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MoldMaking

TECHNOLOGY



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Marshall Cole, Operations Manager, Michigan Tool Works



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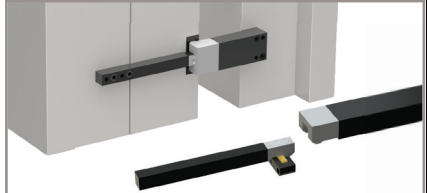


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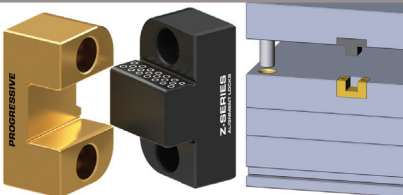
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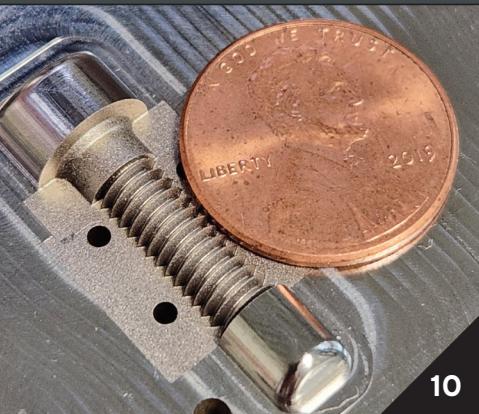
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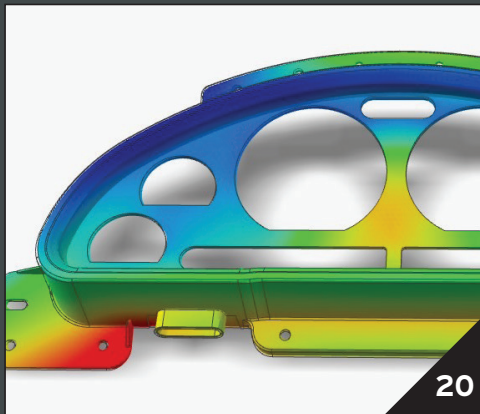


- Integrates asset management, real-time analytics, and KPI reporting.
- Use as a tracking system for tools and equipment or pair with Cve RT for real-time.





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Reducing EDM Dependency

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When Sales Doesn't Speak Manufacturing: The Commercial Blind Spot Hurting Injection Mold Builders, Part 1

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ON THE COVER

Cover photo courtesy of CGS North America Inc. This die-casting mold sample for automotive applications features complex 3D geometry and deep rib structures, requiring high-accuracy, three-axis machining with long-reach tooling at approximately 20XD. The part was machined using CAM-TOOL from CGS North America, PHX series end mills from OSG Corp. and a slim, hydraulic chuck from NT Tool Corp. Together, these technologies enable stable cutting conditions, precise toolpath control and high-quality surface finishes in hardened materials, demonstrating an efficient approach to machining complex rib features traditionally associated with EDM. See related story on P. 16.

Sources (left to right) | Evolve, Cimatron, rimon Technologies

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Each week, MMT Editorial Director, Christina Fuges, sits down with industry insiders for quick, casual conversations on topics impacting the industry today. Enjoy actionable insights on new tech, tips, trends and issues you can put to work in your shop.

CASTING CALL!

Want to be a guest? Reach out! We're always looking for fresh new faces and perspectives from the industry. Email us at: cfuges@gardner.media



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Are You Getting the Right Information at the Right Time?



Mold shop owners don't need more information thrown at them. What they actually need is the right information when it still has time to matter.

Here's a scenario to illustrate: A shop owner gets a call from his steel supplier saying that pricing is moving and that he'd better act sooner rather than later if he needs material for upcoming work. Now this owner of a 25-person shop has five active quotes out, a mold designer he's trying to hire and a Tier 1 customer who's gone quiet on a program he was counting on. He's also

been sitting on a decision for a five-axis machine and some automation for months, waiting for more clarity. He decides to hold off on the steel. And honestly, who could blame him? But here's the thing: The writing was on the wall for weeks, if you knew where to look. By the time it reached him, he was already behind.

That's an information gap.

Sound familiar? Shop owners I talk to regularly spend more time hunting for information than actually doing something with it. Steel pricing lives in one place, tariff uncertainty shows up as a headline you don't have time to read, customer program updates come through delayed emails and phone calls, hot runner lead times are a supplier conversation and workforce issues are a daily reality. By the time any of it becomes obvious, it's already a fire you're putting out instead of a problem you saw coming.

The shops I've watched handle this well (and I've spoken to a lot of them over the years) aren't always the ones with the most advanced equipment. They're the ones who see things a little sooner, know their numbers, grasp their capacity and understand the kind of work worth taking. That kind of clarity changes how they quote, how they negotiate and how they make the call when a supplier says prices are moving.

This is where Manufacturing Connected comes in. For 29 years, MMT has been getting into the details of what it takes to build better molds and run a better shop. That stays the same, but even the best technical content can't tell you something is coming before it knocks on your door.

That's the problem Manufacturing Connected is built to solve. Launching this summer, it's Gardner Business Media's new daily intelligence platform. It's not another publication or a news feed. Instead, it pulls together signals across technology, supply chain, finance and policy and delivers them in focused daily briefings, so you know what's moving, why it matters and what to watch before it becomes urgent.

If you're running a mold shop and that scenario above felt a little too familiar, this was built with you in mind. Be among the first to access it when we launch this summer. Get connected at manufacturingconnected.com. 

Christina Fuges

Christina M. Fuges
Editorial Director

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MMT TIPS

5

TRICKS OF THE TRADE

Great Tips from This Issue

1. Rethink Roughing

Modern roughing approaches focus on maintaining a consistent stock allowance throughout the process to ensure uniform material removal. These approaches also use intelligent rest machining techniques to specifically target and efficiently remove remaining material.

PG. 16

2. Precision Pairing

When compensating for warpage, fewer, well-placed point pairings beat a crowded map—strategic connections create cleaner, more controlled deformation without corrupting the model.

PG. 20

3. Taper Tactics

Instead of chasing perfection on both shutoff halves, focus on the female taper. A simple lapping fixture can dramatically improve roundness, sealing performance and surface finish consistency.

PG. 24

4. Additive Advantage

Don't treat additive tooling as limited to inserts. Advances in cutting tool technology can boost machining performance, helping mold shops increase productivity, reduce cycle times and improve profitability.

PG. 28

5. Knowledge Keepers

Capture shop-floor expertise while the work is happening. Simple phone recordings of decisions, settings and fixes can build a searchable knowledge base that reduces downtime and accelerates training.

PG. 48



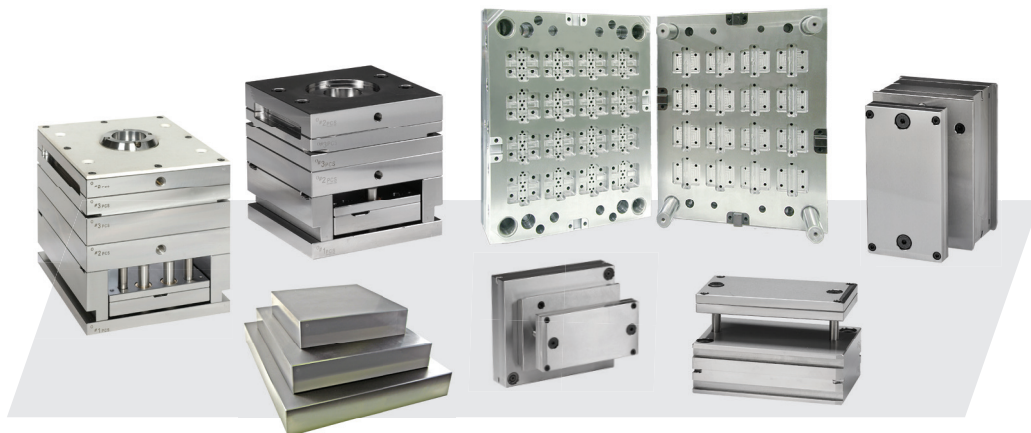
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New Advisors Expand MMT's Industry Perspective

By Christina Fuges

Mark Keller is the Lead Manufacturing Engineer at NyproMold in Clinton, Mass., where he specializes in manufacturing planning, scheduling and lean initiatives. In his role, Keller develops detailed production roadmaps for custom mold components, manages workflows across the shop floor and implements lean manufacturing practices to improve efficiency and consistency. He brings extensive experience in processing injection molds and optimizing production schedules to meet demanding quality and delivery standards.



NyproMold is a world leader in designing and manufacturing high-precision plastic injection molds, serving diverse industries that demand tight tolerances and reliable performance. Keller earned a bachelor's degree in mechanical engineering from the University of Massachusetts Lowell and began his career as a process engineer while still in college. He has spent the past seven and a half years as the

shop's manufacturing planner, combining technical expertise with practical shop-floor experience.

Actively involved in workforce development, Keller serves on advisory boards for several local vocational schools, helping to attract and develop top talent for the moldmaking industry. He has been recognized as a "30 Under 30" rising star in manufacturing.

Keller enjoys challenging himself outside of work, participating annually in endurance events such as marathons, 50ks and half-ironman races. He also plays intramural sports, including baseball, softball, flag football and soccer, and recently celebrated his marriage in October 2023.

He looks forward to joining MMT's Editorial Advisory Board to stay connected with industry leaders and explore emerging trends in mold manufacturing, shopfloor optimization, equipment and workforce development.

mark.keller@nypromold.com / nypromold.com

Sebastian McLearn serves as Tooling Manager at Molded Precision Components (MPC), a vertically integrated engineering-driven injection molding company in Canada specializing in high-volume, performance-critical plastic components. In his role, he oversees the design, manufacturing, repair and maintenance of all company tooling, managing new mold builds, transfer tooling and external machining partnerships to support efficient production.



McLearn holds a Bachelor of Engineering in Computer Engineering from the University of Guelph. He began his career in machining and fabrication as an engineering intern at Huronia Machine, where his responsibilities quickly expanded into project leadership and CAD design. After graduation, he returned to the company and eventually became general manager, leading operations for a

20-plus-machine CNC job shop and gaining hands-on experience in manufacturing management and workflow optimization.

Seeking to deepen his expertise in moldmaking, McLearn joined MPC as a tooling engineer and was promoted to tooling manager within just over a year. He credits much of his rapid development to collaboration with experienced moldmakers, machinists and engineers across the organization.

Active in workforce outreach through Ontario Youth Apprenticeship Program events, McLearn is passionate about strengthening industry pipelines. He brings particular insight into software integration, shop-floor processes, equipment strategy and emerging manufacturing technologies, while striving to build connections and help advance the moldmaking industry.

smclearn@mpccomponents.com / mpccomponents.com

Michael Trace is the senior manager of Tooling Development at TASUS Corporation, where he leads the end-to-end tooling strategy for multiple injection molding plants across Indiana and Alabama. With more than four decades of experience in moldmaking — beginning his career as a toolmaker in 1983 — Trace brings a rare blend of hands-on shop



knowledge and advanced engineering expertise to modern manufacturing challenges.

In his current role, Trace oversees all new tool builds from quoting through production ramp-up, collaborating closely with quality, project management, manufacturing and accounting teams to ensure seamless execution. He is responsible for plant-wide moldflow simulations, design for manufacturing (DFM) guidance and leading cross-functional root-cause analysis teams to resolve critical tooling and process issues before production begins. His leadership has driven measurable results, including a 25% reduction in door-to-press time through standardized work-flows and tooling standards, and a 15% reduction in cycle times on legacy molds through targeted process and cooling optimization.

Trace began his career after earning an associate degree in tool and die/precision machining from Vincennes University, gaining experience in mold design, CNC operations and shop supervision before joining TASUS in 1996. He is deeply committed to mentoring the next generation of tooling technicians and mold setters, helping cut manual mold change times by more than 50%.

Bringing a plastics manufacturing perspective grounded in tooling expertise, Trace values collaboration, knowledge sharing and exploring new viewpoints. Outside of work, he enjoys photography, image restoration and experimenting with generative AI. mtrace@tasus.com / tasus.com

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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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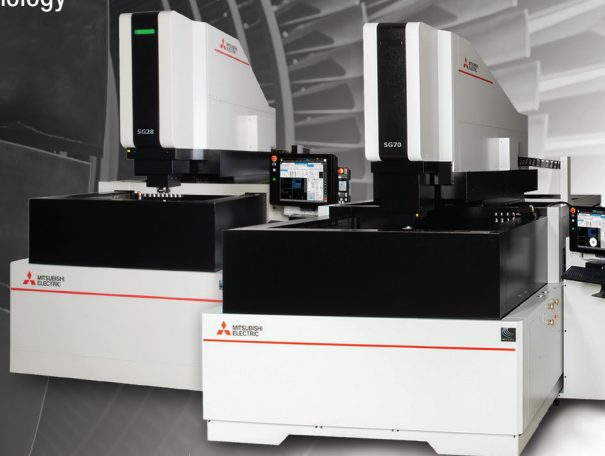
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A Conversation with ... Evolve Tool and Mold Design

By Christina M. Fuges

Can you give me a background on your experience in mold design and manufacturing?

Dean Terrian, Owner, Evolve Tool and Mold Design: I started in manufacturing right out of high school in 1992 in suburban Detroit, where everything was automotive. I worked as a general machinist until the early 2000s, then transitioned into moldmaking. In 2008, I moved to New York due to instability in Detroit and continued in the industry, shifting focus to medical and consumer goods.

I've worked across the full shop floor — lathe, manual grinding, CNC, electrodes, EDM — the whole process. The company I was working at closed. Brian Straiton, the former director of Dynacept, now of Straitek LLC, started Straitek and brought me on. There I learned to handle one-man, one-mold projects: designing and building tools from concept through to sampling. I combined old-school craftsmanship with modern software, templates and automation to take designs from concept to reality.

Later, in 2018, I got involved in scanning technology and joined a startup in Manhattan working with Bob Crozier, formerly of Crozier Fine Arts, a company he sold in 2017. He wanted to scan high-end art to create custom form-fitting cavities for preservation, storage and handling of fine art. In 2021, I gave six months' notice, left my moldmaking job and launched my own design company, working part-time in Manhattan while designing molds on the side.

What happened next with your business and Brewster Plastics?

Terrian: Brewster Plastics, where I designed and built tools, was acquired and became VistaLab Technologies, a manufacturer and supplier of laboratory liquid handling products, spe-



Burning ribs for an eight-cavity square dosage cup mold. Source (all images): Evolve Tool and Mold Design.

cializing in ergonomic pipettes, pipette tips, serological pipets, reagent reservoirs, aliquoting controllers and related accessories. Their focus is on precision, accuracy and ergonomics for research and clinical labs. The company is based in Patterson, New York, and is part of CELLTREAT Scientific Products following an acquisition.

VistaLab was Brewster's largest customer, so they took over the facility. I now operate as Evolve Tool and Mold Design LLC, renting space inside the VistaLab Technologies molding facility. I design and build molds for my own customers and rent the facility to sample the tools I sell. I'm also currently working on two molds directly for CELLTREAT, reshoring projects for their medical customers who want domestic sourcing options.

Vista benefits because I'm on-site for repairs, modifications and new tools. Previously, they shipped tools to New Jersey for fixes, resulting in weeks of downtime and high costs. Now they have immediate support. Having me here as an independent resource is a big benefit. They get on-site expertise without the overhead of building and staffing their own shop. Right now, it's a couple of part-timers and me.

I'm still operating as a sole proprietor, but there's room to scale. Everything is in growth mode.

What makes your setup stand out from traditional mold shops?

Terrian: I'm embedded inside a high-end medical molding facility (VistaLab Technologies), with access to Class 101 molds (many from Tanner Formenbau in Switzerland). I've learned advanced techniques such as custom-formed edge and subgating geometry, cavity cluster assemblies, star gates on heater rods for cluster assemblies in pipette tools, lamina- or bronze insert-coated tapered shutoffs, and other high-cavitation-specific design features from working on those tools. That exposure, combined with my ability to design, build, sample and support in one place, gives me a strong advantage.

Q: Can you describe some of the projects you're working on?

Terrian: Yes. One is an eight-cavity production mold for a *Drosophila* vial. Another is a T-flask, which has two parts (body and lid, ultrasonically welded), that is used for cell culture viewing. These are high-precision, mirror-polished medical components.

