of those vehicles, with about 10,000 parts produced as of this writing. [MMT](#)

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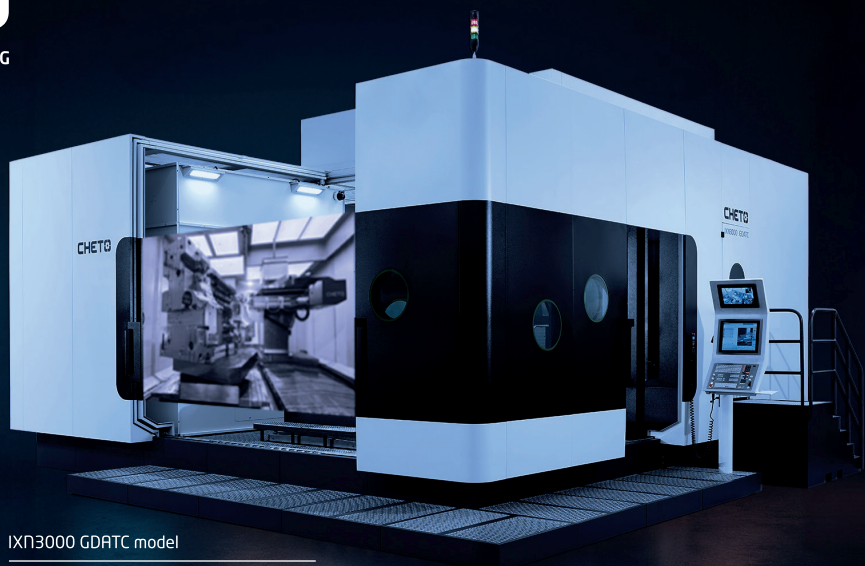
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When Sales Doesn't Speak Manufacturing: The Commercial Blind Spot Hurting Injection Mold Builders, Part 2

Exploring manufacturing fluency in sales - how commercial teams translate shop-floor expertise into customer value, speak credibly with engineers and buyers and turn operations into competitive advantage.

Manufacturing fluency in sales does not mean designing tools, running machines or replacing engineering judgment. It means having a working understanding of core manufacturing processes, the key skill sets on the shop floor, and where complexity, variability and risk actually live. That level of awareness allows sales to ask better questions early, recognize when an opportunity truly aligns, or clearly doesn't, and to speak credibly with both engineers and buyers. This isn't technical expertise; it's commercial awareness grounded in manufacturing reality.

Speaking to Buyers and Engineers

Manufacturing excellence becomes a true differentiator only when it's communicated in the customer's language, and that language varies depending on who's listening. Engineers tend to focus on process control, repeatability, tool life and risk mitigation; sales must translate craftsmanship into predictability and precision into downstream stability, reducing production issues over time. On the other hand, buyers and procurement teams care about cost certainty, total cost of ownership, supplier reliability and program risk, which requires sales to frame process discipline as fewer surprises and technical rigor as reduced long-term cost (see Figure 1).

The same manufacturing capability carries different meanings for different stakeholders. When that translation is missed, engineers hear promises without context while buyers are left with-



Sales professionals who understand manufacturing processes build credibility, ask sharper questions and bridge the gap between engineering and purchasing teams. Source: AI

out the insight needed to evaluate value. Manufacturing fluency is what enables sales to make that connection.

Concepts and Frameworks That Bridge the Sales and Manufacturing Gap

Closing the commercial blind spot doesn't require turning salespeople into engineers. It requires shared reference points as ways to evaluate opportunities, interpret risk and translate capability into value.

Translate Capability-to-Risk

Every manufacturing capability either reduces risk, or introduces it, depending on the application. Capabilities aren't selling points; they're risk controls. Tight tolerance machining reduces assembly risk. In-house validation reduces schedule risk. Proven tooling approaches reduce launch risk. When capabilities are positioned as risk mitigation, not technical bragging, sales conversations improve immediately.

Create Ideal Opportunity Profiles (IOPs)

Not all work that fits technically fits commercially. While an Ideal Customer Profile (ICP) defines who a shop should sell to, an Ideal Opportunity Profile (IOP) defines what kind of work the shop is actually built to win.

At its core, an IOP translates tacit manufacturing knowledge, usually held by senior engineers or experienced project managers, into a shared commercial framework sales can use early in the sales conversation. Instead of reacting to an RFQ, sales can use the IOP to guide customers through tradeoffs they may not have fully considered, such as is explained in **Figure 2**.

In this way, the IOP equips sales to act less like order takers and more like commercial translators of manufacturing reality.

Shops that use IOPs this way differentiate themselves long before tooling is cut. They demonstrate manufacturing fluency in the sales process itself, showing customers that they don't just build tools, they help design better programs.

Shared Commercial Language

In manufacturing sales, misalignment rarely stems from bad intentions; it usually comes from differences in how words are interpreted. Terms like "complex," "we've done this before," or "aggressive timeline" can mean very different things to sales, manufacturing and the customer.

