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MoldMaking TECHNOLOGY

NOVEMBER 2019 / VOL. 22 / NO. 11

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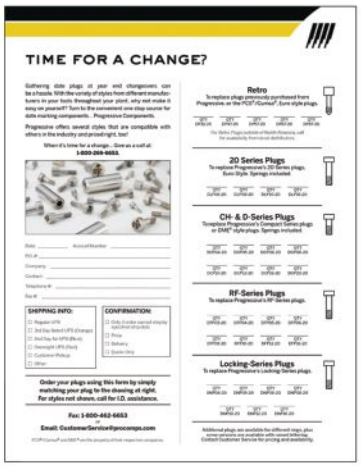
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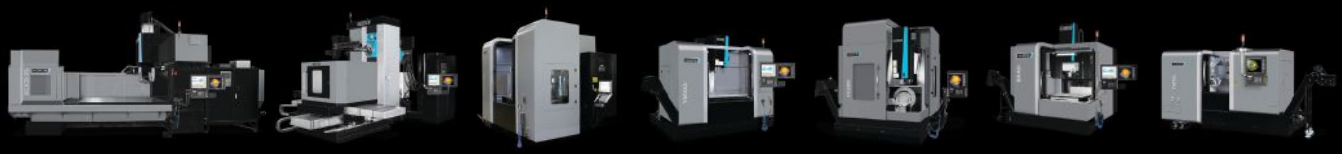

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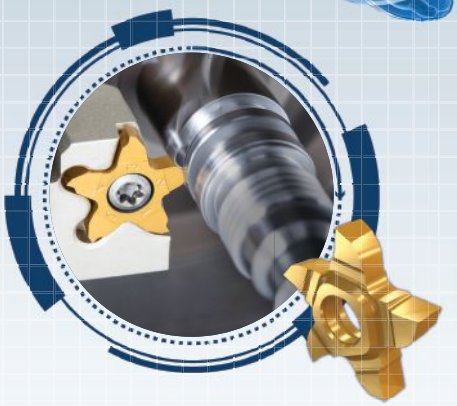

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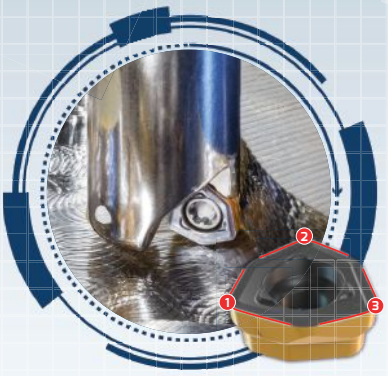

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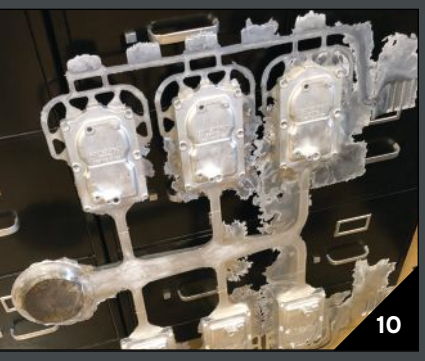

Features

Departments

ON THE COVER

Cover photo courtesy of Creative Technology. This month's cover shows a two-cavity automotive under-the-hood water outlet mold designed and built by Pro Mold & Die in Roselle, Illinois, that consists of 420 manufactured parts, 24 of which are moving. This mold required a dual-management approach to tackle the complexity of the project. For this mold, Pro Mold used *mechanics* to drive all the slides because this approach makes it easier for the customer to sequence the timing and reduce the size of the mold so that it would fit in the customer's required press. See related feature on **page 14**.

Images courtesy of (left to right) Do-Rite Die & Engineering Co., Unique Tool and Gauge and CGTech.

VIDEO ACCESS

5 TRICKS OF THE TRADE

Great Tips from This Issue

1. Getting Mechanical
Designing and manufacturing mold water outlets with mechanics to drive all slides makes it easier to sequence the timing and reduce mold size.
PG. 14.