These parts are expensive. Bringing production in-house reduces costs. The biggest savings come from supply and inventory. Plus, it enables immediate post-molding treatments and packaging on-site. The treatment phase is still ongoing.

Q: What's your long-term vision for growth?

Terrian: I'm in a unique position to grow organically. I can handle one-man, one-mold projects or eventually train a team. With software, automation, five-axis machining, robots and lights-out capabilities, the roadmap is clear. I can offer customers full service (design, build, sampling, production and even packaging) right out the door. I could run high



Installing ejector pins in a four-cavity mold, before setting up in the EDM to burn everything in place.



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Jar and Lid made of PHA via a three-plate mold runner design. The mold uses cams for external threads and a helical spindle from Hasco for the internal threads of the lid.

volumes (for example, 40 million pieces a year) for the right customer.

The biggest challenge is convincing customers to switch to a different molding facility. They already have established relationships. But if someone comes in, they'll see I can provide end-to-end capability.

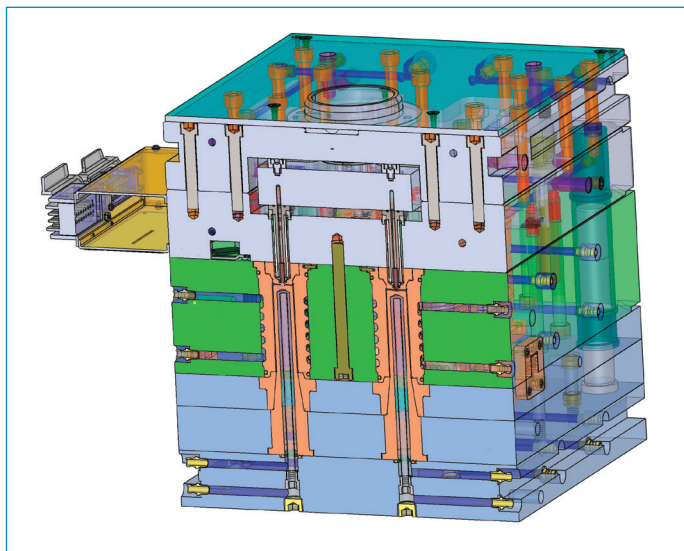
Q: Can you share an example of how your unique business model, as an independent tool shop within a medical molding facility, has resolved a specific problem for a customer that a traditional shop couldn't?

Terrian: One of the first jobs I did here was a dosage cup for Hudson Valley Plastics. They had customers needing cups like those on Nyquil or Robitussin bottles, but the supplier had a six-month lead time post-COVID. We reverse-engineered a sample, built a 12-cavity mold with a hot runner from Incoe and insert stacks manufactured by Adler, assembled it in-house and produced parts quickly. A traditional shop might not have the on-site molding capability to iterate so fast.

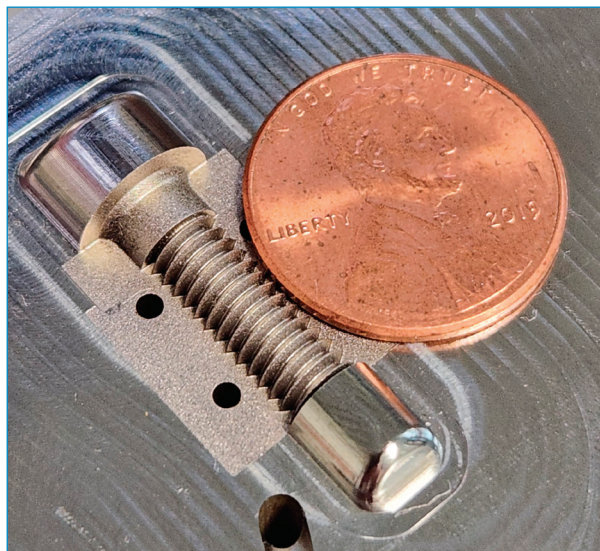
Another project was a bio-resin jar and lid for a client testing a new resin from Canada (PHA, polyhydroxyalkanoate). They wanted a prototype that could scale to production in one mold. The cap is gated on the inside with an unscrewing mechanism using a helical spindle, and the jar uses cams for threads. We sampled it here with the sticky,

gummy resin, which ran at low temperatures, a challenge many shops avoid due to experimentation risks. No other shop would touch it because of the unfamiliar resin.

We also handled cutlery inserts for ITI Technologies, a customer with a proprietary resin. A Prototype facility made spoon and fork mold inserts only for sampling at their facility. We had them ship the inserts to us. We needed a full mold to run the proprietary talc-filled resin (replacing polystyrene due to EPA rules). We scanned the inserts, retrofitted them into an orphaned mold base, designed and made a knife cavity and produced parts. It's a "Frankenstein" tool, but it worked. Again,



Sectional view of an eight-cavity Drosophila vial mold.



EDM burned small external threads for fine detail on the mold insert.

something that traditional shops wouldn't attempt due to the complexity of reverse engineering and sampling with unknown resin formulations.

Q: How are you finding these projects? Are they finding you?

Terrian: Two came from being embedded here in the facility and others through design clients from my past work. Word-of-mouth and my location help.

Q: What are some emerging trends you're seeing in medical molding?

Terrian: The biggest challenge is automating the treatment and packaging of parts while keeping costs down. Packaging kills margins without engineered systems. High-end setups avoid manual labor, but they're expensive. Tooling is straightforward: We can 3D print models, prototype, sample and scale in-house, controlling costs like cycle times and resin. But shipping specs (for example, 50 parts per bag) add up for high volumes, ranging from 800,000 to 20 million to 30 million pieces annually.

The most discussed topic is building a robust supply chain under one roof to handle pricing fluctuations, shipping bottlenecks and tariffs. Last year was panic mode with tariffs. A lot of quoting, but we are selective now. I say no to smoke-and-mirrors customers who quote endlessly without awarding jobs.

Q: Can you walk us through the two projects you mentioned earlier in more detail?

Terrian: For the *Drosophila* vial, the materials used are crystal polystyrene and polypropylene. We are operating the process using an Arburg Allrounder 470C. The manifold consists of an 8-Drop EcoONE hot runner system from DME, featuring bodiless point-gated tips compatible with both PP and PS.

The cavitation design includes eight cavity/core stacks. Each stack contains a cavity insert, a gate cap, a core insert, and a stripper plate. For cooling, each stack on the A plate is equipped with a helical water-jacket cooling circuit. I made sure to avoid any joining lines across or adjacent to one another in the plate to prevent temperature differences exceeding 3–5 degrees. This design allows the process technician to bypass the water lines or run them directly into the manifold, providing more control per zone.



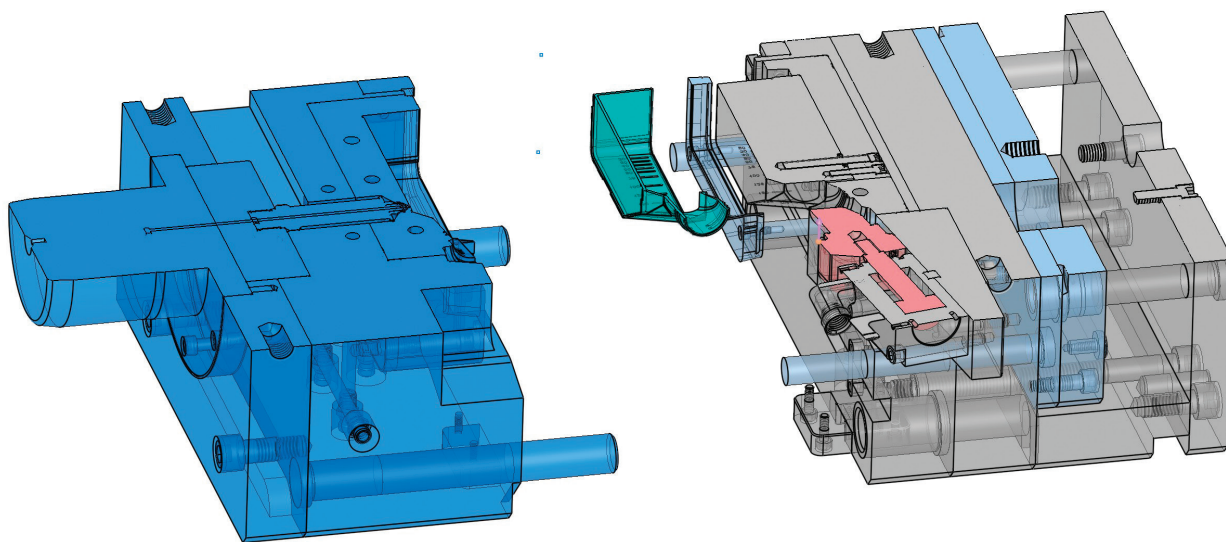
T flask bottle prototype mold.



T flask lid prototype mold.

On the B side, there are cascading bubblers rising from the bottom clamp plate into the cores, and each bubbler has its own cooling circuit.

For the T Flask (Tissue Culture Flask), we have two molds: one for the bottle and another for the lid. These components will be ultrasonically welded together. Each mold uses a valve gate from Mastip, specifically a Verishot single-valve gate unit, along with a stripper plate for ejection. We chose valve gates because they leave only a minor blemish on the part and save material by eliminating the need for a runner. Additionally, they provide improved control over packing, resulting in more consistent injection pressure and faster cycle times.



Sectional view of the T flask bottle mold.

The bottle body mold features hydraulic action for the neck insert, which shapes the bottle neck. Interestingly, the threads do not form a complete helix around the neck; they stop just before the parting line to avoid a die-lock scenario. This design allows the threads to be molded within the cavity and core inserts without requiring an unscrewing mechanism.

The setup includes end-of-arm tooling integration and sequencing switches. I model everything using motion simulation, including the press platens, to anticipate potential issues like tie-bar fit problems, clamping interference and stroke clearance with other components.

The intent is to mold these domestically, then scale up to full production. The resin is crystal polystyrene. The cavities and cores are 420 ESR stainless with an A2 finish for visibility. We have the end-of-arm tooling (EOAT) robot grabbing the parts.

Q: How do you keep on top of changing technology, especially software?

Terrian: I experiment with platforms like Autodesk (Powershape, Powermill, Fusion 360), and others. Similarities across parametric software broaden my understanding. I haven't played with Solidworks, NX or Creo yet. I am exclusive with Cimatron for everything in design, modeling, electrode and CAM.

Cimatron has a unique Quick-split feature that quickly identifies the parting/split surfaces for the core and cavity, and then identifies any undercuts where slides or lifters are needed. It then assigns attributes to the parting and shut-off surfaces to create Boolean cuts and stitched parametric inserts, slides and/or lifters in a single function, while keeping everything associative. Pretty powerful stuff.

"I'm evolving incrementally, sticking to molds because I love making the mold that makes the parts."

Cimatron also offers extensive integrated CAD/CAM features for machining and automation across the entire process, which I can scale up and grow into. Cross-platform issues can be nightmares, so I test trials. I avoid cloud-based subscriptions. I prefer local for security (for example, International Traffic in Arms Regulations (ITAR) compliance) and control. I don't run multiple licenses simultaneously because it's expensive.

Q: Looking back, what would be your top three tips for someone starting a similar one-man mold shop?

Terrian: First, partner up if possible. Start with a team for accountability. The entrepreneurial mind can lie to itself about workload; bouncing ideas prevents jams. I bounce everything off Brett Wallace here, who knows molding inside out.

Second, know you'll work insane hours. Structure screen time (CAD/CAM) and floor time (setup/running machines) accordingly during the workday. You can't do both simultaneously with multiple projects. I find myself

doing a lot of CAD on weekends and evenings.

Third, stick to the roadmap and don't worry about money. Ensure quotes cover everything (for example, shipping, revisions). Iron out scopes to avoid free work. My friend and colleague Jillian Schwam of WV International advised: "Stick to the roadmap."

Q: Any final thoughts on your journey and the industry?

Terrian: I've been a shop rat since I was 14, nearly 40 years. I thrive on challenges, not chaos; I'm evolving incrementally, sticking to molds because I love making the mold that makes the parts. **MMT**



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Reducing EDM Dependency

Optimizing roughing and electrode strategies in hard material mold machining.

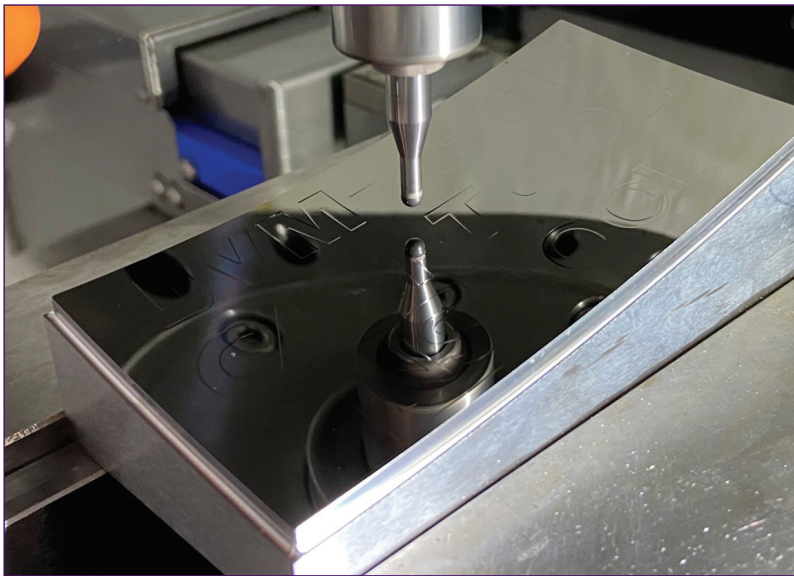
As mold shops face increasing pressure to reduce lead times while maintaining high accuracy and surface quality, many are re-evaluating how much work is truly necessary in EDM. Advances in CAM technology, high-speed machining strategies and tool path accuracy now make it possible to significantly reduce EDM usage by optimizing roughing and finishing strategies earlier in the process.

Although EDM remains essential for certain features, it introduces several indirect costs that should be considered. These include the design and programming of the electrodes, manufacturing and material costs for the electrodes, machine setup and alignment, burn time and the need for multiple passes. Polishing and finishing after the EDM process also contribute to the overall costs.

In many cases, EDM is used not because it is the most efficient option, but because it is predictable. The opportunity today lies in shifting that predictability into the machining process itself.



Long-reach tooling in demanding deep rib geometry, delivering smooth, consistent surface finish without polishing, demonstrating the impact of controlled tool paths and stable machining. Source (all images) CGS North America



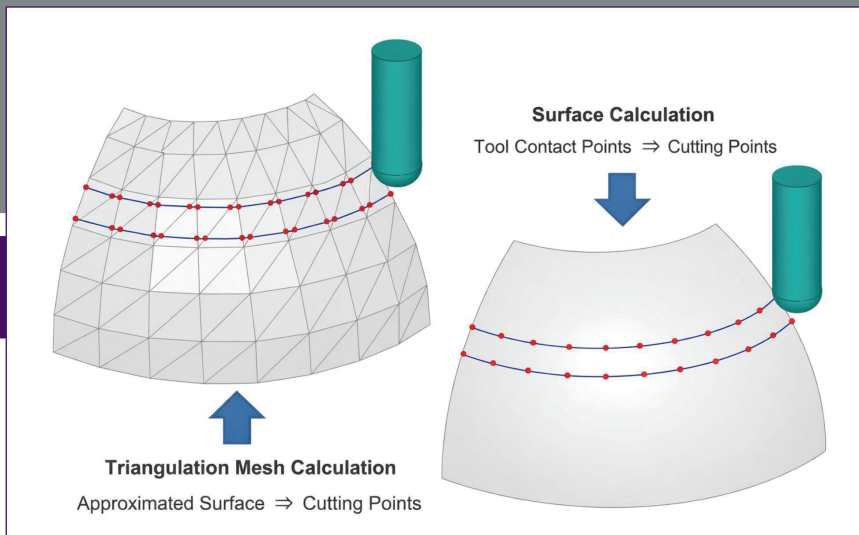
A true mirror finish straight off the machine. When proven processes are captured and paired with advanced CAM, precision tooling and high-performance machines, exceptional results become repeatable.