What sounds manageable in a commercial conversation may signal elevated risk on the shop floor, while what a customer considers "standard" may quietly push the tool beyond its intended operating window. Shared commercial language closes that gap. It's the ability for sales to discuss opportunities using the same cause-and-effect logic the shop uses to evaluate work, while still framing the conversation around outcomes the customer cares about.

From the tool builder's perspective, this starts with understanding how shop-floor decisions translate into business results. Customers don't buy machine specs or process charts; they buy predictability, reliability and confidence that the mold will perform over time. Sales fluency in manufacturing allows those outcomes to be explained in meaningful business outcomes:

Engineers Focus On

- Process control and repeatability
- Tool life and longevity
- Risk mitigation strategies
- Downstream production stability

Translation needed: Craftsmanship into predictability, precision into reduced production issues

Buyers care about

- Cost certainty and TCO
- Supplier reliability
- Program risk reduction
- Long-term value delivery

Translation needed: Process discipline into fewer surprises, technical rigor into reduced long-term cost

FIG. 1: Successful sales translation converts engineering priorities—process control, tool longevity, risk mitigation – into buyer outcomes: cost certainty, reliability and predictable long-term value. Source: Kallan Sales Development

Engineers care about repeatability, process control and risk mitigation: On the shop floor, this shows up in how the tool is designed and built. That means precision machining where it matters most, standardized build practices and controlled handoffs between operations. When sales can connect these practices to long-term tool stability and reduced production risk, engineering conversations shift from skepticism to trust.

Buyers care about cost, delivery and reliability: On the shop floor, those outcomes are driven by build strategies that limit rework, realistic schedules based on actual capacity and disciplined project management. When sales can explain how this reduces downstream surprises and total program cost, price discussions become grounded in value rather than concessions.

When sales teams can speak this shared language, they stop translating customer demands of the shop and start translating shop capability for the customer. That shift builds credibility early, reduces misalignment later and positions the mold builder not as a vendor fulfilling requirements, but as a partner helping customers make better manufacturing decisions.

Knowledge Transfer; Not Training

Enablement should make experience transferable. That means:

- **Teaching how the shop evaluates work: Sales should understand:** how the shop assesses part complexity, tolerances, tooling requirements and process variability. This knowledge helps them identify which opportunities are technically feasible and commercially sensible.
- **Exposing sales to real-world tradeoffs:** Every decision on the shop floor involves balancing speed, cost, quality and risk. By experiencing these tradeoffs firsthand, sales can translate them into realistic expectations for customers, rather than overpromising or underselling capabilities.
- **Bridging technical capabilities to customer outcomes:** Ensure every conversation connects what the shop can reliably deliver to the results the customer cares about.

This isn't about scripts. It's about context. When sales understands how shop-floor decisions shape risk, cost and outcomes, they're equipped to negotiate trade-offs with customers before commitments are made, when alignment is still possible.

The Competitive Advantage Most Shops Are Overlooking

The manufacturing skills gap is real, but an equally critical gap exists on the commercial side. One that often goes unnoticed until it manifests in unpredictable pipeline, missed timelines and strained customer relationships. For many shops, this commercial skills gap can be just as costly as shop-floor deficiencies.

Looking ahead, the shops that succeed won't be defined solely by the sophistication of their equipment or the depth

1. Complexity vs. Tolerance

Explain how tolerance stack-ups affect build strategy, validation time and long-term consistency. Show where relaxation reduces cost without increasing risk.

2. Volume vs. Tooling Robustness

Frame tooling decisions around lifecycle economics. Help customers see when higher upfront investment reduces total cost per part over the program's life.

3. Speed vs. Process Stability

Discuss commercial implications of launch speed. Highlight what can be accelerated safely and what introduces risk. Protect Schedules and budgets

FIG. 2: Smart tooling decisions balance tolerance precision, lifecycle durability and launch speed – optimizing quality, cost and timeline without compromising long-term manufacturing consistency or budget. Source: Kallan Sales Development

of their technical expertise. They will also be distinguished by sales teams capable of effectively communicating technical value and aligning customer expectations with operational realities.

Manufacturing fluency isn't about turning salespeople into engineers. It's about giving them the context to have better commercial discussions earlier. When sales understands where complexity, variability and risk actually live, they can ask sharper questions, recognize true fit and translate manufacturing capability into outcomes that matter to both engineers and buyers.

That translation prevents overselling to engineering, under-informing procurement and discovering misalignment after work has already begun. Before frameworks and tools come into play, manufacturing fluency is simply knowing how the

shop really works and using that understanding to build trust before the first chip is cut. [MMT](#)

Scan QR Code to Read Part 1 of "When Sales Doesn't Speak Manufacturing"