2. Power It Up
To overcome any disparity in the thermal conductivity of the work metals, three primary power setting parameters may need to be modified: on-time, peak current (amperage) and polarity.
PG. 20.

3. Measuring Up
Aluminum helps to reduce mold build and repair time. For example, molds that have more mechanisms and depth will have more savings in aluminum versus P20 as it requires less time for machining and benching.
PG. 26.

4. Automatic Problem-Solving
Automating program simulations eliminates watching toolpaths and provides a simple thumbs up, thumbs down message along with an indication of what tool and program line is causing the problem.
PG. 30.

5. No Redundancies
An automated tooling supply chain management system uses software and counters installed directly on molds to collect all relevant tooling data, eliminating a tooling engineer's redundant data collection and analysis work.
PG. 48.

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CELEBRATING 40 YEARS OF GRIT

We are celebrating our 40th Anniversary, and on behalf of the entire Alliance family, we want to thank you for being our partners in this journey. We wouldn't be here without you.

There have been many changes over the years, but one thing has remained unchanged: our grit. It is that grit that makes us who we are and defines our company. When you look around the shop you will see grit coloring our hands, dusting our benches, and swirling through the air. Small remnants of dirt from delivering on promises rain or shine, little pieces of left behind polishing stones, grease, sand and plastic from the molds we clean, abandoned splinters of welding wire and laser engraving soot are just a few of the examples of grit that surround us daily. It is threaded into the fine detail of our lives and no matter how much you clean there will always be a hint of grit that is left behind.

That GRIT is the kind you find in our hearts. The GRIT of courage and strength to start a company from nothing. The GRIT to put it on the line and to try new things that no one else thinks possible. The GRIT that provides the passion and perseverance to take on challenges no one else could. The GRIT to do whatever it takes to not only get the job done, but done right. The GRIT that Alliance was built on is a special grade. It makes us who we are and holds us together as a family. GRIT is in our blood and it flows through our veins, feeding the hunger to be better each and every day. The same Alliance GRIT that started as a dream in a garage 40 years ago is alive in every single person that calls this place home. It is our GRIT that makes the difference between us and every other company out there, and it's the reason why we will continue to be a dominant force in the industry for the next 40 and beyond.

GRATITUDE. RELATIONSHIPS. INTEGRITY. TENACITY.

Who's Leading?

You are!

Most, if not all of the mold builders I visit and speak with are *leading* in ways that they sometimes don't even recognize, but we do.

- Leading in innovation
- Leading in customer satisfaction
- Leading in workforce development
- Leading in industry involvement
- Leading in continual improvement
- Leading in business growth
- Leading in technology

It is this leadership—in one, two or all of these categories—that is the metric we use to determine our Leadtime Leader Winner each year. As I like to say, this annual award is not just about being the biggest shop or the shop with the shortest delivery times. *It's about what you do with what you have.*

MMT LEADTIME LEADER 2020 AWARDS

Enter our 2020 Leadtime Leader Awards Competition today.

It's about what you do with what you have.

Take some time to look a little deeper into what our Leadtime Leader Awards Competition is all about by visiting our Leadtime Leader Zone. You'll find answers to the most frequently asked questions about this program, read the stories and watch the video features of past winners, and you'll most likely learn that it's time for your shop to enter.

Rewards include:

- Cover of *MoldMaking Technology*'s June issue
- Full feature story in the June issue and online
- Video feature filmed at your shop to accompany the article (which appears online and is shown at the Amerimold Expo Leadtime Leader booth)
- Guests on the *MMT*/Manufacturing Alliance Podcast
- Awards presentation ceremony and celebration at Amerimold
- Complimentary 10 x 10 booth and attendee registrations for Amerimold
- A targeted advertising program in Plastics Technology magazine to market your company to more than 33,000 molding subscribers
- Free expanded showroom on www.PTonline.com and www.moldmakingtechnology.com.

We are still accepting entries, so put your hat in the ring today by visiting the Leadtime Leader Zone and clicking on the logo to submit your information to start the process.