Rethinking Roughing Strategies

One of the biggest opportunities to reduce EDM lies in the roughing stage. Poor roughing often leaves inconsistent stock, excess material in corners or areas that are difficult to reach, forcing additional EDM work later.

Modern roughing approaches emphasize several key strategies to enhance machining efficiency. First, they focus on maintaining a consistent stock allowance throughout the process to ensure uniform material removal. These approaches also use intelligent rest machining techniques to specifically target and efficiently remove remaining material.

It's also crucial to control tool engagement, particularly when working with hardened materials, to prevent tool wear and breakage. Lastly, transitioning among multiple tool sizes rather than relying solely on large tools enables more effective material removal and better adaptability during machining operations. A structured



Surface-based calculation uses the true CAD geometry to generate cutting points, unlike mesh-based methods that approximate the surface. This higher accuracy produces smoother, more consistent toolpaths – enabling stable, long-length-to-diameter machining in deep ribs and hard-to-reach areas, while delivering superior surface finish.

it exists, preventing unnecessary air cutting and unexpected tool loading. This becomes critical when using long, small-diameter tools, where even slight overload can lead to premature wear or

roughing process sets the foundation for reducing or eliminating EDM in later stages.

Leveraging Tool Path Accuracy and Process Control to Reduce EDM

One of the key factors in reducing EDM dependency is the ability to machine accurately and predictably in hardened materials, particularly when working with small tools and long length-to-diameter ratios, as commonly seen in rib machining.

Surface-based tool path strategies play an important role here. By generating tool paths directly from the CAD surface rather than relying on mesh approximations, the resulting NC code more accurately reflects the intended geometry. This reduces deviation of the machine from the part's true curves, which becomes especially critical when machining hard steel with small, long-reach tools. Even minor inaccuracies at the tool path level can translate into inconsistent tool engagement, increasing the risk of tool wear, chatter or breakage.

When paired with a well-structured machining process, this level of accuracy allows shops to confidently machine areas that have traditionally been reserved for EDM. In practice, some shops have been able to significantly reduce the number of electrodes required per job, and in certain cases, eliminate them altogether.

Stock Recognition and Controlled Material Removal

Accurate tool paths alone are not enough. Equally important is the system's ability to correctly identify and respond to remaining stock, particularly in difficult conditions such as deep ribs, hardened steels and small tool applications.

Effective stock recognition ensures the tool engages only material where

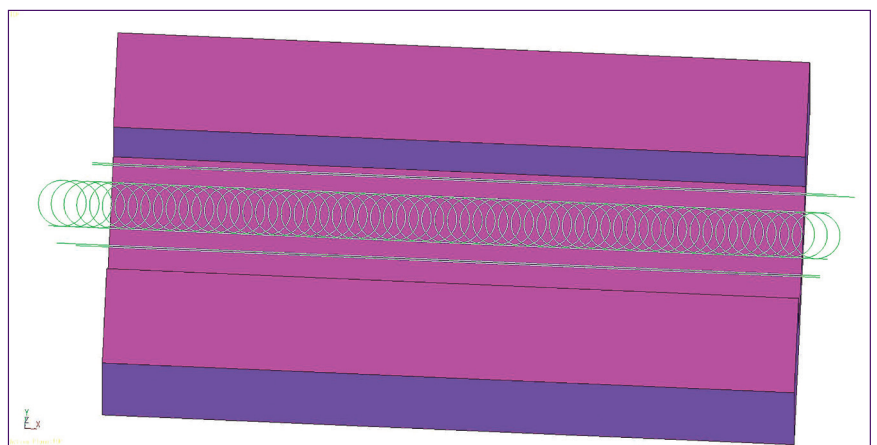
tool breakage.

Beyond recognizing the stock, the approach strategy is just as important. The ability to control how the tool enters and engages the material (combined with the use of trochoidal motions where necessary) helps maintain consistent cutting conditions where the tool is never overloaded. This level of control is essential to protect fragile tools and maintain stability in high-risk areas.

Optimizing Roughing for Rib and Electrode Geometry

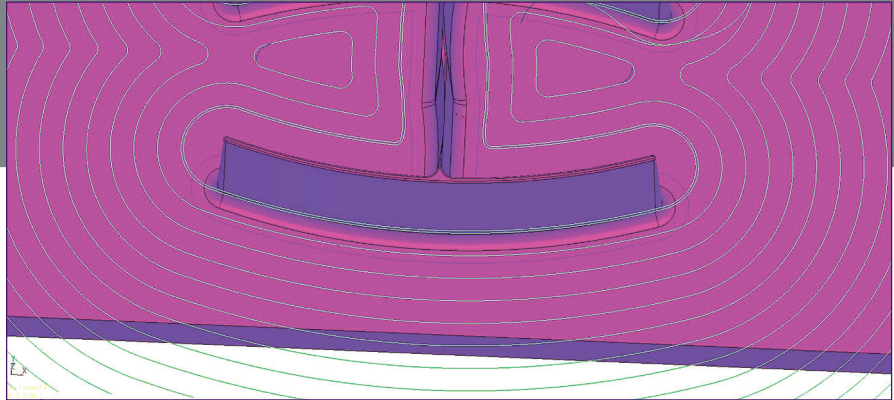
Roughing strategies also play a significant role in minimizing downstream EDM work. One effective approach is to vary the stepover strategy within a single tool path.

For example, larger stepovers can be used in open areas to maximize material removal rates and smaller, more controlled final stepovers are applied near walls or ribs. Reducing feed rates during this final engagement allows the tool to machine to finished conditions without introducing excessive load or cycle time. This approach enables ribs and tight features to be



Trochoidal tool paths introduce controlled looping motion to keep radial engagement constant during slotting operations. This prevents tool overload, stabilizes cutting conditions and extends tool life.

In many cases, EDM is used not because it is the most efficient option, but because it is predictable. The opportunity today lies in shifting that predictability into the machining process itself.

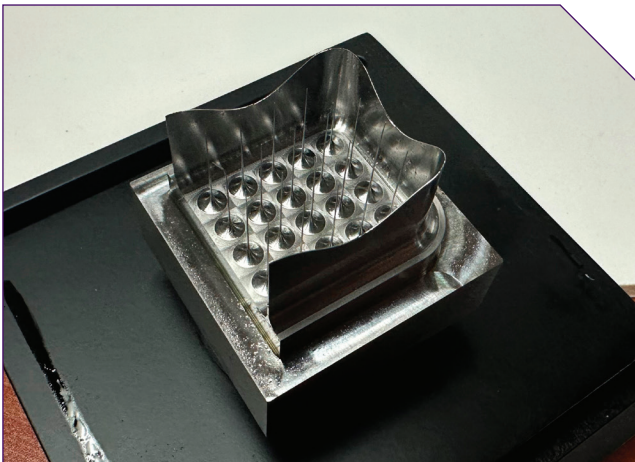


Tool path strategy dynamically adjusts stepover based on geometry – aggressive in open areas for efficiency, then tightening near ribs and walls for control. Slowing feed rates in the final passes ensures stable cutting, allowing features to be finished directly and reducing the need for EDM cleanup.

roughed to net shape, significantly reducing or eliminating the need for EDM cleanup.

A similar concept applies when machining thin electrodes, particularly those made from brittle materials such as graphite. In these cases, the material removed during roughing often provides the structural support needed during machining. Once that support is gone, the remaining geometry becomes highly susceptible to vibration. Any additional finishing passes can lead to excessive chatter, overcutting or even complete electrode breakage.

Because of this, these components must be machined as close to the final size as possible during the initial pass. Using a controlled final stepover strategy allows the tool to achieve near-net or finished conditions during roughing, eliminating the need for additional finishing passes and ensuring stability throughout the process.



At every Z step-down, a roughing pass is followed by a controlled finishing pass. This is repeated to full depth, as no remachining is possible. Once the material is removed, the small pins become too fragile and will break with any additional cutting.

Simulation and Verification

One reason shops rely on EDM is the perceived risk of machining complex features in hard materials. To mitigate this risk, simulation and verification tools play a crucial role by providing confidence before the part reaches the machine.

Collision detection features ensure the safe use of long tools and remaining stock analysis validates machining completeness. Also, verified tool paths facilitate more unattended machining. With greater confidence in the overall machining process, shops can reduce their reliance on EDM as a fallback.

The Biggest Gains

Shops that implement these strategies typically experience several benefits, including fewer electrodes per job, reduced overall cycle times and less polishing and rework. Additionally, there is an improvement in surface finish directly off the machine, leading to increased machine utilization. In many cases, although EDM is not entirely eliminated, it transitions into a targeted process rather than serving as the primary method.

EDM will always have a place in mold manufacturing, particularly for extremely deep features or geometries that cutting tools cannot access. However, its role is evolving.

By improving tool path accuracy, enhancing stock recognition and optimizing roughing strategies, moldmakers can shift more work onto the machine with confidence, even in hardened materials and complex rib structures.

The result is a more efficient and balanced process in which EDM is reserved only for applications where it adds true value, rather than being used as a default solution. **MMT**

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From Shrinkage to Simulation: Mastering Warpage Compensation in Mold Design

Understanding anisotropic shrinkage and geometry-driven warpage, designers use simulation, point mapping and feature alignment to virtually compensate parts, reducing costly trial-and-error tooling iterations significantly.

The art and science of compensating for part warpage entails using simulation software to analyze part quality after molding and, when warpage occurs, adjusting the mold design to improve results. Colloquially known as “Kentucky windage,” this process is continually simplified by advances in simulation and design software.

Material Behavior

Minimizing shrinkage is no longer a significant challenge because moldmakers understand how material behavior differs among plastics. While some materials shrink uniformly (isotropic) across entire parts, others shrink depending on the direction (anisotropic) in which plastic flows into a mold. As the plastic enters the mold through the gate, its shrinkage can be measured in the “flow” direction.

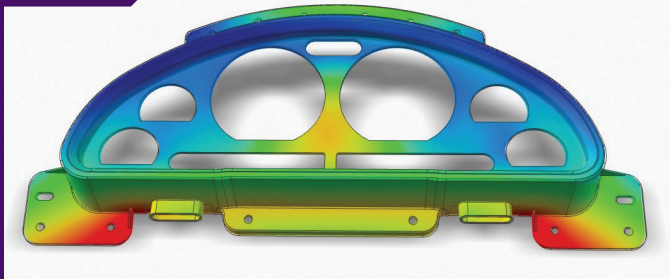
The plastic eventually changes direction as it fills around the mold’s internal geometry and can only flow 90 degrees in the “flow” direction. As the plastic then flows in the “converse” direction, we observe slight pressure changes that push the material into the cavity.

While this variable shrinkage can be easily measured, other variables — like part geometry — also contribute to warpage. A part’s geometry may have areas that are thin and others that are thick, which can cause some of the thinner areas to “freeze,” or solidify, before the thicker sections.

The Advantage of Modern Solutions

In the past, a moldmaker had to rely on firsthand experience to make decisions. It was not uncommon to build a mold sole-

FIGURE 1



Color variation highlights warpage: red marks the most severe distortion, while a blue band traces warpage along the vertical surface facing the screen. Source (all images): Cimatron

ly to determine how badly a part would warp and then alter the mold to counteract the warpage.

Standard CAD drawing tools that produced basic prismatic models were unable to handle oddly shaped parts, such as warped models, and this limited what could be done using CAD software. Significant effort has since been invested in addressing the warpage challenge, and today, several simulation software solutions can predict the molding cycle and resulting part warpage.

While the accuracy of compensated parts is an advantage, it becomes a challenge when compensation results reveal design issues. For example, holes designed to be produced straight up and down, and walls and ribs developed with sufficient draft to release from the mold, could instead be produced with undercuts or trapped in the mold due to warpage.

Likewise, oblong holes appear where round holes were initially designed, molded part features are out of alignment and parting lines are no longer flat. These issues have prevented many in-progress molds from further development.

In Figure 1, the color variation reveals a wide range of warpage, with the red portion indicating the most extreme warp. Across the vertical surface facing the screen, a band of warpage is shown as a blue curve.

Step 1: Calculating Compensation with Points

CAE software typically generates STL models of warped parts that designers import into their CAD systems, allow-

FIGURE 2

Points are placed on the original model and mapped to the simulated warped model, enabling the original geometry to be conformed to predicted distortion contours.

ing them to be edited to compensate for warpage.

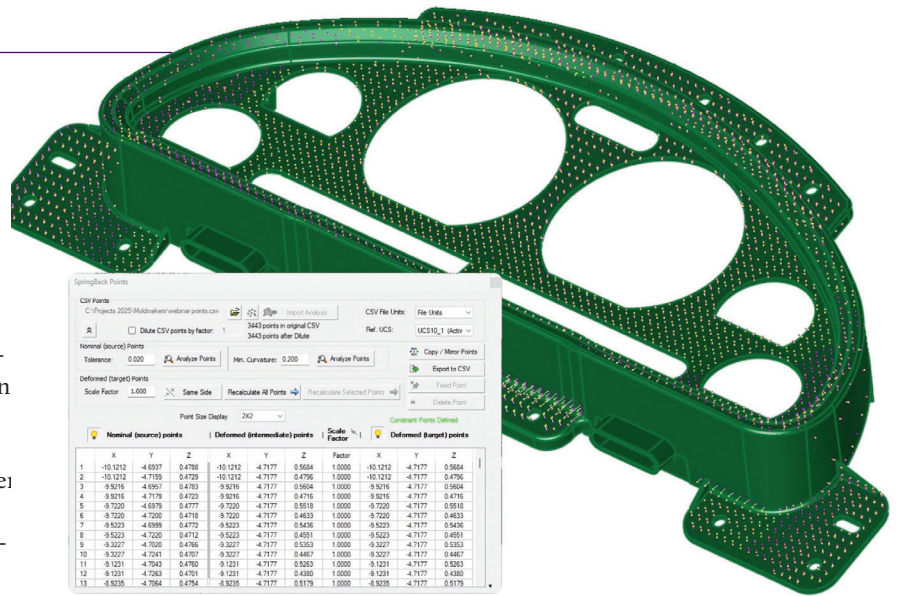
These STL models may already incorporate warpage compensation, also known as morphing, reducing the tasks required of mold designers. Greater effort has recently been invested in creating NURBS (non-uniform rational B-spline) surface models that can include either predicted or compensated warpage.

This process does not involve simply removing the original model from the mold and replacing it with the new, warped model, as the draft angles of the original model should be retained when adjusting the model to align with the compensated geometry.

A designer can elect to deform the original CAD data to match the compensated model created in the mold warpage simulation. In this case, points are projected onto the warped model and then paired with the corresponding points on the original model.

Care must be taken to ensure that the distance between points in these pairings does not exceed the wall thickness of the model, and that a point on the cavity side of one model does not accidentally pair with a point on the opposite side or core side of the second model. Using fewer points often results in a cleaner deformation of the part.

Figure 2 shows points placed across the original model and then “mapped” to the warped model generated using simulation software. This pairing of points will be used to warp the original to the contours of the calculated warped model.



Points can be manipulated in groups or individually. In cases where a particular area of a part exhibits excessive warpage, a threshold percentage can be set to limit the amount of warpage applied. The simulation can then be rerun to determine if the resulting model is correct or at least improved. If not, a higher percentage of compensation can be applied and the simulation can be run again. Once the pairing is complete, the original part is warped to the compensated model, and most of the part is adapted to meet the desired results.

While this technique may require several iterations, virtual adjustments are less labor-intensive and costly than physical prototyping, which involves cutting steel to achieve the same end.

Step 2: Aligning Part Features

At this stage, most of the part is adapted to the required results, but some wiggle room is needed to avoid corrupting

the model through manipulation. The focus can now turn to finer details, such as aligning holes on the warped model with those on the original using the warped model as a roadmap (see **Figure 3**).

Advanced warpage capabilities allow alignment of features, holes, edges and even entire chains of geometry to match the original feature's location with its new location on the warped model. There may be several pairings before this is complete and a complicated model may involve over 100 pairings.