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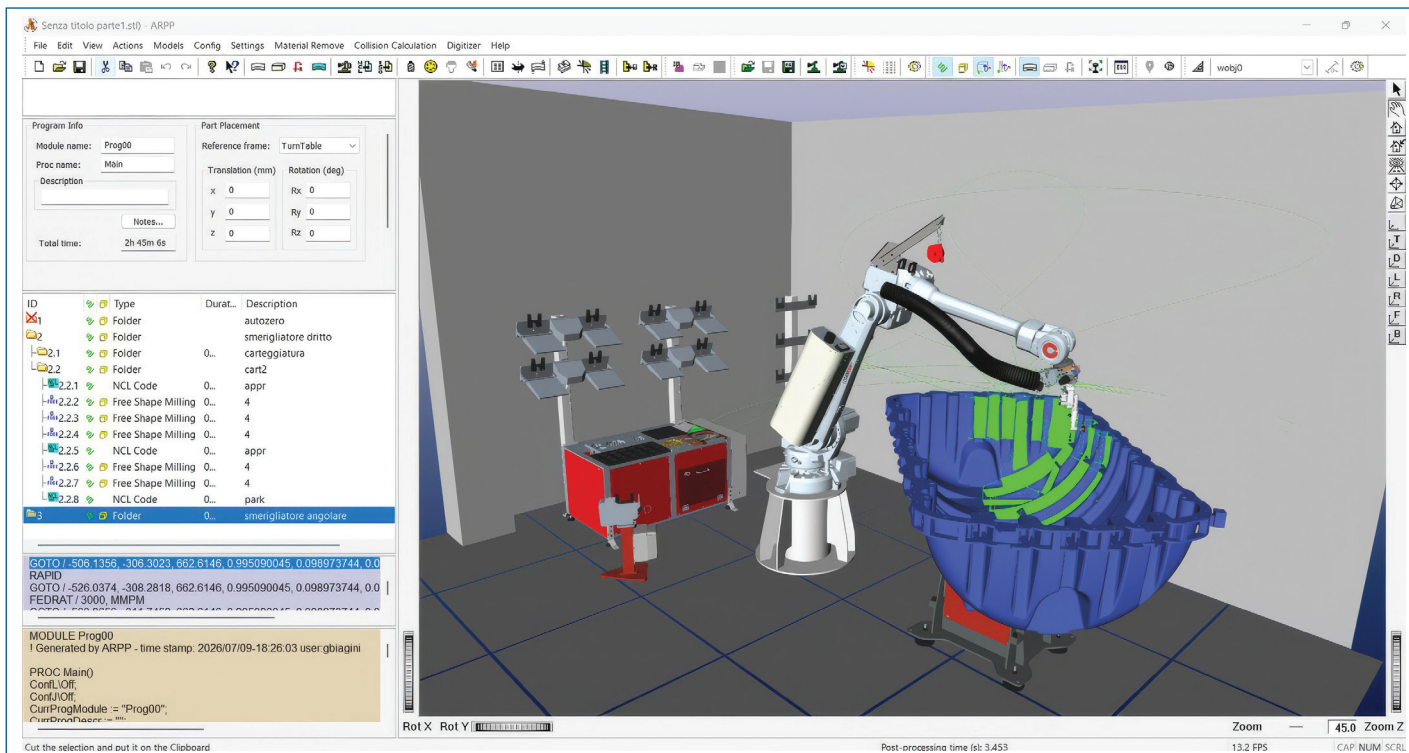
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Robotic polishing automates finishing across rotomolding, composites and other mold types, with plastic injection molds a natural next candidate.



Offline programming and true 3D simulation enable users to design, simulate and optimize robotic movements before production begins. Source (all images): Forged Path Automation

Polishing molds by hand takes significant time, varies in quality and exposes workers to dust and hazards. New robotic systems using advanced software can automate these tasks, cutting processing times dramatically while delivering consistent results. Current real-world applications have concentrated on mold and forming processes such as rotomolding, thermoforming, sheet molding compound (SMC) compression molding, resin transfer molding (RTM), aircraft molds and stamping, and plastic injection molds are a natural candidate for the same automation. This approach can help shops maintain output, reduce reliance on hard-to-find skilled talent and improve workplace safety.

Simple Software-Driven Robotics

At the core of the system is user-friendly software that creates a digital twin of the part. "Operators can import virtually any major CAD file format, with .STEP files preferred for their ease of conversion and simulation accuracy," explains Chris Urban, president of Forged Path Automation.

Users simply select areas of the model on screen and the software automatically generates the robot program prior to execution, eliminating the need for manual coding. During operation, operators can monitor the generated code in real time as the program runs.

It supports common industrial robots and includes force

sensors to control pressure, allowing adjustments for aggressive or gentle finishing. “If sensors detect excessive force during a run, the robot stops automatically and onboard alarms alert the operator, helping prevent damage from misaligned parts or unexpected surface conditions,” Urban says.

Robotic cells feature enclosures for dust control, custom linear axes for smooth, hand-like movements and various tool heads for different tasks. The system uses auto-zero probing to locate the part accurately, adapting to variation in part orientation without requiring precise fixturing — each application is evaluated individually to identify the best workholding approach.

“The system then trims edges and polishes surfaces automatically. This differs from older, rigid setups by focusing on adaptable processes rather than one-size-fits-all machines,” Urban says.

Programming is significantly faster than traditional robot programming environments too. “Operators typically program jobs roughly 10 times faster than with conventional tools and the software’s external-axis management, which is critical for polishing, is handled in ways that conventional robot software cannot match,” Urban says. It makes high-level automation accessible to operators without advanced training.