Good luck! MMT

Christina Fuges

Christina M. Fuges
Editorial Director

Follow MMT on: Follow @MMT_ChristinaF

THIS MONTH ON moldmakingtechnology.com

VIDEO: Die Sep Demo at Amerimold 2019

Die Sep showcases its mold separator and tipper, giving Amerimold attendees the chance to see a 90-second mold removal process.
short.moldmakingtechnology.com/diesepdemo

PODCAST: "Leading" Shops Give Away Secrets to Success

MoldMaking Technology and The Manufacturing Alliance Podcast discuss the process of becoming a Leadtime Leader with X-Cell Tool & Mold (2019 winners) and Maximum Mold Group (2018 winners).
short.moldmakingtechnology.com/LLAShops

SLIDESHOW: Tech Trends: On the Cutting Edge

This collection of highlighted cutting tool products from leading technology suppliers offers complete solutions for a range of machining processes.
short.moldmakingtechnology.com/TTCutting

EVENT: Meximold

Meximold 2019 will address the business development, best practices and networking interests of the growing plastic injection mold manufacturing industry in Mexico.
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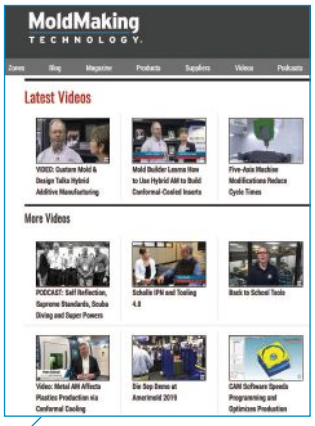
EAB Picks: Videos

With the ever-increasing popularity of videos in the media, especially in social media, *MoldMaking Technology* continues to bring the moldmaking industry a variety of eye- and mind-pleasing content. The fruits of our labors can be found online at moldmakingtechnology.com, and we asked our Editorial Advisory Board members to let us know their top picks from videos released in the last year.

The number one video is **Mold Maker Solves Skilled Labor Shortage by Changing Company Culture**. This video was a collaboration between *MMT* and sister publication *Modern Machine Shop*. It was released about eight months ago and has more than 1.1K views! Viewers learn how Westminster Tool (Plainfield, Connecticut) created a unique company culture by using a solid onboarding program, personality profiles and learning styles to quickly and effectively grow its own skilled workforce.



We asked our Editorial Advisory Board members to share their top *MMT* video picks released in the last year.

With an equally impressive number of views, our video featuring the 2019 Leadtime Leader Award winner is another top pick. X-Cell Tool and Mold (Fairview, Pennsylvania) captured the attention of our EAB and our readers, and for an obvious reason: To learn about X-Cell's strategies for success.

Other top picks included:

MoldMaking Technology and Autodesk Discuss Connected Design and Manufacturing. Here, Jamie Sciturro, technical solution executive for Autodesk Inc., provides a brief overview of connected design and manufacturing and what it means to the OEM, molder and moldmaker.

Part of a larger feature, **3 Ways a Small Mold Builder Uses 3D Printing** was filmed at Amerimold 2019. In it, Byrne Tool + Design's Design Center Manager Marc Mitchell shares how the company uses 3D printing for prototyping and one-shot molds.

How Water Flow Monitoring Optimizes Mold Production has shown numerous viewers how important it is to monitor water flow and temperature through a mold. Progressive Components' Rebecca Hamstra provides a great overview of how having the proper tools with which to track and report these measurements leads to overall optimization of a mold's performance. MMT