Step 3: Isolating Pull Directions
Draft angles must be oriented from

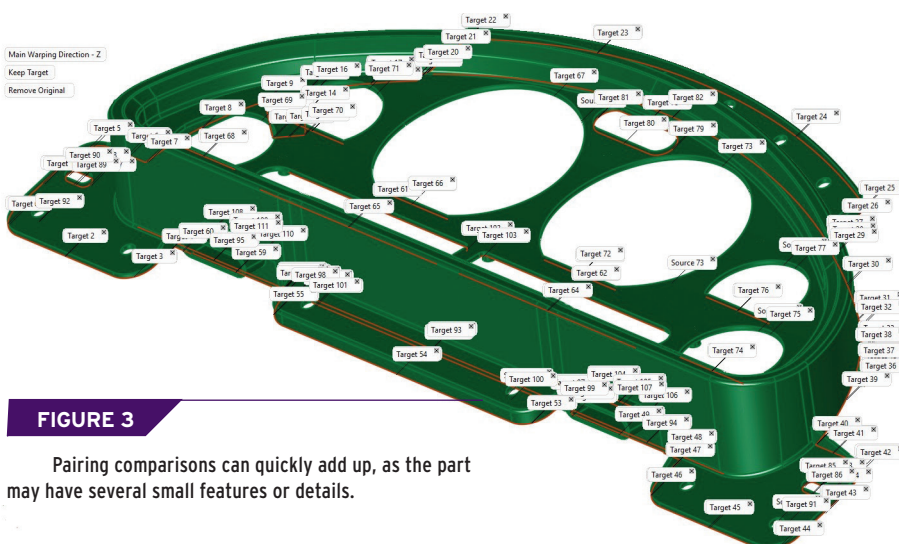


FIGURE 3

Pairing comparisons can quickly add up, as the part may have several small features or details.

a direction other than their original Z-axis orientation. To achieve this, a copy of the model can be used to run another advanced warp simulation that aligns its primary direction to the Y-axis. The mold designer is not concerned with the rest of the part, which might deform radically, because the new slide faces will be imported into the first part and the two merged.

Setting the pull direction along the Y-axis instructs the software to maintain the draft in that direction, disregarding angles in other directions. As such, the part will remain unchanged in the Y-direction as it does in the Z-direction.

The few surfaces affected by the side or Y-axis pull direction are then imported into the first model. Again, any features along this pull direction that are moved will need to be relocated. Care also needs to be taken to merge the parts so that any geometry created or replaced has the correct draft condition along the merge area (see Figure 4)

When working with lifters, the pull direction may not be immediately evident. Once the direction is determined, the

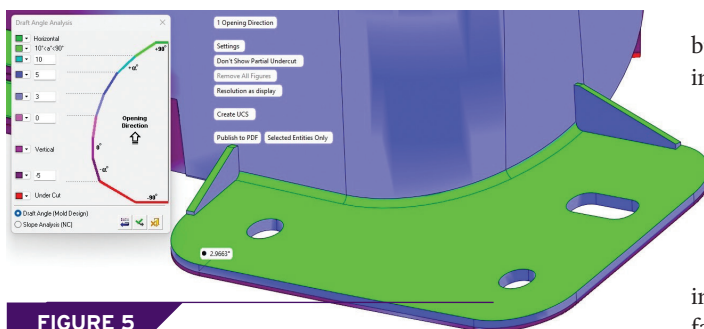


FIGURE 5

The bottom purple section was redrafted after shifting into the core half; the edge is swept downward, and core faces trimmed to match, resulting in zero or slight negative draft for release.

walls affected by the draft may need to be rebuilt or altered using direct modeling.

Using direct modeling capabilities, an oblong hole can be transformed back into a hole of nominal dimension (a true round hole) and on the high side of tolerance, accounting for shrinkage.

Step 4: Working with Parting Lines

When a part is warped, parting lines that were originally clean and flat become wavy or segmented. Of course, a flat parting line is significantly better for building and manufacturing tooling and for controlling overall costs than any alternative.

To correct this result, the parting line can be raised by a minimal amount, perhaps 0.030-inch, so the flat face desired can be achieved and the warped faces recessed into the core

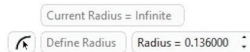
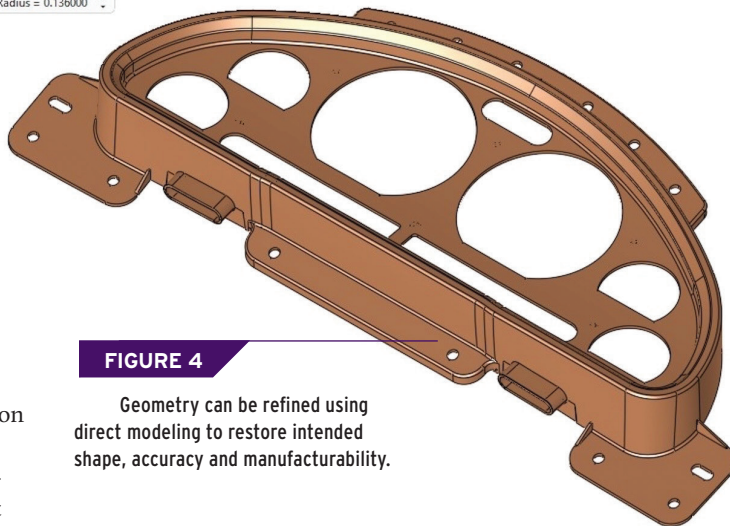


FIGURE 4

Geometry can be refined using direct modeling to restore intended shape, accuracy and manufacturability.



side of the tool. Parting could originally have fallen directly onto the bottom face of the part, but because the bottom is now warped, the parting line is minimally raised above the old face and the warped faces are allowed to remain.

Because it is better to burn the warped part areas than to burn entire parting faces, the new 0.030-inch faces burned into the core will be slightly undercut. This adds draft along the parting line to reduce the plastic part by a fraction and allow the part to release.

In Figure 5, the purple section shown at the bottom has been redrafted. The draft must be corrected because it is now in the core half of the mold. Where the split in the wall has occurred due to elevated parting, the new edge must be swept downward and the core faces trimmed to the new swept face. In this case, the sweep occurred straight down, resulting in zero draft. However, it could also be swept with a negative half-degree to ensure the purple face releases freely.

In each scenario, part redesign is required and must be approved by the end user of the plastic part. The mold designer should also consult with the moldmaker to discuss the moldability of the part. While creating another EDM condition may at first be objectionable, moldmakers may prefer adopting this new method over the time-consuming, laborious process of trial and error. [MMT](#)

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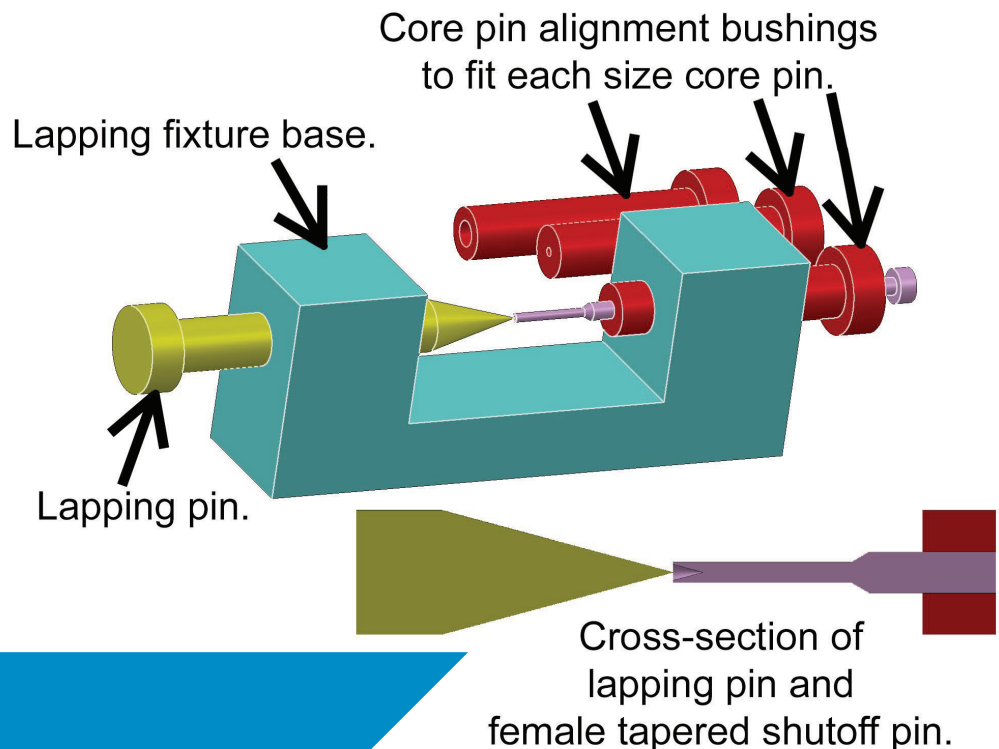
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Stopping Flash on Small Core Pins: Better Fits, Longer Shutoff Life

Small core pins are prone to flash, but improved shutoff design, lapping techniques and strategic geometry changes can reduce wear.



Flash on small core pins can be one of molding's most frustrating and persistent problems. Tight tolerances, rapid heat buildup and delicate shutoff surfaces make these tiny components difficult to manage. By improving shutoff fit, simplifying geometry and using a few proven shopfloor tricks, molders can reduce flash and extend core pin life.

Small Core Pins: Difficult to Keep Flash-Free

In "The Many Causes of Flash" article (*MMT* January/February 2026 issue), I listed the most common causes of flash that are almost universal. However, there are some special instances of flash that will only affect certain molders. One special cause of flash often occurs on small core pins and can be particularly difficult to correct. One reason is that flash tolerances are often tighter for small holes. Another is that small core pins heat up quickly as molten plastic hits them and then cool slowly, allowing plastic to creep into smaller gaps. It can be

A single fixture with a series of bushings can accommodate a variety of core pins to precisely lap the shutoff inside the female pin. Remember to initially make the female shutoff shallow to leave material for lapping. With the correct bushings, the fixture can also be used to align the male and female pins for measuring their stackup.

Source (all images): DJC Plastic Consulting

quite frustrating trying to reduce flash caused by these small components.

Small Core Pins: Tapered End Shutoffs

Long, small-diameter core pins, typically 0.08-inch (2 mm) diameter or smaller, often have tapered male ends that enter and shut off inside matching tapered female shutoffs in the mating core pins. The tapers align the ends of the pins and provide concentricity. If the shutoff between the male and female tapers of these delicate core pins does not have a very good fit, the result will be flash in the hole they form.

The male taper is easier to produce than the female taper for two reasons: first, because it is an external surface, it can

be ground using a spinning fixture and a surface grinder; second, it can be examined optically 360 degrees for proper diameter, angle, length and surface finish.

The female tapered shutoff, on the other hand, is more difficult to produce and to measure. It can be cut with a high-speed CNC mill using a very small cutter or with an EDM. The milled taper may have surface defects due to chatter, cutter flex, core pin flex or cutter step-over. An EDM shutoff must be made by first building an electrode; the electrode then “burns” the taper into the pin. Any imperfections in the electrode will be transferred to the shutoff. In addition, the orbiting of the EDM and EDM scale will make the shutoff less than a perfect match to the male taper.

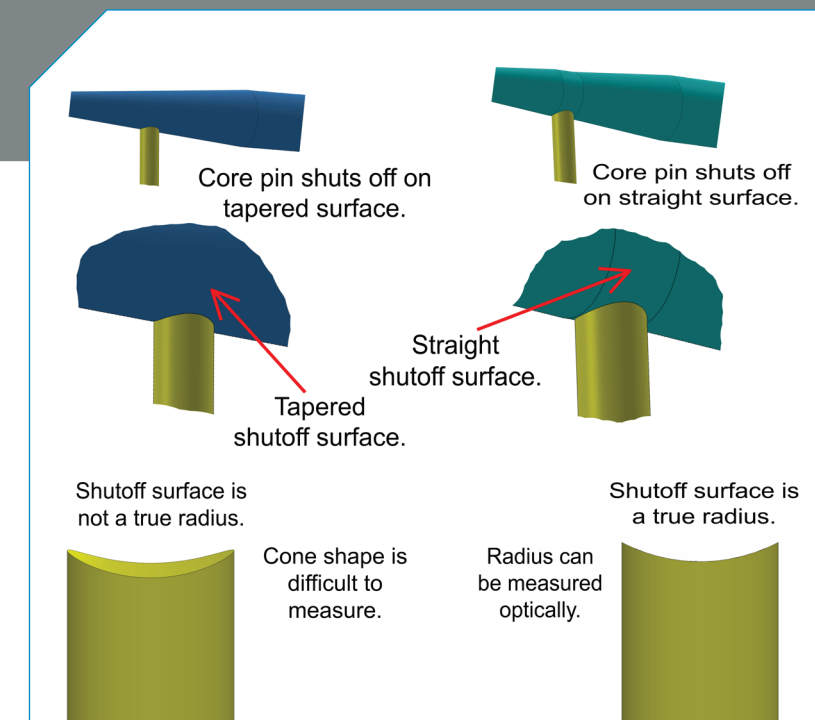
Shutoff Improvement Solutions

A common flash remedy is to add a shim under the head of one or both core pins to increase pressure on the tapered shutoff. There are three reasons why this is not the best approach. First, adding more pressure may not correct the flash. Second, forcing two surfaces with imperfections together will accelerate wear on the shutoff surfaces or cause the female taper to bell-mouth. Third, this can be the costliest; as the mold cycles, the core pins heat up and expand, which can exert too much compression on one of the pins, causing it to bend and break. I have sometimes left the cold pins with no press or even a 0.001 inch (0.025 mm) or more gap in the shutoff, which would then close after a few cycles as the pins heat up.

There is a better solution to improve the roundness and surface finish of the female taper. Since the male taper can be made with a smoother and more uniform surface, not much can be improved on that half of the shutoff.

After some experimentation, I found that a simple lapping fixture will produce a nearly perfect female tapered shutoff.

The fixture consists of a “C”-shaped base with concentric holes for pins (the holes can be wire-EDMed at one time), bushings to fit in one or both holes of the fixture, and a sacrificial lapping pin. The female pin's taper must first be cut to a depth 0.002 to 0.003 inch (0.05 to 0.08 mm) shallower than



It can be difficult to measure the tapered surface of a core pin that shuts off on the tapered cone of its mating core pin. The shutoff surface is not a radius but is a cone that cannot be measured optically. Creating a short straight section on the center core pin provides a true radius for the side core pin to match, which can be easily measured optically.

One special cause of flash often occurs on small core pins and can be particularly difficult to correct. One reason is that flash tolerances are often tighter for small holes.

the final depth. Starting with coarse lapping compound on its tip, slide the lapping pin into the female taper and rotate the pin by hand. Do **not** use the male core pin as the lapping pin.

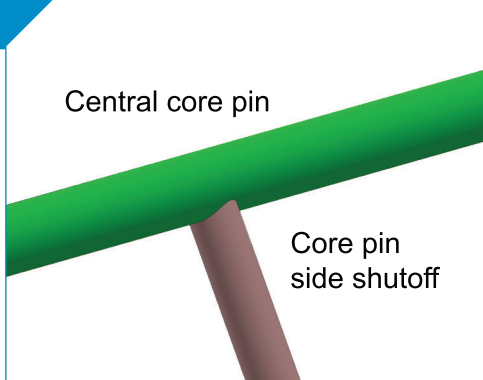
Clean the female pin and check the stackup with the mating male pin. (The lapping fixture can be used to align the two pins to make measurements easier.) Repeat the lapping until the final stackup is obtained using progressively finer lapping compounds. The lapping pin taper will need to be dressed occasionally.

Small Tapered Core Pins: Side Shutoffs

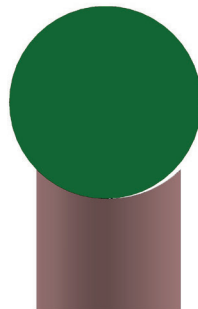
Small core pins with side shutoffs are another special case in which flash shutoffs are common. The core pin forming a hole through the center of a part is typically contained in a slide, and the side shutoff pins are stationary in the “A” or “B” halves. In some cases it is the reverse, or all the pins may be formed on slides. (The problem of creating a robust shutoff on small diameters is the same in any case.) If the side

core pin shuts off on a straight section of the center core pin, then the shutoff surface of the side pin is much easier to form: it can be ground or machined with wire EDM and measured optically.