Scaling From Fine Detail to Large-Format Parts

This technology automates surface finishing, such as removing overspray or achieving a smooth polish. Examples include finishing complex composite parts in hours instead of days or treating coated components with fewer consumables. Cells can handle molds up to 6 meters by 3 meters (roughly 200 square feet) as a single setup. With a linear rail extension, width coverage can reach 12 meters or more, and very large molds can be processed in two sections by rotating 180 degrees.

It works on larger parts with multiple robots for extended reach. Also, for surface coverage, any area accessible with a 3-to-5-inch disc is a strong candidate; smaller features around parting lines or side walls can be addressed with unitized discs and flap wheels in the 3/4- to 1-inch range.

“The highest-value approach typically has the robot system handle 70-85% of polishing, with an operator finishing the most complex or inaccessible areas separately,” says Urban. While the technology is expanding to other processes like cutting or coating, Urban says the main focus remains surface finishing, where manual work is common. For

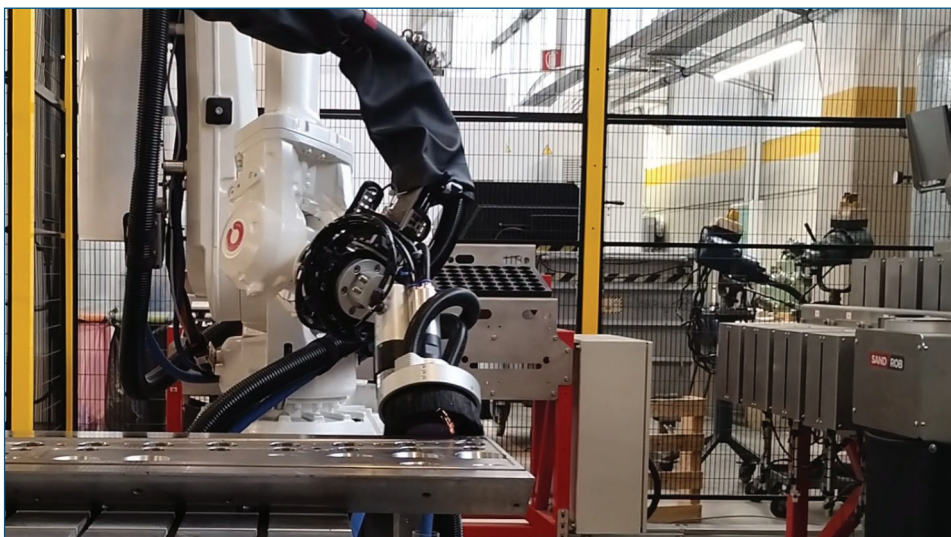


Quality is built into the process through tools that enable manufacturers to visualize, validate and control each step before and during production.

moldmakers, it targets the repetitive polishing steps that vary by part geometry.

Speed and Safety

Processing times drop significantly. “Robot finishing typically takes one-third to one-quarter the time of manual polishing, translating to a 3-4x throughput increase, boosting capacity and allowing quicker turnaround. Results stay consistent and highly repeatable, removing variability from manual judgment, and measurements provide clear quality data,” Urban says. For EDM scale and recast removal, the right media and pro-



Flexible automation solutions can be tailored to industry-specific requirements for seamless integration and improved operational efficiency.

grammed tool paths handle these surfaces effectively, provided the area is accessible.

Safety improves with enclosed systems that contain dust and reduce exposure to it. Labor shifts from hand work to simpler loading, unloading and oversight, helping to retain workers and ease skill gaps as experienced workers retire.

Consumable costs fall with optimized tool use. For example, according to Urban, controlled, constant pressure extends abrasive life, resulting in 10-15% savings on abrasive costs compared to manual methods. Overall, it supports higher efficiency and scalability without large infrastructure changes.

Practical Considerations

“Setup may need testing for very intricate or tiny features,” Urban says. “As geometry increases in complexity, the value proposition decreases, since areas that cannot be reached with standard disc tooling require alternative approaches or remain manual.”

Surface finish is not predictable through digital simulation alone. Achieving a target Roughness average (Ra) value requires a series of trials on representative sample material using various pressures, polishing media and other parameters before full production runs.

Upfront costs for full cells vary widely, from a basic setup to larger, custom configurations, depending on robot size, reach requirements and application complexity. Savings in time and materials often justify these investments through return-on-investment calculations, particularly given the 3-4x labor productivity gain and reduced abrasive consumption, according to Urban. For large parts, the system is generally designed as a stand-alone cell, though integration with other shop equipment can be considered for specific applications.