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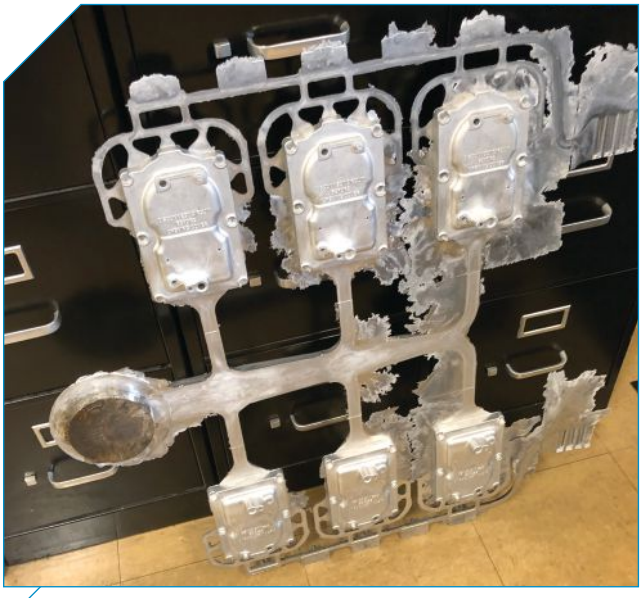
A Conversation with ...
Do-Rite Die & Engineering Co. Inc.



Images courtesy of Do-Rite Die & Engineering Co.

Do-Rite Die & Engineering specializes in building die cast dies. One notable difference between die casting and plastic injection molding is flash. In dies, flash is often desirable, even if minimal, to ensure the material fills the die completely (as shown here). A trim die, built for every die cast die, is used to trim overflows and gates from the parts.

What do you believe sets your company apart from other shops?

Paul Szymanski, vice president: For one, the fact that we are pretty much 100% die cast dies. We do some repair work on molds for plastic, but very little. I believe that is rather unique for a shop to be primarily building die cast dies, and we have a lot of expertise in that area.

One of our biggest advantages is that we have in-house design capabilities. We design die cast dies and can perform repairs and make modifications quickly for customers. This service extends beyond the dies we designed, too, of course. We have no problem drawing up any design details that need refurbishment or modification. Many of our larger customers may have in-house design teams, but we also work with smaller businesses that do not, and so this service is an advantage for them especially. We can also assist with part design, providing solutions for how to improve gating, reduce porosity or for making it easier to eject the part. Oftentimes, we are involved in fine tuning the part to make it simpler or more efficient to cast.

We have a small but highly skilled team, and we do almost everything in house. Typically, we outsource the die set or mold base, but all the cavities and inserts are made in our own shop. Also, all sampling and post processing is performed by our customer. This is kind of unique to die casting versus plastic molding. It is rare that a die cast tool maker would also do all the qualification work, unless they were also performing production work because of the need for a furnace. While plastic melts at very low temperatures and the molding process can be fairly clean, die casting can be very hot and messy. It requires a special, separate room or facility, and multiple safety precautions must be taken, not to mention training, clothing and other equipment. It is a whole different animal.

What are some primary differences in the way die cast dies and injection molds for plastic function?

Szymanski: Well, the concepts of both are similar, but there are different factors we need to consider for heat. Die cast dies endure a lot more heat than plastic molds (aluminum melts at 1200°F, though the tool itself may only heat to 400-500°F), so our cavities require more shutoff steel and our gating is more voluminous; water for cooling is sometimes less important because some customers would rather run hotter for better fill

DO-RITE DIE & ENGINEERING CO. INC

3344 Butler Ave.
South Chicago Heights, Illinois
708-754-4355
do-ritedie.com

- Founded in 1953 by John Szymanski in the southern suburbs of Chicago, Illinois. John's sons Alan and Edward joined the business in 1975 and 1985, respectively, and have led the company since John retired in 1987. Later, in 2005, Alan's son Paul joined the company and now serves as vice president.
- Manufactures die cast dies for the automotive industry, including transmission forks and cams, and for industrial products like electrical connector housings and related parts, serving mainly Tier 1 and Tier 2 supplier customers.
- Capabilities include moldmaking but focus is on die cast dies, sizes typically fit up to an 800-ton machine.
- Currently employs 13 team members, including one apprentice.