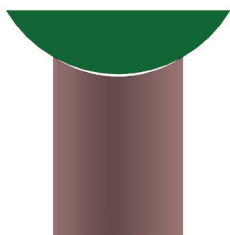
However, the difficulty increases if the side shutoff occurs on the drafted surface of the center core pin. This shutoff surface is not a radius but rather a cone, so it cannot be ground



Side core pin shutoff
radius larger than
central core.



Injection pressure
can move core,
opening up shutoff.



Side core pin
radius smaller
than central core.

Shutoff stays centered.

When producing a side core pin to shut off on a central pin, making the cut radius the same or slightly smaller than the central pin radius is preferable to making the cut larger than the mating radius. Although making it either smaller or larger will produce a gap, as the mold cycles, the larger cut radius tends to wear more on the thin sides. Injection pressure opens the gap more to one side. In contrast, a smaller cut radius will have a small gap at the bottom. As the mold cycles, the sides of the cut will eventually wear, closing the bottom gap before opening a gap on the sides.

through and will need to be formed by wire EDM. It cannot be measured optically, at least not directly. A method I developed for measuring a tapered radius shutoff is to make a sacrificial core pin of the same diameter and length as the side pins and wire EDM the tapered shutoff. Then grind away the side of the core pin tip, removing the larger portion of the taper, leaving a clean, sharp edge that is easy to measure.

This provides a true radius that can be measured optically, both the radius and the distance to the pin's base. Comparing these measurements to a CAD model of that pin cut through in the same place will confirm if the cone is cut correctly. If not, make the necessary adjustments before cutting the production core pin.

Simplifying Taper Removal

A simpler way to form a shutoff on a tapered center pin is to remove the taper in the shutoff area. Making that small area straight will make both the center and side pins easier to produce and measure. The model should be updated to reflect this change, but the change to the part geometry is minimal.

Series: Emphasizing the Basics

In this article series, Dennis Czubin, a seasoned plastics professional, shares valuable insights from his 40-plus years in the industry, focusing on fundamental principles in part and mold design to help mold builders and molders enhance their practices and avoid common pitfalls.

Extending Shutoff Life

Moving steel pieces rubbing against each other with every cycle will eventually wear down the shutoffs and the pins will have to be replaced. The thin steel at the sides of the radius is the first area to wear, creating a more oval-shaped shutoff surface. Injection pressure can then push the center core pin to one side, opening a larger gap on one side of the shutoff, allowing more flash.

One trick I learned to extend the life of side shutoffs is to make the radius of the side pin slightly smaller than the diameter of the mating center pin, with the bottom of the radius cut to its full depth. This may initially create a small gap between the bottom of the radius and the center pin, but the gap is minimal and typically does not result in measurable flash. As the mold is cycled, the sides of the cut radius will wear first. As it does, the side pin seats into the center pin, closing the gap at the bottom and extending the shutoff's life. This simple trick can double the life of the shutoff.

Small core pins with delicate shutoffs pose a challenge with flash but using a few tricks can help these shutoffs fit better and last longer. [MMT](#)

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Why Moldmakers Should Evaluate 3D-Printed Cutting Tools

Moldmakers already use additive manufacturing for high-value mold inserts; next is applying additive cutting tool advancements to boost productivity, profitability and smarter tooling decisions.



Batch production of end mills produced via 3D metal additive manufacturing. Source (all images): Iscar Metals

In 2003, I visited a mold builder near Rochester, New York, where I saw 3D printing used for prototype parts for the first time. I had just switched jobs from programming CNC mills and lathes for plastic injection molds to working for a cutting tool supplier. At that time, additive manufacturing was emerging, primarily producing plastic prototypes, and many in the industry, including myself, were concerned about the potential reduction in mold work due to these new 3D technology.

Additive manufacturing has not progressed as rapidly as many anticipated. However, nearly 23 years later, it is clear that additive manufacturing technologies, including metal additive manufacturing, are now established practices in moldmaking rather than merely experimental capabilities.

It is a proven production technology for applications where thermal management, geometric complexity and lead time have direct economic implications. In injection molding, laser powder bed fusion (LPBF) has shown its value in creating conformal-cooled components.

At the same time, the cutting tool industry has been advancing many of the same metal additive strategies to improve coolant delivery, reduce mass, consolidate assemblies and accelerate development of application-specific tooling that pushes the boundaries of indexable cutting tool development.

For moldmakers, these developments should not be viewed as separate trends. They're closely related by the same engi-

neering principle: when process performance is limited by heat transfer, fluid access or geometric/machining constraints, additive manufacturing can create solutions that traditional production methods cannot.

Moldmaking has already embraced this principle, mainly for high-value core/cavity insert applications. The next step is to recognize that additive advancements in cutting tools should influence their cutting tool decisions, which can directly impact shop productivity and profitability.

Mold-Cutting Tool Technical Overlap

Moldmaking and cutting tool production are governed by comparable technical demands. Both disciplines benefit from precise control of heat and wear, and in maintaining dimensional stability under severe service conditions. In moldmaking, the consequences of poor thermal management are well understood: longer molding cycles, hot spots, differential cooling, part distortion, sink and inconsistent quality. In cutting tools, inadequate heat management leads to accelerated wear, reduced cutting-edge integrity, poor chip evacuation, unstable machining and lost productivity.

In both cases, the performance ceiling is dictated by the constraints of conventional manufacturing. Examples such as straight-drilled cooling channels and line-of-sight machining are among the more common constraints that limit how effectively design engineers and machinists can produce internal



Finished end mill. Notice multiple/optimized coolant channels pointing along the insert cutting edge.

features where they are needed most. Metal additive manufacturing changes this design conundrum, allowing the freedom to design internal features according to process requirements rather than machining access.

This is the foundation of conformal cooling in moldmaking and also of advanced coolant delivery in additive-produced cutting tools. The applications differ, but the goal is the same: control heat and flow at the point where needed most.

Additive Value in Process Optimization

Too much discussion around metal additive centers on geometry alone. For experienced moldmakers, that's only part of the equation. Another real value of additive manufacturing lies in enabling process-driven internal design architecture.

In molds, that means cooling channels that follow the cavity geometry, providing more consistent cooling and extracting heat more uniformly across the tool. In cutting tools, it means internal coolant passages engineered to minimize pressure loss, improve chip evacuation and direct coolant precisely to the cutting zone.

In both industries, additive processes allow designers to place thermal and flow functionality where it improves output.

Reinforcing Moldmaker Knowledge

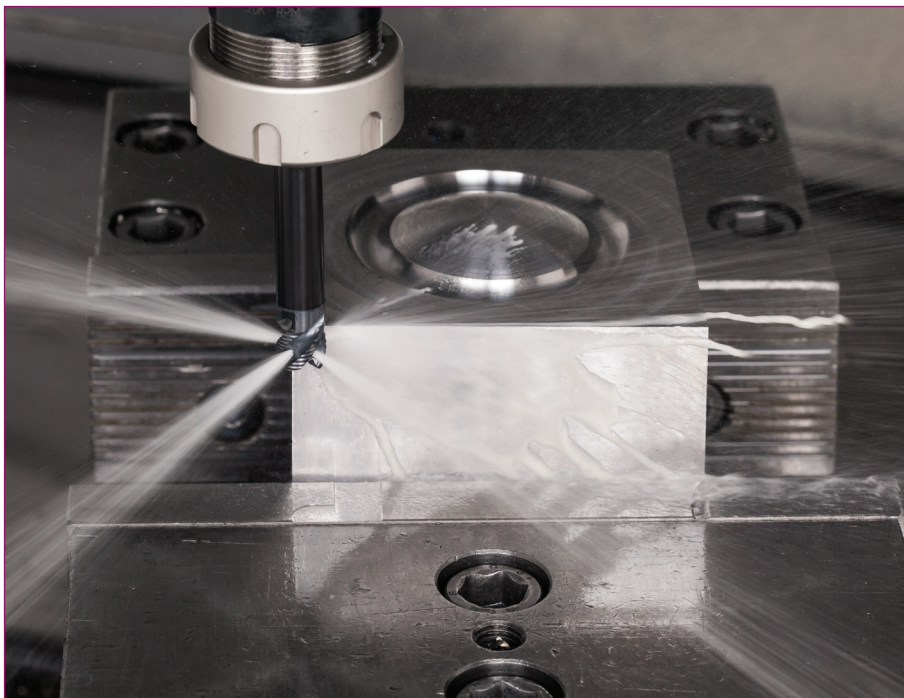
The cutting tool sector has arrived at many of the same conclusions that leading mold shops have already reached. Additive delivers the most value when used selectively, in applications where conventional manufacturing imposes design limits that directly affect performance. Standard tools remain well-suited to established manufacturing methods. Likewise, many mold components with straightforward geometry and accessible cooling paths will continue to be machined with conventional-type cutting tools because there's no loss of productivity.

But when a tool or insert is constrained by heat, internal flow, access or customization requirements, deep/long depth-to-diameter cutting tool ratios, additive becomes a high-value solution. In cutting tools, this has led to additive-produced tool bodies, custom coolant-fed cutters, specialized boring tools and deep hole drilling tools and other low-volume, performance-driven cutting tools for all facets of machining applications (for example, drilling, milling, turning, parting and grooving, and so on). In moldmaking, it has led to conformal-cooled inserts, thermally optimized cores and integrated features that reduce assembly complexity and improve molding consistency.

It's clear that both industries rely on the same manufacturing strategy: applying additive where functional complexity creates measurable process gains. Otherwise, use conventional methods/tooling that meets production needs.

Hybrid Additive-Subtractive Approaches

Something learned over the years about additive manufacturing is that the approach can rarely completely replace conventional manufacturing/machining processes. In



Solid carbide interchangeable head with coolant directed at the cutting edge of each flute.

Cutting Tools



Long reach optimization is achieved with an interchangeable system capable of delivering high-pressure coolant directly to the cutting edge.

moldmaking, a laser powder bed fusion insert still requires downstream operations such as stress relief, support removal, machining of shutoffs and datums, polishing of cavity surfaces and final fitting into the tool assembly. In cutting tools, additive-produced components similarly require finish machining, grinding and coating processes. These are not shortcomings of the process. They are part of a more complete production model.

Many moldmakers have plenty of experience in choosing between or combining additive and subtractive strategies for mold production and easily identify where additive manufacturing can provide benefits that conventional design/machining cannot produce or compete economically.

The cutting tool sector's adoption of additive technology should reinforce confidence among moldmakers that they have similar choices when it comes to cutting tool selection, and to seek tooling produced by additive processes when circumstances dictate.

Why Printed Cutting Tools Matter

The relevance of additive-type cutting tools has direct implications on how molds are made, especially how fast. Many mold shops spend a significant portion of their capacity on roughing and finishing hardened steels, machining deep cavities, producing complex three-dimensional surfaces and managing difficult chip evacuation conditions. These are precisely the

kinds of applications in which additive-enabled cutting tool designs can deliver performance benefits. Improved internal coolant delivery, lighter tool bodies, application-specific cutter geometry and more efficient chip control improve machining stability, extend tool life and reduce production cycle times. This should speak to moldmakers who typically strive to mold quality parts as fast as possible.

A moldmaker that adopts advanced additive-enabled cutting tools should be able to reduce machining cycle times, improve unattended machining reliability, lower tool consumption and shorten delivery schedules. In a high-pressure production environment, those gains translate directly into stronger margins.

Business Case for Printed Cutting Tools

For moldmakers, the time is now to evaluate additive technologies from the cutting tool sector and determine where to apply them to improve machining processes. Newer tools designed and produced from additive are based on reengineering the tool around function (another aspect that should speak to moldmakers) and the decisions rest on drivers, such as:

- Coolant is optimized (flow, pressure, direction), improving cutting tool life (not uncommon to see as much as 30% increases, and sometimes higher)
- Reduction of mass where not beneficial to performance, which is highly beneficial for long reach applications typically encountered in moldmaking

- Improved design structure to support rigidity and/or add a damping effect
- Stronger utilization of existing machine assets, increasing capacity
- Reduced risk of production bottlenecks caused by heat and chip control limitations/issues
- Improved part quality (better surface finishes and tolerance control)

In short, additive contributes value on both sides of the moldmaking operation. It improves what goes into the press and it can improve the processes used to build a mold in the first place.

Strategic Conclusion

The moldmaking industry does not need more reminders that metal additive manufacturing has promise. That point has been proven. Where moldmakers can benefit now is by taking a broader view of where additive-derived advantages are emerging and how they can be applied across the moldmaking workflow.

The cutting tool industry offers that perspective. Its use of 3D additive manufacturing is part of broadening its manufac-

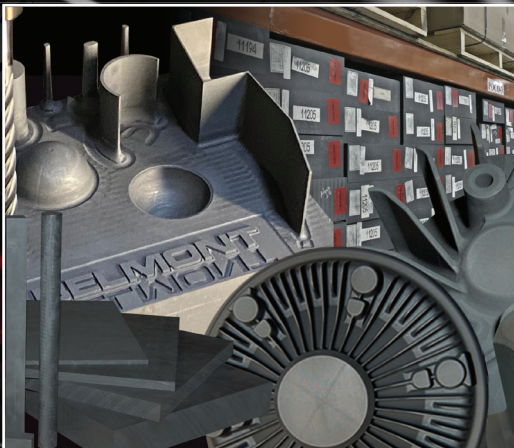
turing model, removing processing constraints and converting design freedom into throughput, consistency and profit. The use of 3D printing is setting new limits on achievable (smaller) diameters and cutting tool types, while providing the benefits of internal fluid management and function-driven geometries (for example, many different types of indexable tools for different machining requirements).

The message is straightforward. Additive should not be regarded solely as a method for producing conformal-cooled core and cavity inserts. It should be evaluated from the cutting tool perspective as a broader performance technology; one that can improve both molding outcomes and machining processes used to produce molds. Shops that recognize this will be better positioned to reduce lead times, increase productivity and protect profitability in an increasingly competitive market. **MMT**

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When Sales Doesn't Speak Manufacturing: The Commercial Blind Spot Hurting Injection Mold Builders, Part 1

Understanding the gap and how misalignment between sales and manufacturing undermines opportunities and limits a company's ability to win work.



Strong moldmaking capabilities are not self-evident; sales must translate shop-floor excellence into customer outcomes or differentiation erodes and pricing pressure wins eventually. Source: AI

SYMPTOMS YOU CAN HEAR & SEE

"These don't feel like a big deal in the moment, but over time, they create a widening gap."



Subtle Signals

The disconnect isn't usually dramatic. It's incremental. It shows up in daily commercial conversations where sales moves faster than manufacturing reality.

THE CUMULATIVE EFFECT

Individually, these seem minor. Collectively, they bake damage into the quote before the job even starts.

✖ NOT A COMPETENCY ISSUE

Manufacturing knows how to build.
Sales knows how to sell.
The failure is in **alignment**.



Generic Capability Descriptions

Using buzzwords like "high precision" or "tight tolerances" without specific context creates commoditization.

"Complex Tooling"

"Quality Parts"



Assumptions Filling Gaps

Quotes built on incomplete understanding of the manufacturing process or unverified customer data.



False Reassurance

Overconfidence framed as certainty to close the deal, often masking significant technical risk.

"Don't worry, we've done this before..."



Poor Opportunity Selection

Saying "yes" to work that stretches the shop's weaknesses and saying "no" only when it's too late.



Feature Focus vs. Value Focus

Conversations centering on "what we can do" rather than "why it matters" or where the risk lives for the customer.

Most conversations about the manufacturing skills gap stop at machinists, toolmakers and engineers. And to be clear, that gap is real. Talent is harder to find, experience is retiring and technical excellence is under constant pressure. What gets discussed far less is a different kind of gap, one that exists inside the same organization, but between sales and manufacturing. This gap doesn't show up on the shop floor first. It shows up in commercial conversations during quoting, opportunity qualification, and early customer engagement long before a tool is ever built.

In many small and mid-sized shops, this challenge can be further amplified when owners and senior technical leaders are the ones handling sales. Not because they lack commercial awareness, but because their depth of knowledge often makes it difficult to step back and translate complex capability into decision-oriented value for customers who don't live in the details every day.