Mold builders dealing with labor constraints and efficiency needs should consider robotic polishing automation. It turns time-intensive manual tasks into reliable, faster operations with clear gains in quality, safety and capacity. **MMT**

FOR MORE INFORMATION

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forgedpathautomation.com
Chris Urban, President

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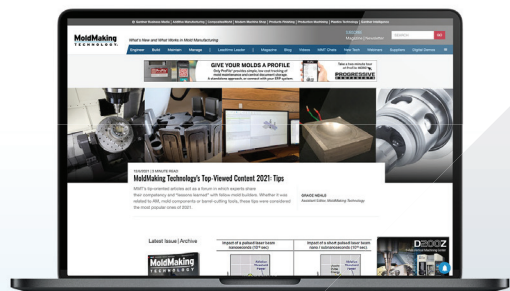
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Technology Showcase

Assorted

Data-Driven Process Control Integration

Progressive Components has released System Cooling Connect, a controller designed to integrate with injection molding machines.

Since 2014, the company's System Cooling suite has enabled injection molders and moldmakers to collect, monitor and analyze data from cooling lines within molds during production. The system records coolant flow, temperature and pressure as time-stamped data for historical tracking and optimization.



System Cooling Connect links cloud-enabled System Cooling Manifolds directly to injection molding machines for real-time data acquisition.

Features include:

- Access to process data, including supply temperature and pressure, return temperature by zone, flow by zone and return pressure, with defined limits and alarm signals.
- Ethernet, Wi-Fi and 4G connectivity.
- OPC UA and EUROMAP 82.1 machine integration.
- Built-in support for remote assistance, software updates and troubleshooting.

Optional add-ons include System Cooling Connect VNC, which extends the controller with local visualization capabilities for machines that support VNC and provides access to the System Cooling Live Local dashboard, providing factory-wide visibility remotely or from a central control room.

Progressive Components / procomps.com

AI Solution Streamlines Toolpath Programming

Cimatron showcases its CAM Agent, which uses agentic AI to help manufacturers make better use of existing resources. Developed in collaboration with Limitless Labs, the fully integrated machining strategy agent analyzes part geometry and available tool libraries to generate complete three-axis toolpaths.

By automatically recognizing machining requirements, recommending strategies and handling repetitive programming tasks, Cimatron's CAM Agent helps manufacturers create reliable CNC programs more efficiently. The technology demonstrates how artificial intelligence can support greater CNC programming automation while accounting for the specific geometry, tooling and requirements of each job.



Cimatron also showcases capabilities available with Cimatron 2027, which offers new features and improvements for mold and die design, CNC programming, machine simulation, electrode design and production, wire EDM operations, assembly data management

and other core manufacturing workflows.

Cimatron SuperFinish is a finishing technology developed in conjunction with ModuleWorks to calculate tool paths directly from exact surface geometry rather than relying on a mesh approximation. The results are highly uniform, mirror-like milled surfaces that can be produced without increased machining time.

Cimatron FeedOptimizer uses tool, machine and material data to determine the optimal feed rate throughout a tool path. By adjusting feed rates according to actual cutting conditions, the technology can help reduce cycle times, extend tool life and protect machinery from excessive loads.

Cimatron / cimatron.com

Precision Five-Axis Performance for Complex Mold and Die Work

Mitsui Seiki USA's vertical machining center, the Vertex55X NEO, is designed to help mold and die manufacturers produce complex, high-precision parts faster and more consistently while meeting increasingly demanding customer delivery schedules. Designed to tackle challenging geometries, difficult-to-machine materials and demanding surface finish requirements, the Vertex55X NEO features a tilting A-axis and full rotary C-axis that enable complete machining operations in fewer setups. This configuration allows the use of shorter cutting tools to reach deep cavities, undercuts and intricate features while improving accuracy and surface quality.

A key feature of the Vertex55X NEO is its ultra-high-speed spindle, capable of speeds up to 30,000 rpm. Combined with advanced thermal stability and positioning accuracy of ± 0.001 mm, the machine helps mold manufacturers reduce polishing requirements and shorten lead times while maintaining part quality.

Equipped with a FANUC 31i-B5 Plus control featuring AI contour control and high-speed processing capabilities. Integrated automation options, probing technology and rapid tool-changing capabilities further support unattended and highly efficient production.

The Vertex55X NEO incorporates roller-type linear guideways, absolute linear glass scales on the X, Y and Z axes, and absolute rotary Inductosyn scales on the A and C axes, to provide precise positioning and exact location upon startup.

The Vertex55X NEO offers travels of 550 mm (X), 600 mm (Y) and 500 mm (Z), along with feed rates ranging from slow, controlled finishing passes to high-speed roughing operations.

MITSUI SEIKI / mitsuiseiki.com/



Add 303 Stainless Steel to In-Stock Inventory for Faster Turnaround

TCI Precision Metals expanded its in-stock raw material inventory with the addition of 303 stainless steel, providing manufacturers with faster access to this widely used alloy for precision machining applications. The expanded inventory supports quick-turn requirements for precision pre-machined blanks, helping customers reduce material lead times and move jobs into production faster.

303 stainless steel is an austenitic stainless steel designed for improved machinability. Its machining characteristics make it a popular choice for precision components requiring extensive turning, milling, drilling or threading.

TCI Precision Metals' Machine-Ready Blanks are designed to help shops shorten setup time, reduce scrap and increase overall throughput by up to 25% by eliminating material preparation. The blanks are said to arrive machine-ready for production, allowing manufacturers to move material directly into machining rather than spending time preparing raw stock.