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conditions and surface quality. Also, die casting can be a much more destructive process when it comes to the tool itself. Die cast dies, which are generally built using H13 tool steel, must be a bit more robust because aluminum requires higher injection pressures and more shutoff to prevent the tool from splitting. Because inlet velocities are so high, careful attention must be paid to placement of gates to avoid standing material. The aluminum has an affinity for steel and at these elevated temperatures causes soldering of the aluminum to the tool steel resulting in difficulties with ejection. Heat-checking can also occur due to thermal fatiguing of the tool steel during the die casting process. This degrades the surface finish of the casting and can even cause critical areas to be out of dimensional tolerance. Areas near the gate are also susceptible to erosion and washout. These factors require careful consideration when determining the flow direction and approach angles of the gating and runner systems as well as sizing appropriately to generate the required flow volume and velocity. Also, die casting requires more draft on the parts to aid in ejection.

Die cast dies generally produce between 100,000-200,000 shots. An injection mold might be capable of generating over a million shots. In both die casting and plastic molding, the life of a tool depends on part geometry and how the casting is gated and vented.

At this point, we have not purchased a five-axis machining center. We can machine electrodes to create complex cavity details that might otherwise require a five-axis machine to cut directly into the steel. We can use a combination of three-axis machining and electrodes to create all the details in the cavities. We use our wire EDM to ensure accurate hole sizing as well. We do plan to add five-axis capabilities at some point in the future.

With regard to tolerances, some are very critical for die casting and can require ±0.002 inch. Typically, though, general tolerances we see specified are closer to ±0.005 inch.

Let's talk venting. How is it addressed in die cast dies?

Szymanski: As with plastic injection molds, we use venting to get air out of the die so that we have as little porosity as possible in the die casting. Where vents in plastic molds are typically very small, in die casting they are usually larger, such that they will fill with material. When designing die cast dies, we try to determine the last area within the cavity that will fill and use overflows to help eliminate voids or poor fill areas. Overflows are pockets outside of the

The electrodes shown here are used to burn the majority of details into the die cast die inserts made by Do-Rite Die & Engineering. While the company is looking to invest in five-axis technology in the future, its skilled team knows how to achieve creating even the most complex details using EDM or a combination of electrodes and three-axis machining.

casting area where excess metal can flow. They allow excess material to flow through harder to fill areas of the casting while keeping the tool hot enough so that the impression can be fully filled before the material begins to cool and solidify. In plastic molding, molders usually like to have a hard shutoff between the mold halves to prevent flash, but in die casting, we will sometimes allow for some flash to help with flow and reduce the possibility of damaging shutoff areas. This is less of a concern because most flash will be removed with a trim die.

Overflows might be located opposite the gate side or around the outside of the part cavity. Ideally, they are used wherever you might have a hard time filling die details, such as intricate corners. When the part comes out of the die, it is placed into a trim die (another tool built specifically for each die cast die) that removes all the overflows and the gates, as well as punching out any flash in areas that are cast through. Those trimmed overflows and gates can go into re-melt so the material can be reused. While minimizing the amount of material per casting can be beneficial, it is less of a concern because of its ability to be re-melted and used again. MMT

By Christina M. Fuges

VIDEO Access the related video under the Videos tab at *MMT* online.

Using Teamwork and Attention to Detail to Tackle Complexity

Taking on complex molds requires a solid understanding of true complexity and teamwork.

Many shops tout expertise in the discipline of complex, multiple-cavity molds, but during my visit to Pro Mold & Die in Roselle, Illinois, I learned that it's the definition of complexity that counts.

Twenty-five employees hustle around a 30,000-square-foot facility armed with modern software, and high-speed machining equipment prepped to deliver 24-hour continuous operation for designing and building injection molds, and die-cast dies. These tools range from small to large complex parts with multiple side actions and plates for the automotive, appliance, household, lawn and garden, and medical device markets.

This shop's sweet spot is four- to eight-cavity complex plastic injection molds, two-shot (shooting two different materials at the same time) molds and family molds with six or eight different parts. That sounds like complexity to me. Plus, they back every tool they build with a comprehensive 12-month warranty.