The risk isn't that shops can't build great tools. It's that sales teams are not able to consistently explain why their capabilities matter, who they matter to and when they don't. When sales doesn't understand shop-floor skills and technical excellence isn't intentionally translated into customer-relevant outcomes, differentiation drifts toward features, and features almost always compete on price. Great manufacturing doesn't automatically translate into commercial advantage, and we cannot assume that value is self-evident to our

Figure 1 Small quoting signals—generic claims, assumptions, false reassurance, poor fit, and feature talk—quietly widen the gap between sales promises and manufacturing reality.

Source (all images): Kallan Sales Development

prospects. That translation happens, or doesn't, during sales conversations.

The Disconnect Between Sales and Manufacturing

In most mold shops, this disconnect isn't dramatic or intentional. There's no single moment where sales and manufacturing "stop talking." Instead, it's subtle. Incremental. And because it's subtle, it becomes normalized as "just how things work." Sales conversations move faster than manufacturing reality. Quotes are built under time pressure. Customer questions are answered in real time, and assumptions fill the gaps where a deeper understanding of the manufacturing process should reside. None of these feels like a big deal in the moment, but over time, they create a widening gap.

Common quoting failures include generic capability claims, assumptions-driven estimates, misplaced confidence, mistimed yes/no decisions, and sales conversations that stress what a shop can do—without explaining why it matters or where risk lives (see Figure 1).

Individually, none of these is catastrophic, but collectively they compound. By the time manufacturing feels the impact, the damage is already baked into the quote, the timeline or

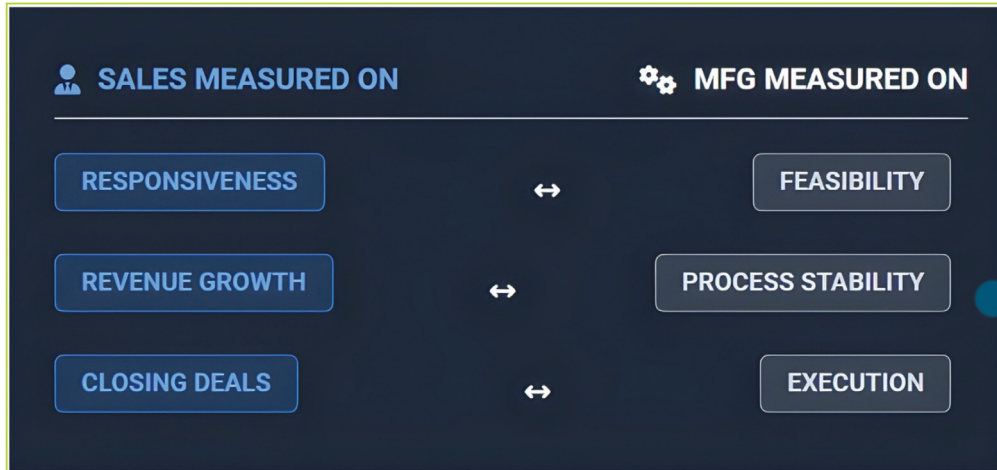


Figure 2 Sales is rewarded for speed and growth, while manufacturing is measured on feasibility, stability, and execution—misaligned metrics fuel quoting failures.

the customer's expectations. This isn't a competency issue. Manufacturing knows how to build. Sales knows how to sell. Even in owner-led or technically driven sales environments, the challenge isn't knowledge, it's alignment.

What's missing is a shared operational language that allows manufacturing reality to surface clearly in commercial discussions, before commitments harden and flexibility disappears. This does, however, assume the conversation hadn't stalled earlier in the buying process and that the lack of translation resulted in a lost opportunity altogether.

Real-World Consequences

This disconnect isn't just inconvenient, it's expensive. When complexity is misjudged, or risk isn't fully understood, it doesn't get priced in and margins erode quietly, often explained away later as "execution challenges" or "customer pressure."

Unrealistic delivery commitments trigger internal fire drills, forcing operations into reactive mode, eroding trust between sales and manufacturing and creating strain that customers feel even if it's never stated outright. At the same time, shops lose bids where they were the best technical fit because the value wasn't communicated clearly, while winning work that should never have been pursued, tying up capacity in the wrong programs.

Customers don't care where the disconnect originated. Engineering feels oversold, purchasing feels surprised and confidence erodes even when intentions were good. These aren't minor operational annoyances; they surface directly

Most shops, if they think about it at all, view sales enablement as CRM training, scripts or activity management. Very few think about enablement as a competitive lever. Effective sales enablement in manufacturing goes beyond the sales process.

to see the business the way the shop does. They're measured on responsiveness and revenue, while manufacturing is measured on feasibility, stability and execution. Without a shared lens, both sides are doing their jobs well, just not in alignment (see Figure 2).

As a result, sales people are rarely trained to understand:

- What truly differentiates one tool builder from another.
- Where the shop excels and where it doesn't.
- How manufacturing risk translates into commercial risk.

Without a working understanding of how work flows through the shop, from design intent to machining strategy to validation and handoff, sales can't accurately evaluate opportunities. They can't tell the difference between work that fits

the shop's strengths and work that quietly stretches it. And they struggle to explain value in ways that resonate with engineers, buyers and operations leaders on the customer side. Not because they aren't capable, but because they were never given the same view of the business as manufacturing.

The Case for Sales Enablement Inside Manufacturing Organizations

Most shops, if they think about it at all, view sales enablement as CRM training, scripts or activity management. Very few

think about enablement as a competitive lever. Effective sales enablement in manufacturing goes beyond the sales process.

It includes education on core manufacturing capabilities and operational constraints; understanding how risk impacts margin, delivery and customer outcomes; and, clarity on where the shop wins and where it struggles. It also provides

in margin predictability, delivery and long-term customer trust.

The Root Cause

Most sales training, when it exists, typically focuses on process, activity and persuasion. Those tools are useful in transactional environments where risk is low and outcomes are repeatable. But in technical, high-mix, high-variation manufacturing environments, that approach breaks down quickly.

The reality is that most salespeople are never taught

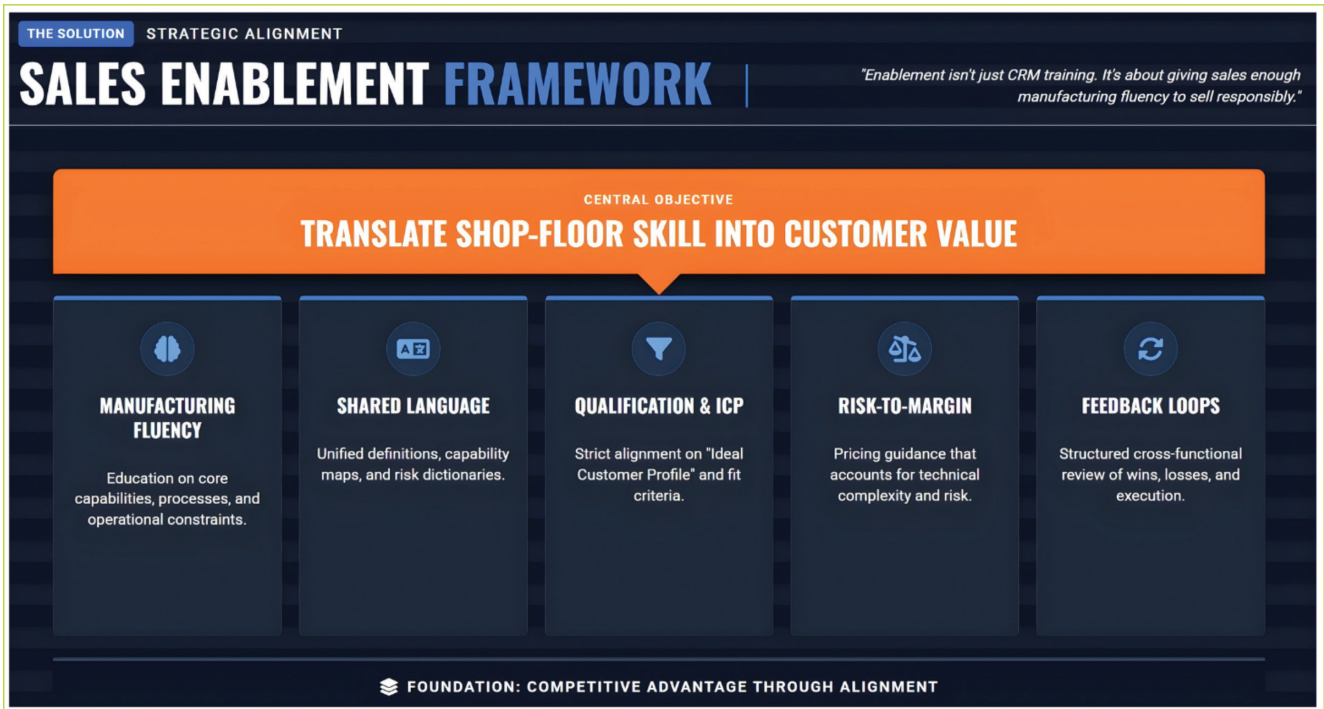


Figure 3 Sales enablement aligns manufacturing fluency, shared language, qualification, pricing risk, and feedback to translate shop-floor expertise into measurable customer value.

clear frameworks for opportunity qualification and ideal customer and opportunity alignment (see Figure 3).

Most importantly, it creates a shared language among sales, engineering and operations. This isn't about turning salespeople into engineers. It's about giving them enough manufacturing fluency to sell responsibly and profitably.

Understanding the gap is only half the story. While Part 1 explores how misalignment between sales and manufacturing puts opportunities at risk, the question remains: what does effective sales enablement in manufacturing look like

in practice? In Part 2, we'll look further into the concept of manufacturing fluency in sales, how commercial teams can translate shop-floor skill into customer value, speak credibly with engineers and buyers and turn operational excellence into a tangible competitive advantage. [M M T](#)

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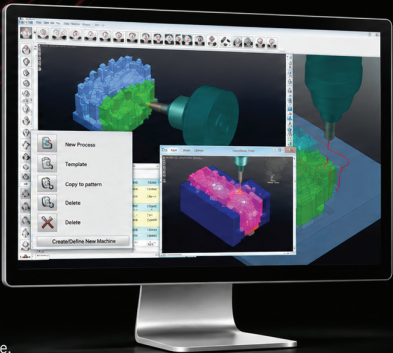
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30 Under 30: The Momentum Continues



MoldMaking Technology's recognition program has evolved into a steady pipeline for identifying and highlighting emerging talent in the moldmaking community. Rather than treating it as a one-time award, the program is positioned as an ongoing effort to spotlight young professionals who are already contributing inside their shops and across the broader industry. These individuals are often advancing technical capability in areas like machining, automation and process improvement, while also stepping into leadership roles earlier in their careers. The article spotlights Skuld LLC Manufacturing Engineer Keenan Jensen. Since joining in late 2024, he has quickly become a key contributor to the company's advancement in lost foam investment casting and its patent-pending additive manufacturing evaporative casting process.



Source | Skuld LLC

MGS Develops Auto-Injector Platform with Moldmaking and Manufacturing Built In



MGS is shifting from traditional contract manufacturing into fully integrated product platform development. Instead of building components in isolation, the company is embedding moldmaking, tooling, automation and high-volume manufacturing directly into the early design of its A.i.r. auto-injector platform. This approach allows the device architecture to be designed for manufacturability from the start, reducing risk, simplifying assembly and improving scalability. By combining design expertise with in-house tooling and production capabilities, MGS can compress development timelines, support customization and move complex drug delivery devices more efficiently from concept to commercialization.

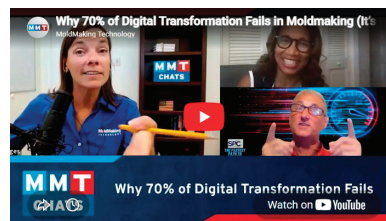


Source | MGS

MMT Chats: Human Element Fuels Digital Success



One recurring tension in manufacturing is digital transformation and technology alone does not guarantee success. This video interview highlights how many digital initiatives in moldmaking and manufacturing underperform when the focus is placed on software, data systems or automation without equal attention to people, process and culture. Through conversation-style insights from the MMT Chats series, the piece reinforces that adoption succeeds when shop-floor teams are engaged early, trained effectively and trusted to shape how tools are used. Rather than replacing human expertise, digital systems work best when they amplify it, improving communication, visibility and decision-making across the moldmaking workflow.



Source | MMT

How Advanced Milling Technology Strengthens IBC Mold Manufacturing



Modern high-performance milling strategies are reshaping the production of intermediate bulk container (IBC) molds. This article explains that increasing part size, tighter tolerances and demand for consistent wall thickness are pushing moldmakers toward more capable machining platforms. Advanced milling systems improve stability, accuracy and metal removal efficiency, especially when working with large, complex mold components. By combining rigid machine structures, optimized toolpaths and high-speed cutting strategies, shops can reduce cycle times while maintaining surface quality and dimensional consistency. The article underscores that productivity gains come not just from faster cutting, but from more predictable processes that reduce rework, improve repeatability and support higher-volume IBC mold production.



Source | Schutz

IMTS 2026

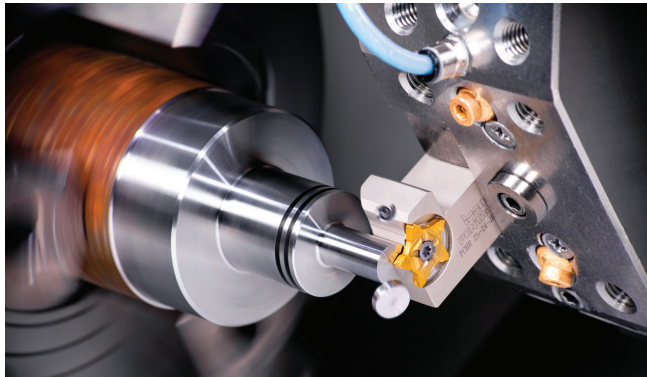
Grooving, Parting Insert System Reduces Downtime, Improves Machining Stability

Iscar USA's Quickpenta 24 insert system for grooving, parting and light turning applications is designed to simplify insert indexing, reduce downtime and improve machining stability. The Quickpenta 24 combines a multifunctional cutting platform with a clamping mechanism that enables faster insert changes and increased shopfloor productivity.

At the core of the system is the Quickpenta 24's Safe-Lock clamping mechanism, engineered to provide secure insert retention and stability during machining. The locking design allows operators to release the insert with two turns of a screw, enabling quick and easy replacement while minimizing machine downtime.

Inserts can be rotated by hand to the next cutting edge, allowing for fast indexing without complicated setup procedures. This streamlined process is designed to help reduce interruptions and improve machine utilization in high-production environments.

The Quickpenta 24 is available in a range of cutting widths, including 1.5 mm (0.059"), 2.0 mm (0.078"), 2.4 mm (0.094") and 3.0 mm (0.118"), with a maximum depth of cut of 12.7 mm (0.5"). Pinpointed coolant delivery directs coolant pre-



cisely into the cutting zone for improved heat management, chip control and tool performance.

The same Quickpenta 24 insert can be used in both right- and left-hand tools, supporting parting, grooving and side-turning applications. The Quickpenta line is compatible with traditional Penta holders, providing shops with an easy transition path while expanding machining flexibility.

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CAD/CAM Software Features Advanced Machining Strategies

Open Mind Technologies highlights the Hypermill 2026 CAD/CAM software suite, featuring a broad range of enhanced machining strategies and programming capabilities increase programming speed, machining reliability and surface quality.

Advancements in rest machining technology optimize tool paths and create smoother machining transitions by automatically detecting rest material while accounting for clearance and feed specifications. The five-axis rest machining strategy has been redesigned with calculation algorithms for Z-level, parallel and normal machining strategies, providing precise and reliable machining of complex geometries.

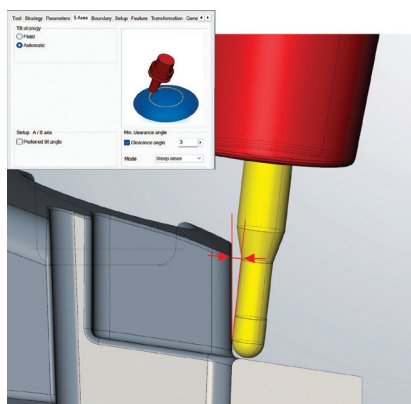
Further improvements include optimized five-axis cutter orientation determination and enhanced collision avoidance for smoother simultaneous movements. A minimum clearance angle option gives programmers greater tool control by promoting machining with a defined clearance angle between the tool shank and workpiece.