Machine-Ready Blanks eliminate the need for in-house sawing, grinding, flattening and squaring operations, as well as outside processing. This allows shops to devote more machine capacity and labor to producing finished parts while simplifying material handling and production planning.

TCI offers two options to meet different production requirements. Standard-size Machine-Ready Blanks in low quantities are stocked and ready for immediate shipping. Ready-to-ship blanks can be ordered online for same-day or next-day shipping and arrive square, flat and parallel within $\pm.002$ " of specified dimensions on either two or six sides.

For applications requiring specific dimensions, tolerances or production quantities, custom made-to-order Machine-Ready Blanks are available with quick turnaround. These blanks are manufactured to customer specifications and are said to be as close as $\pm.0005$ " dimensionally and as close as .002" in flatness, squareness and parallelism.

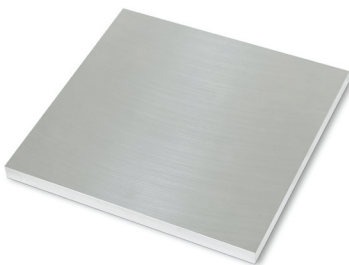
Every Machine-Ready Blank arrives deburred, clean and individually packaged to help prevent damage during shipping and handling, allowing precision material to move from receiving directly into production without

the additional steps normally associated with preparing raw stock.

Having 303 stainless steel in inventory expands the material choices available to customers seeking the productivity advantages of Machine-Ready Blanks. It also supports manufacturers facing tighter delivery schedules, limited skilled labor and increasing pressure to get more productivity from existing CNC equipment.

By outsourcing material preparation to TCI, manufacturers can avoid tying up saws, grinders, machining centers, operators and floor space with preliminary operations. Starting with material that is already square, flat, parallel, clean and ready for production is designed to reduce non-value-added operations and help shops achieve more predictable machining results.

TCI Precision Metals / tciprecision.com



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Wire EDM Provides Micron-Level Accuracy for High-Precision Applications

Sodick's AX350L wire EDM is an advanced, oil-based system engineered for extreme micromachining, reliability and long-term performance.

The AX350L utilizes dielectric oil to create a small discharge gap, enabling optimal surface finishes and micron-level accuracy. Paired with Sodick's iGroove+ wire rotation technology – which improves surface quality while reducing wire consumption by up to 30% – the AX350L is said to provide optimal surface roughness with lowered operating costs, making it well-suited for high-precision applications and complex components.

Engineered for stability, the machine incorporates a temperature-stable structure and thermal displacement correction system, maintaining precision throughout extended machining cycles. Combined with automated wire threading, oil submersion and corrosion prevention, the AX350L is designed to support fully unattended lights-out operation.

Sodick, Inc. / sodick.com/



Spindle System Streamlines Small-Tool Machining

NSK America Corp.'s iSpeed5 spindle system is an independent electric motor spindle system in which the main spindle on the machine is locked during operation. Using an independent electric motor spindle provides

extremely vibration, low runout and high speed to optimize the capabilities of the machine for even the smallest tools. The iSpeed5 system is available in two configurations – one offering

60,000 rpm maximum and the other offering 80,000 rpm maximum.

The iSpeed5 system is fully tool-changeable and fits into the tool carousel of most machining centers. Electrical and air interface runs through a stock block that mounts to the face of the machine spindle, keeping it always ready and clear of standard tooling operations.

According to the company, the iSpeed5 system offers lower maintenance costs, flexibility and the capability to use small-diameter tools in machine tools already owned – without impact on machine clearances or current capabilities.

NSK America Corporation / nskamericacorp.com/



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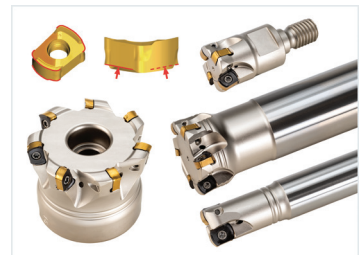
High-Feed Milling System Reduces Cycle Times

The DiFeedWinV high-feed milling system by Ingersoll Cutting Tools provides the strength and stability needed for roughing and semifinishing complex cavity and core geometries while maintaining consistent, predictable performance.

Featuring radius-style, high-feed inserts that provide strong edge strength, makes them well-suited for hardened steels and long tool overhangs. An angled V-bottom insert face increases the contact between insert and cutter body, promoting secure seating and improved stability during aggressive tool-paths. This allows feed rates up to 0.090" per tooth, enabling faster material removal while reducing cutting forces that can lead to vibration or deflection. With the ability to ramp at angles two to four times higher than traditional high-feed cutters, the DiFeedWinV gives programmers greater flexibility when machining deep pockets, contoured surfaces and 3D geometries.

High cutter densities help maximize productivity by engaging more cutting edges in the cut, while four cutting edges per insert provide cost efficiency. Increased insert stability during plunging operations further improves reliability when entering material in tight or confined areas. Available in diameters ranging from 0.625-3.00", the DiFeedWinV is designed to reduce cycle times, improve process stability and achieve consistent results.