For more reliable deburring of cross holes and internal threads, a hole brush tool automatically alternates spindle rotation direction during multiple brushing passes. In addition, both the five-axis deburring and five-axis hole deburring strategies now automatically optimize contour sequences and milling directions.

When performing five-axis multiblade point milling, Hypermill 2026 provides more robust toolpaths

and smoother machine movements for complex impeller and blisk geometries. The redesigned camberline mode for tool orientation determination now supports additional applications including fuel pump and inducer geometries.

A 2D hale machining strategy produces surfaces without processing marks across the sealing direction, making it well-suited for scratch-free



finishing applications such as semiconductor and watch manufacturing. The strategy provides an alternative to conventional milling because material removal occurs without active spindle speed while the spindle axis continuously aligns the tool edge to the contour. Hale machining is currently available for machines equipped with Siemens controls.

Programming in Hypermill 2026 has been enhanced with capabilities for complex machining applications. For the first time in Hypermill and Hypermill Virtual Machining, users can program right-angle heads in Hypermill Tool Builder while avoiding collisions through detailed simulation and collision tracking.

New tool types with complex geometries such as hole brushes, hale tools, indexable cutters with shoulder mill inserts, indexable cutters with face mill inserts, helical thread drill/mill cutters and front/back chamfered cutters, can now be created more quickly and reliably using enhanced automation features in Hypermill Tool Builder.

The five-axis automatic mode further simplifies reliable five-axis programming by automatically determining optimal tool positions and efficiently utilizing indexed and simultaneous machine movements based on analysis of the complete tool path.

Enhanced CAM plan turning strategy for turned and mill-turned parts reduces programming time and increases accuracy. CAM plan turning automatically generates production-ready contours, recognizes machining features and provides the required machining areas for NC programming, enabling programmers to consistently enrich turning contours with all relevant manufacturing information.

Open Mind Technologies USA, Inc.
| East Building, Level 3, 133351
| 888-516-1232

IMTS 2026

Sinker EDM Maintains Accuracy During Long Machining Cycles

MC Machinery Systems Inc. showcases the Mitsubishi SG70 Sinker EDM, designed to deliver stable, repeatable results that maintain accuracy throughout the burn process. Thermal displacement compensation monitors environmental changes and automatically adjusts during long machining cycles. Meanwhile, IDPM3 optimizes spark energy in real time, to reduce electrode wear while maintaining consistent machining conditions.

The SS Jump 5 technology, which enables high-speed No-Flush machining to improve efficiency and shorten cycle times without compromising accuracy. The SG70's construction and large-capacity work area provide the foundation needed for oversized molds and demanding applications, while the M800 control and Esper II Navigator simplify setup and programming to reduce operator input.

For manufacturers producing large, complex tooling where accuracy must remain consistent, the SG70 provides stability and repeatability to keep production moving forward.

**MC Machinery Systems, Inc. | South Building, Level 3, 338129
| 630-616-5920**



Cooling System Improves Coolant Delivery for Shrink-Fit Chuck Applications

Haimer's Cool-Flash cooling system for shrink-fit chucks is designed to direct coolant to the cutting edge through integrated slot geometry. Developed from the Cool Jet system, Cool-Flash distributes coolant through multiple precision slots that guide it along the tool shank via the chip flute and into the cutting zone.

The system operates with standard machine tool pressures of approximately 20 bar and does not require modification to existing coolant systems. Coolant delivery is integrated directly into the shrink-fit toolholder body, eliminating the need for external nozzles or additional attachments.

The slot configuration is designed to maintain high runout accuracy without introducing additional unbalance. The design also preserves toolholder clearance, even at high spindle speeds.

Cool-Flash is available for tools with diameters ranging from 6-50 mm, covering a broad range of finishing and roughing operations in precision machining environments.

**Haimer USA | West Building,
Level 3, 431510 | 630-833-1500**



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Horizontal Machining Center Supports High-Precision Mold Manufacturing

Kitamura Machinery will showcase its HX500iG/630#50 horizontal machining center at IMTS 2026, Booth 338520, highlighting a high-performance platform designed for stable, high-efficiency machining of hardened steels and complex mold geometries.

HMC As die and mold manufacturers continue to face increasing demands for shorter lead times and improved surface finish quality, machining stability under load has become a critical factor in maintaining consistent results across long, complex toolpaths. The HX500iG/630#50 is engineered to address this requirement through a rigid structural foundation and process-controlled motion system.

The machine features a heavily ribbed cast iron structure, precision box ways and twin ballscrew drives on the X and Y axes. Hand-scraped construction and thermal stability design help maintain rigidity and damping performance during both roughing and finishing operations in hardened mold steels.

Kitamura's Arumatik-Mi CNC control with high-speed, high-accuracy control III standard provides advanced toolpath processing with an 8,190-block look-ahead function, helping maintain programmed feedrates through complex CAM-generated geometry while supporting consistent surface finish quality. Linear scale feedback on all axes delivers positioning accuracy of $\pm 0.000039''$ full stroke and repeatability of $\pm 0.000020''$, providing the precision required for demanding mold and die applications.

A 4-step geared spindle system – available in 20,000 RPM (#40) or 12,000/8,000 RPM (#50) configurations – offers both high-speed finishing capability and high-torque cutting performance for hardened material machining.

For production scalability, the HX500iG/630#50 includes a standard two-station automatic pallet changer, field-expandable up to 21 pallets and full

FMS integration, enabling manufacturers to scale automation as mold production requirements grow. A 62-tool automatic tool changer is also expandable up to 212 tools, with optional matrix storage up to 308 tools for extended unattended operation.

The HX500iG/630#50 will be on display at IMTS 2026, demonstrating how stable machining perfor-

mance, advanced control technology and scalable automation are said to support high-quality mold manufacturing with improved efficiency and process consistency.

Kitamura Machinery of USA, Inc.
| South Building, Level 3, 338520
| 847-520-7755

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IMTS 2026

Sinker EDM with a Compact Design

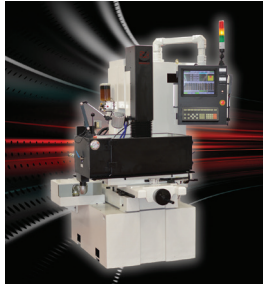
Part of **Belmont's** exclusive Maxicut Series, the MX-226C combines the EDM generator with user-friendly EDM settings designed to streamline setup and features a compact machine body that houses the oil reservoir within the machine base. This configuration reduces floor space requirements and eliminates cables on the shop floor.

Key features include a programmable Z-axis that automatically controls depth and generator settings from roughing through finishing cycles, as well as conversational G and M code programming that simplifies programming and reduces operator learning time.

Additional capabilities include a linear glass scale with one-micron resolution and the ability to interface with ancillary devices. An optional adaptive logic control continuously monitors cutting conditions to help prevent arcing and shorting during challenging machining applications.

Designed for moldmaking, tool and die, aerospace and production environments, the MX-226C delivers the precision, performance and ease of use that manufacturers demand.

Belmont Equipment & Technologies | South Building, Level 3, 338854 | 248-588-7011



Dot Peen Marker Enables Portable Marking

Rocklin Manufacturing's handheld Flymarker Mini 85/45 plus is a portable, battery-operated dot peen marker with a marking area of 85 X 45 mm and a weight less than 7 lbs.

The Flymarker Mini's marking force can be adjusted directly on the unit to accommodate materials from plastics to aluminum to hardened steel, up to 63 HRC. The unit can also be equipped with a strong magnet for deeper markings and visibility after various metal treatments.

With automatic height compensation, the marker provides a constant marking result on round or uneven surfaces.

The design eliminates tripping hazards from power cords or cables as well as safety issues that can occur during hand stamping and other manual marking processes. The fiberglass-reinforced, break-resistant housing provides durability in rough environments. Accessories are available, including a column frame for rapid conversion to a tabletop unit and an integrated barcode scanner mounted directly on the unit, among others.

Rocklin Manufacturing | North Building, Level 3, 236400 | 712-255-7957



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& Plates • Saw Cut & Surfaced Ground Plate to 144" long

CAM-TOOL Version 22 Focuses on Faster Programming and Smarter Machining

CGS North America will preview the upcoming release of CAM-TOOL Version 22 at IMTS 2026, highlighting new capabilities designed to help mold manufacturers reduce programming time, improve machining efficiency and simplify complex manufacturing processes.

Developed with a focus on continuous improvement and evolving manufacturing requirements, CAM-TOOL Version 22 introduces enhancements centered on automation, advanced toolpath technology and improved usability. The new release aims to help programmers complete more work with fewer steps while maintaining the precision and reliability required for mold and die applications.

New functionality reduces repetitive tasks, minimizes clicks and streamlines common programming operations, allowing users to spend less time on software setup and more time optimizing machining strategies. These enhancements help shorten programming cycles and improve overall workflow efficiency.

Version 22 also expands support for modern cutting technologies, including enhanced bar-

rel tool machining strategies. These capabilities enable mold manufacturers to achieve improved surface finishes while significantly reducing machining time. By maximizing tool engagement and efficiency, barrel tools can increase shop productivity without sacrificing part quality.

Additional advancements in 5-axis machining further simplify complex programming requirements. Improved toolpath quality, enhanced collision avoidance functions and greater programming confidence help users tackle challenging geometries more efficiently while reducing the risk of costly errors during machining.

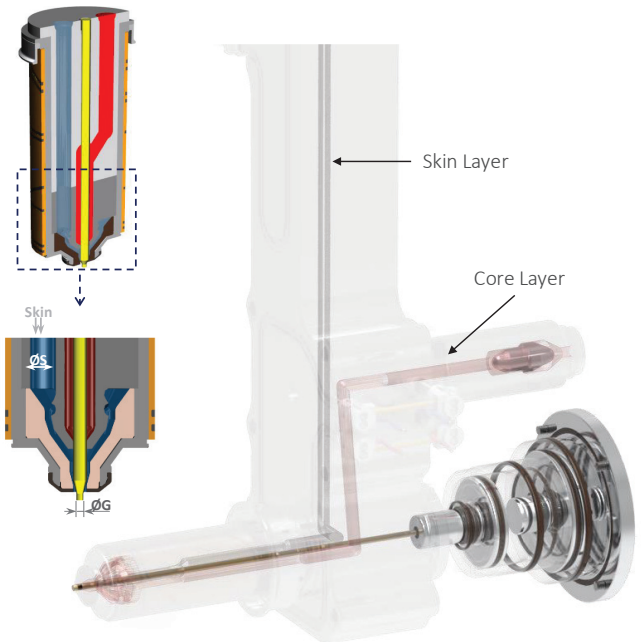
The overall objective of CAM-TOOL Version 22 is to provide manufacturers with CAM technology that programs faster, machines smarter and improves productivity with less effort. The release builds on CAM-TOOL's long-standing reputation for highly accurate toolpaths and efficient machining solutions developed specifically for mold and die manufacturing.

**CGS North America | East Building,
Level 3, 133149 | 519-737-6009**



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Bridge Mill Boosts Performance in Mold and Die Applications

Takumi's H12E bridge mill is well-suited for die/mold applications with demanding accuracy and surface finish requirements. The H12E incorporates a range of design features and technologies designed to boost performance.

To maximize stability and rigidity, the H12E's bed, column and cross-rail are created from a single-piece frame with no weldments. The cross-rail saddle carries a constant weight, enabling fast cutting speeds without compromising surface finish. In addition to minimizing vibration, the machine's design maintains close positioning of the spindle to the bridge to reduce overhang.

A Big Plus CAT 40 direct drive spindle provides a maximum speed of 15,000 rpm via a 25-hp motor. Takumi's iSpinII intelligent thermal compensation system counters ambient temperature variations to promote consistently high levels of precision. Temperature-controlled, direct-coupled ballscrews further improve repeatability, while linear scales on all axes allow exact positioning.

Offering the largest Y-axis travel in its class, the H12E includes X, Y and Z travels of 49.2" X 37.4" X 22.8". Capable of accommodating parts weighing up to 4,400 lbs, the machine provides a solution for producing large components.

The H12E offers extra-wide door openings to allow easy part loading and unloading, and large windows provide high visibility into the work envelope. The H12E features a FANUC Oi Plus or Heidenhain TNC7 control as standard, with a Siemens Sinumerik One control available as an option.

Takumi USA | South Building, Level 3, 338319 | 315-725-7365

High-Feed Milling Series Reduces Cost Per Edge for Mold Machining

Tungaloy-NTK America Inc.'s DoFeedTri high-feed milling series offers an economical and reliable solution for complex mold machining operations. Designed with double-sided inserts for a total of six cutting edges, DoFeedTri provides reduced cost per edge compared to conventional inserts with four cutting edges.

DoFeedTri's trigonal-shaped inserts feature a large contact face that provides secure insert retention when screw-clamped onto the cutter, eliminating insert movement during machining. Furthermore, the 12-12.5 degree entry angle directs the cutting force in the axial direction, reducing chatter and improving stability during machining with long-overhang tool setups. Strong cutting edges are said to provide long tool life and security at increased machining rates.

DoFeedTri is well-suited for ramp-down operations due to a long inner cutting edge that cuts more material than conventional milling inserts. The increased maximum ramping angles also improve productivity in helical ramping and pocket machining operations. These features provide a versatile solution for diverse applications in moldmaking.

Two insert grades are available: AH3225, which is well-suited for steel machining applications, and AH8015, which is optimized for hardened steel and heat-resistant superalloys. Cutters are offered in diameters ranging from 16-80 mm in metric sizes and from 0.625-4.0" in imperial sizes. With a range of high-precision cutters, DoFeedTri is designed to help mold builders reduce machining costs while promoting consistency across a variety of applications.

Tungaloy-NTK Inc. | West Building, Level 3, 431522 | 888-554-8394



Precision-Ground Pins and Punches Feature Mirror Finish

Punch Industry USA will feature its precision-ground rounds and small-diameter mold and die components in Booth #135229. Using the latest grinding equipment, Punch Industry can produce round steel and carbide components with diameters ranging from 0.025 to 1.0 (0.0001-0.04 inches), depending on the length and shape of the pin or punch. In addition to rounds, Punch Industry can process square, triangular or unusual shapes. Whether steel or carbide, a mirror finish can be achieved on ground pins without polishing.

Custom small-diameter components the company has produced include ferrule pins, micro pins and punches for electronics and medical micro molds, and factory automation pins and punches.

Punch Industry USA has been supporting American mold and die makers, injection molders, metal stampers and manufacturers by supplying precision steel and carbide components – such as core pins,

ejector pins, sleeves, punches, button dies and production tools – from its office in Itasca, Ill., since 2017. The company is the U.S. subsidiary of mold and die component manufacturer Punch Industry Co. Ltd. in Tokyo, Japan, and operates with the support of 11 ISO-regulated manufacturing facilities.

**Punch Industry USA Inc.
| East Building, Level 3, 135229
| 630-625-8080**



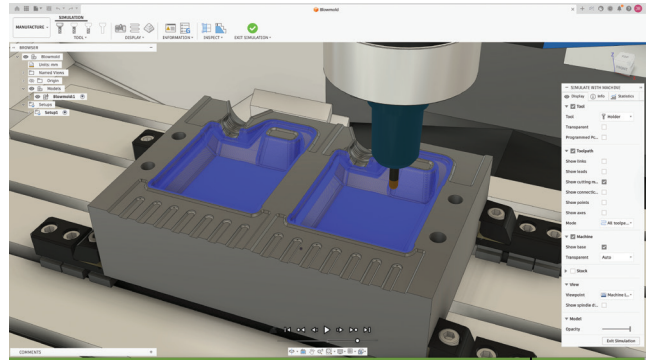
Fusion for Manufacturing Accelerates Mold, Tool and Die Workflows

Autodesk will demonstrate how connected design and manufacturing workflows can help mold, tool and die manufacturers reduce rework, improve programming confidence and accelerate delivery of high-quality components.

For moldmakers, manufacturing success depends on more than generating toolpaths. It requires a connected process that accounts for manufacturability, workholding, fixtures, jigs and validation before material reaches the machine. At IMTS, Autodesk will spotlight how Autodesk Fusion for Manufacturing helps teams make those decisions earlier, from part and fixture design through CAM programming and toolpath simulation.