Ingersoll Cutting Tools / ingersoll-imc.com



CAD/CAM Automation Technology Streamlines Manufacturing Workflows

Tebis America's SmartOps automation technology within the Tebis CAD/CAM environment is designed to streamline and standardize manufacturing workflows.

SmartOps improves CAD design preparation and CAM programming by automating repetitive processes, improving consistency and reducing manual programming effort. The technology enables manufacturers to build scalable,

reliable automation workflows directly within the Tebis environment – without requiring scripting or coding expertise.

"Manufacturers are under increasing pressure to improve efficiency,

reduce programming time and maintain process consistency," says John Kowalczyk, president, Tebis America. "SmartOps gives users the ability to automate proven workflows, while maintaining the flexibility and control needed in modern manufacturing environments."

SmartOps uses wizard-based dialogs to guide users through automated CAD/CAM workflows. Users can follow established best-practice processes or manually intervene and adjust parameters as needed, creating a balance between automation, flexibility and process reliability.

The platform also allows manufacturers to quickly adapt processes without rebuilding programs from scratch. Users can swap machines, change tooling, modify clamping setups, adjust parameters and exchange part variants, while maintaining process continuity and efficiency.

A distinguishing aspect of SmartOps is its accessibility. Unlike many automation systems, SmartOps does not require external automation software, scripting or programming knowledge. Users can develop and manage automated workflows themselves directly inside the Tebis CAD/CAM platform.

Tebis America Inc. / tebis.com



Laser Measuring System Supports Micromachining Precision

The demands on precision in micromachining are constantly growing – especially when measuring extremely small tools. Blum-Novotest's LC54-Digilog is designed to meet these challenges, offering the full range of functions of the LaserControl Digilog laser measuring systems for tools in the 5 µm to 16 mm diameter range.

The LC54-Digilog can generate several thousand measured values per second, with dynamic adjustment of the



measurement speed to the nominal speed of the tool. Each cutting edge is measured individually, enabling precise comparison between the shortest and longest cutting edges. This results in a repeat accuracy of 0.2 µm, and concentricity errors caused by contamination on the toolholder, for example, are automatically detected.

Blum-Novotest, Inc. / blum-novotest.com

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Moldmaking Index Eases in August but Maintains Expansion Streak

A softer month for orders and hiring trimmed the index to 54.7, though production stayed strong and the market held for an eighth straight month of expansion.



MIKE SHIRK
Senior Market
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led research and analysis in
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Moldmaking Index



The **Gardner Business Index (GBI)** Moldmaking Index gave back about a point and a half in August for a reading of 54.7, holding in expansion for an eighth consecutive month. The month's clearest soft spot was employment, which fell nearly six points to 48.7 and dipped below the break-even line for the first time in the current expansion. New orders and production also cooled, though both remained comfortably in growth territory. Backlog and supplier deliveries both improved more than a point, while exports held near 47.0 as the lone sub-50 component. Material prices eased again to 79.7, extending a multi-month slowing of input-cost pressure. Despite the softer reading of current conditions, optimism improved, with the Future Business Index rising to a three-month average of 66.7.

Components Scorecard

	Change vs	
	Month Ago	Year Ago
Supplier Deliveries	▲	▲
Production	▲	▲
New Orders	▼	▲
Employment	▼	▲
Backlog	▲	▲
Exports	▲	▲

Shade = distance from 50 (darker shades are further from 50)

Direction = change (Pointing up is better)

The **GBI Components Scorecard** reports the monthly change rate of primary moldmaking market factors contributing to the overall monthly index reading.

Reading the Scorecard: Color indicates where a component value falls relative to 50 for the current month. Green indicates expansion; red indicates contraction.

Shade indicates a value's distance from 50; the darker the shade, the further from 50.

Direction indicates a value's change versus the previous period. Pointing up is always better.

Future Business Index



The **GBI Future Business Index** is an indicator of the future state of the moldmaking market from industry respondents regarding their opinion of future business conditions for the next 12 months. Over 50 is expansion and under 50 is contraction.

Find the latest moldmaking market research and reporting at [GardnerIntelligence.com](https://gardnerintelligence.com)

Shop Talk: Adventures with Geoff

By Mike Murakami

Who is Geoff? Well, he isn't a moldmaker, machinist or designer. Geoff is an injection mold. Back in my earlier days working for a small shop, we were a rag-tag, ambitious bunch tackling projects we had no business taking on.

At this company, we had a few molds being built concurrently, and typically had one or two toolmakers assigned to each job, with one of them designated as the "champion" of that build. Instead of using generic numerical identification, we decided to give the molds human names instead. I mean, we were often spending more time with these molds than our own families, so why not?

We were a bunch of old-school toolmakers trying to get the most out of our equipment. We had a pretty good sinker and wire EDM, but our CNC machines were only three-axis, and surface grinders with sine plates and Bridgeports with tilted heads were the norm. This meant we had to get "creative" with a lot of our builds.