Autodesk Fusion for Manufacturing gives manufacturers the speed and confidence to design products, develop processes and drive CNC machines in one connected platform. By uniting design, CAM, additive and subtractive workflows in a single environment, Fusion keeps teams, data and decisions aligned across every stage of production. For mold, tool and die teams, that means design intent can flow more directly into CAM, toolpaths can stay associated with design changes, and manufacturing engineers can consider fixtures, jigs and setup strategy as part of the same connected workflow.

GPU-accelerated toolpath simulation helps teams review toolpaths faster, making it easier to check machining behavior, validate toolpaths and identify issues earlier in the programming process. The Steep and Shallow toolpath helps streamline finishing for complex mold surfaces by intelligently address-



ing steep and shallow regions with appropriate toolpath strategies such as scallop, contour and parallel. Improvements including smoother steep-to-shallow transitions, optimized point distribution, spiral-style finishing behavior, corner smoothing and support for multi-axis tool motion are designed to help programmers create more consistent finishes across challenging geometry.

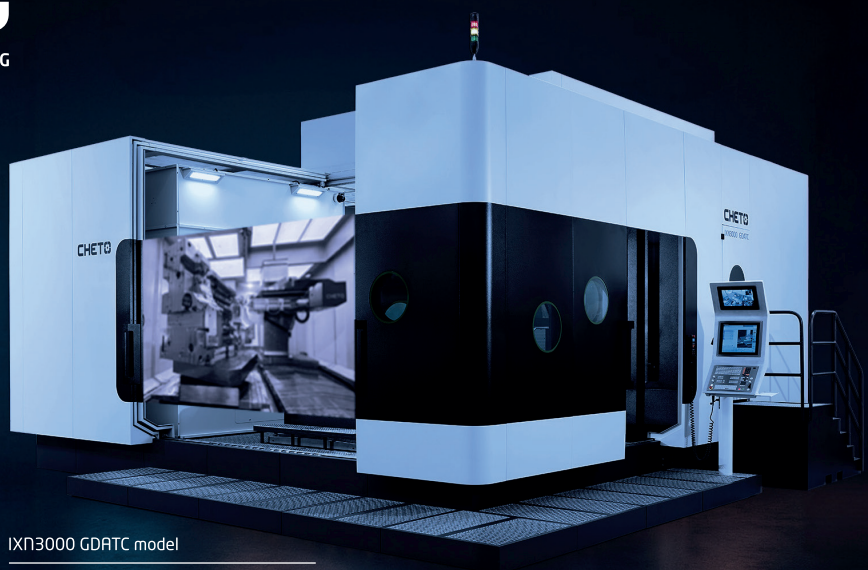
Autodesk will also demonstrate Design for Manufacturing workflows that help teams identify difficult geometry earlier, plan machining and prepare the manufacturing process with fewer disconnected handoffs. In Fusion, designers, manufacturing engineers and CAM programmers can work from the same model while developing the supporting fixtures, jigs and workholding needed to machine complex mold components more efficiently.

**Autodesk Inc. | East Building, Level 3, 133310
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Five-Axis Portal Milling Machine Enables Precise Machining of Large Structures

Zimmermann Inc. displays its FZU22 five-axis portal milling machine, which is well-suited for machining various workpiece shapes, sizes and materials. Aluminum, plastic, wood and other substrates can be processed, as well as finishing carbon fiber reinforced and other composite materials. The overhead gantry provides precise production of models and molded parts. A standard machine includes a toolchanger for 24 tools and a CNC from Siemens or Heidenhain for full motion control and tracking. A specialized five-axis milling head with a 15-kW spindle mills complex contours and tight pockets in large molds.

Zimmermann Inc. | South Building, Level 3, 339336
| 248-305-9707



Automatic Surface Grinder Improves Precision, Simplifies Operation

Okamoto's ACC-818SA-iQ automatic surface grinder is engineered for manufacturers seeking higher precision, improved automation and simplified operation in a compact footprint.

The machine structure features a heavy-duty Meehanite cast-iron base, robust slide assemblies and premium-grade components throughout. The double-V longitudinal ways and precision cross-feed guide system provide smooth table movement and stable accuracy during continuous grinding operations.

The rigid wheel-head assembly incorporates Okamoto's sealed, maintenance-free spindle, capable of producing fine surface finishes while maintaining stability under demanding grinding conditions. A standard spindle inverter offers variable wheel speed for performance across a wide range of materials.

Even complex grinding cycles can be configured quickly by following on-screen prompts, eliminating the need for G-code programming. Key parameters and multistep sequences can be entered in just a few steps, enabling consistent, high-precision results with minimal training.

Okamoto Corp. | North Building, Level 3, 236732
| 847-235-3500



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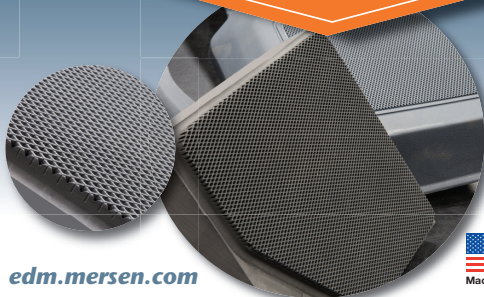
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Advanced Machining Solutions Accelerate Production Output

Mazak showcases advanced machine tool, automation and digital solutions designed to help manufacturers increase throughput and do more with fewer resources.

Live, real-world part cutting demonstrations showcase Mazak machines for multitasking, full five-axis machining, vertical and horizontal machining, CNC turning and Swiss-type production turning. Mazak machines offer seamless automation integration, and the company spotlights several productivity-enhancing solutions that range from simple bar feeders and gantry loaders to standalone cobot systems and full multi-machine palletized cells.

"In an environment of rising labor costs, tariffs, inflation and other economic demands, we



maintain our focus on providing high-value, high-performance and productive solutions," says Dan Janka, president of Mazak. "Today's shops are under tremendous pressure to increase their production in less time. To succeed, they need to do more with less, and they will accomplish that with the highly productive machines and automation technologies that Mazak will showcase at IMTS 2026."

Among the 15 machines Mazak features are models from its Neo Series, Ez Series, multitasking machines and Syncrex Swiss-style Production Turning Series. Neo Series machines result from Mazak continuous improvement and redesign of

existing models in line with current needs of manufacturers. Neo Series machines at the show include the Integrex i-200ST Neo multitasking machine outfitted with gantry loader automation and the HCN-5000 Neo horizontal machining center paired with Mazak Multi-Pallet Pool compact multilevel pallet stocker system.

Mazak North America | South Building, Level 3, 338300 | 859-342-1700

Five-Axis Machining Center with Automatic Pallet Changer

Hurco Companies will debut its new BM500U 5-axis machining center. Designed for efficient production of complex parts, the machine will be demonstrated alongside a new eight-station automatic pallet changer that facilitates unmanned operation.

The BM500U uses an integrated trunnion table design intended to promote accuracy and allow for increased Z-axis clearance. With a high work-envelope-to-floor-space ratio, the machine includes a 19.7" (500mm) rotary tilt. The machine has capability for both five-axis simultaneous and 3+2 five-axis machining. A 15,000-rpm, 11kW Big Plus direct drive spindle offers robust material removal rates. An automatic tool changer provides capacity for 60 tools as standard, with a 96-tool version optionally available.

The BM500U will be paired with a rotary-style automatic pallet changer with eight stations. Capable of serving a range of machine types, the system uses 12.6" (320mm) pallets that accommodate parts up to 17.7" (450mm) in diameter and 15.7" (400mm) in height.

The BM500U also includes a broad range of standard features designed to boost productivity and flexibility, including linear scales, a spindle cooler, through-spindle air and coolant, flood coolant and an air mist collector.

Hurco Companies, Inc., | South Building, Level 3, 3338319 | 317-293-5309



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Moldmaking Holds Expansion in June

Backlog slipped and production eased, but a jump in exports and renewed hiring kept the market growing for a sixth straight month.



MIKE SHIRK

Senior Market
Research Analyst
Gardner Intelligence

Mike has been an essential part of Gardner Intelligence for over six years and has led research and analysis in various industries.
mshirk@gardner.media

■ Moldmaking Index



The **Gardner Business Index (GBI)** Moldmaking Index climbed to a reading of 54.0 in June, extending its expansion to a sixth consecutive month following six straight months of contraction through the second half of 2025. Backlog slipped to land exactly on the 50 break-even line and production eased several points. Those soft spots were offset by a four-point surge in exports (still short of expansion) and a rebound in employment of more than two points. Material prices eased slightly but remain elevated on moldmakers' margins. The Future Business Index closed the month with its three-month average rising to 65.6, signaling continued optimism about the year ahead.

■ Components Scorecard

Change vs
Month Ago Year Ago

Supplier Deliveries	▲	▲
New Orders	▼	▲
Production	▼	▲
Backlog	▼	▲
Employment	▲	▲
Exports	▲	▲

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.

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

Direction = change (Pointing up is 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)



Are Those My Parts?

By Bob Novak

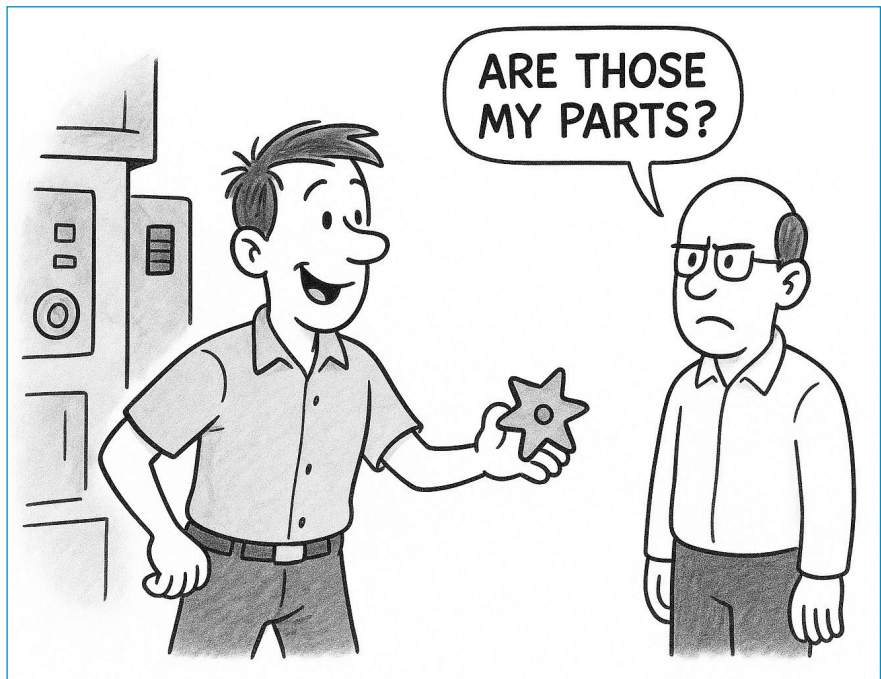
It was 1984, two years after I completed my tool and die/moldmaking apprenticeship. Eager for new experiences, I joined a small toolroom that supported an injection molding company. The lead moldmaker there was probably the finest I've ever worked with — skilled, exacting, and, truth be told, a bit of a prima donna. At that time, it wasn't unusual for moldmakers to carry themselves like big fish in small ponds. Being young and impressionable, I absorbed both his commitment to quality and his flair for drama.

Eventually, business slowed, and I moved to another shop owned by a friend from my apprenticeship. He leased space inside a molding company whose founder had passed, leaving the son to keep things going. We supported their molding operation and built new tooling — work I loved.

One day, the bosses dropped “the hottest job in the shop” on my bench: a four-cavity, star-shaped part in a small MUD frame. No time for a formal design—just build

it and fast. The best part? Overtime wasn't an issue. I put in long days and nights to get it done.

The morning I finished, the press was already waiting. Sampling a mold is one of the most nerve-wracking experiences for a moldmaker — everyone gathers to watch, hoping for success, bracing for a train wreck. Thankfully, on the second cycle, four perfect parts popped out. The inspector gave the green light for production and I was riding high.



A proud young moldmaker learns a lifelong lesson in humility, ownership and pride — one star-shaped part at a time. Source: ChatGPT

Proud of my accomplishment, I grabbed a handful of parts, admired my work and strutted back toward the toolroom. Along the way, I passed the workstation of the young lady I was dating (now my wife). To impress her, I tossed her one of the parts with a grin.

That's when I heard a sharp voice behind me: “Is that one of my parts?”

Turns out the customer had been holding up assembly, waiting anxiously for these very components. They'd arrived early that morning to scoop up as many as possible. And here I was, tossing their parts around like souvenirs.

Nobody scolded me. The customer was thrilled production could start, but I was mortified. My long hours, flawless build and early pride evaporated in seconds. The lesson? Never forget who the parts belong to.

I still keep one of those star-shaped parts in my toolbox as a reminder.

And my wife? She remembers it too. Her verdict: “That was really funny.” Easy for her to say. **MMT**



Submit your shop story today.



A four-cavity, star-shaped part packed into a small MUD frame. Source: Bob Novak

FOR MORE INFORMATION

Bob Novak, Retired Associate Dean, Waukesha County Technical College, novakbob59@gmail.com

How Mold Shops Can Retain Critical Knowledge

By Michael Blickenstorfer

The most experienced mold builder in a shop retires and suddenly recurring issues take longer to resolve. Downtime increases, errors become more frequent, and critical problems depend on a shrinking number of experienced individuals. Many mold shops already face this challenge as experienced technicians leave and fewer skilled workers replace them.

The problem is often misunderstood as a documentation issue. Most companies already have procedures and manuals in place. The real gap is that experience-based knowledge is rarely fully documented — and even when it is, it isn't accessible where it's needed most: directly on the shop floor.

The solution is to capture knowledge during daily work and make it instantly retrievable at the machine. Here is how:

1. Identify where knowledge loss creates the most risk.

Start with the processes where judgment matters most — mold setup, troubleshooting, maintenance, and startup after downtime. If only one or two people can reliably solve certain problems, those are your highest-priority areas.

2. Capture knowledge while work is actually being done. Do not pull experts into meetings or ask them to write procedures after hours. Use simple voice or video recordings on the shop floor, in real conditions. A short explanation of what's being done and why is far more valuable than a polished but rarely consulted manual.

3. Structure and organize what you capture. Raw recordings alone are hard to reuse. Transcribe and label content by machine, task, or workflow so technicians can search and find relevant answers quickly. This transforms isolated recordings into a living knowledge base.

4. Prioritize decision-making over step-by-step instructions. Ask experienced technicians to explain why they chose a particular setting, what symptoms triggered their response, and what alternatives they ruled out. In moldmaking, where no two jobs are identical, understanding the reasoning behind a decision is often more valuable than following a fixed procedure.

5. Make knowledge accessible at the point of need. The value of captured knowledge depends entirely on how easily it



A system helps mold shops capture, organize and reuse tribal knowledge, reducing downtime, minimizing errors and accelerating technician skill development. Source: rimon Technologies

can be retrieved. Technicians should be able to access relevant guidance directly at the machine — by scanning a QR code, asking a question in their own language, or pulling up a quick reference without leaving their workstation.

6. Set clear rules around privacy and intellectual property. Establish upfront what can and cannot be recorded. Many shops limit capture to machine operation and maintenance, excluding part geometry or sensitive process parameters. Clear guidelines build trust and make experienced staff more willing to participate.

7. Use captured knowledge to strengthen mentorship. When routine questions are answered by the system, experienced technicians are freed up for higher-level coaching. New employees gain confidence faster because reliable guidance is available even when a mentor is not nearby.

8. Commit to continuous capture. The shops that benefit most treat knowledge capture as an ongoing practice, not a one-time project. As equipment changes and new problems are solved, the knowledge base grows — becoming a permanent shop asset rather than expertise that walks out the door.

The question is no longer whether to document knowledge, but how quickly it can be accessed when it matters most.

FOR MORE INFORMATION

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Michael Blickenstorfer, co-founder



IMTS2026

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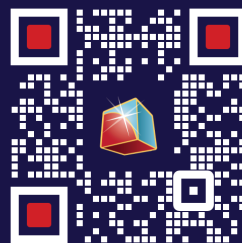
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