Ray, our lead moldmaker on a job, was having enough mix-ups with the other departments and said, "Enough with this. My mold is now going to be known as Geoff!" We went along with it, and personally, I found it hilarious. I had no problem discussing Geoff's development as if he were a struggling grade-schooler.

What made Geoff infamous, you ask? Well, two things happened. First, two of the gate nozzle seals got burned oversized or oval. I don't remember who made the mistake, but it was



Meet Geoff – the only mold in the shop with a name, a face and a legendary backstory. Source: ChatGPT

probably me. So how do we fix something so deep? Just make the mistake bigger!

We intentionally burned the nozzle seal an extra 0.2" in diameter and wire-cut a ring that we could aggressively press-fit into the back of the cavity. We made the hole dead-on size with the hope that the press-fit wouldn't distort our hardened insert that was to be pressed into this softer P20. Success!

That insert wasn't going anywhere. The nozzle slipped in perfectly, and aside from a handful of people, no one would ever know. This worked so well that a similar fix was needed years later, and we were like, "No problem, let's Geoff it!"

The second reason Geoff became infamous was because the part was distorting on a molded feature that had an o-ring around it. I'm pretty sure the part was within tolerance because it was only a couple thou on the plastic, but months of minor tweaking went into trying to achieve perfection, making us all go slightly insane.

The coolest thing about building Geoff was when he was on the bench and had all of his hydraulics hooked up. So cool, in fact, that Ray took out his phone to record the lifters and slides being cycled. Someone chuckled, and he said, "I'm going to show this to my kids!"

Because of this crazy adventure, I will always remember Geoff, but most importantly, the awesome team that brought him to life. [MMT](#)

Sharing Manufacturing's Most Human Moments

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FOR MORE INFORMATION

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MACHINING

How Add-On Spindles Give Five-Axis Machines a Speed Boost

By Mike Blanchard

Most five-axis machines top out at spindle speeds between 6,000 to 15,000 rpm, which is plenty for roughing with large-diameter tools. However, finishing fine detail, texture and micro-features in a mold calls for small tools that need spindle speeds between 40,000 to 90,000 rpm to cut effectively. Without that speed, shops risk poor surface finishes, broken tools and long cycle times.

One option is buying an ultra-high-speed five-axis machine, which can cost more than \$1 million. These machines reach higher rpm, but they are not built for roughing and running the main spindle near its top speed. Doing so for long periods can cause it to heat up and wear out faster. Some shops instead run two machines, one for roughing and one for high-speed finishing, which adds programming, labor and floor space requirements.

An add-on high-speed spindle offers another route. These compact, governed spindles load into a machine's existing tool changer like any other tool. The main spindle continues to handle roughing at a lower rpm, and the add-on spindle takes over for high-speed milling, finishing or drilling mold details. Retrofit spindle systems generally cost less than \$6,000 and shops often see a return on that investment within weeks.

Running small tools at their intended surface footage, rather than well below it, keeps them from dragging through

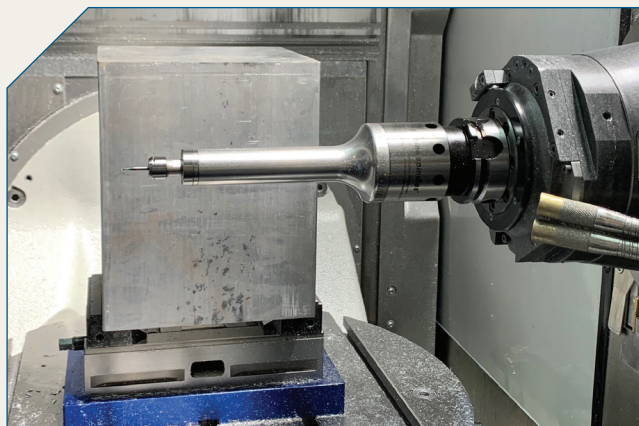


Add-on air-turbine spindles can be integrated with a range of CNC machines, including this five-axis machine. Here the spindle is milling at 65,000 rpm. Source (all images): Air Turbine Tools

material, overheating or wearing out early. Governed spindles hold consistent high-speed cutting even under load. For example, increasing a cutting tool's speed from 10,000 to 40,000 rpm through an add-on spindle allows a proportional increase in feed rate, cutting cycle time by as much as 75%. These spindles generate no heat, which helps avoid thermal growth and tool-length deviation that can occur with electric or gear-driven alternatives, supporting tolerances as tight as 2 microns.

Many five-axis machines already have through-spindle air, which lets these spindles load automatically from the tool magazine with no extra wiring or controls. Machines without that feature can use a mounting block-and-collar system to deliver compressed air only when the spindle is engaged. Manual, plug-in versions also are available for shops running single-tool operations. In every configuration, integration is designed to work with standard CNC operations without disrupting existing programming.

For moldmakers working with small-diameter tooling, deep cavities, undercuts or hard-to-reach geometries, an add-on high-speed spindle can extend what an existing five-axis machine can do without the cost or floor space of a second one. **M M T**



From roughing to finishing in one setup. High-speed spindles bring new capabilities to existing five-axis machines.

FOR MORE INFORMATION

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