When Pro Mold & Die Co-Owner Dave Long talks about mold complexity, he means a lot of moving parts and a level of work that must be dimensionally perfect. "To us, complex is not just tight tolerances. There are a lot of people who can do that. We're looking for a larger part with a lot of moving parts," Long says.

For example, he mentions a four-cavity mold with four or five lifters in each part that might have 18, 20 or 30 moving parts in the mold. It's not just the tight tolerance; it's all the functions that come with the mold. Most of Pro Mold's molds do not just open and close; there is a lot of sequencing involved to ensure that happens properly. "It's all about what goes first, second, third, fourth, fifth, sixth, etc. before mold opening and closing. There are probably seven or eight actions that have to take place before you can even open the mold," Long says. It sounds like you can really ruin a mold if you open it out of sequence.

Images courtesy of Creative Technology.

When Pro Mold & Die Co-Owner Dave Long talks about mold complexity, he means a lot of moving parts and a level of work that must be dimensionally perfect.

Making It Mechanical

What lured me to Pro Mold was the cover photo. It is a two-cavity automotive under-the-hood water outlet mold that Pro Mold recently completed (early). And, as of this writing, the customer has completed mold sampling with no required changes! Now, this mold doesn't just 'look' complex (and quite beautiful, to boot); it *is* complex. It consists of 420 manufactured parts, 24 of which are moving.

Each cavity has 12 moving parts (slides, lifters, guides, pins, etc.), making a total of 24 moving parts for a part that's only the size of your fist. And, to move those 12 parts requires the other 408 parts in the mold, which they had to manufacture, and by 'manufacture', Long means the 420 parts were custom. They could not purchase any of those parts through a catalog. Plus, the mold weighs 14,000 pounds. 420 parts is a long cry from the typical 170 parts Long recalls from years ago.

Pro Mold has designed and manufactured water outlets in the past, but they made most movements with *hydraulic cylinders*. For this mold, they used *mechanics* to drive all the slides because this approach makes it easier for the customer to sequence the timing and it reduces the size of the mold, so that it would fit in the customer's required press.

"The customer did not want all the cylinders that we used in previous molds. The sequencing is harder, and it takes a bigger press. This mechanical mold does cost more, but the customer was willing to pay a little more to have more mechanics, and not as much sequencing and cylinders that may leak. Our design is automatic—this triggers that before that triggers that. So, when you open the mold, things happen. It's easier for the customer," Long says.

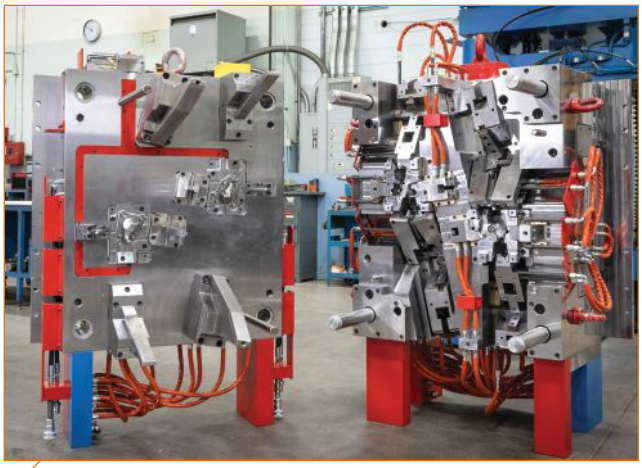
Managing the Mold Build

This complexity takes more than technology and skilled workers, it takes a team. Equipment is important, but people are critical. "Four of us are smarter than one of us," Long recites from memory of a quote he saw on a conference room whiteboard at one of his customer's facilities years ago.

"That has stuck with me. I believe we have a culture that encourages employees to work together on part design to provide the optimal design for manufacturing (DFM) to keep maintenance costs down and to make the mold more manufacturing-friendly," Long says.

For example, when Pro Mold gets a part from a customer, the team looks at the part design to see if there are any avenues they can take to make the mold better while keeping costs, maintenance and delivery down and quality up. We all know that it's one thing to design a part; it's another to make it work.

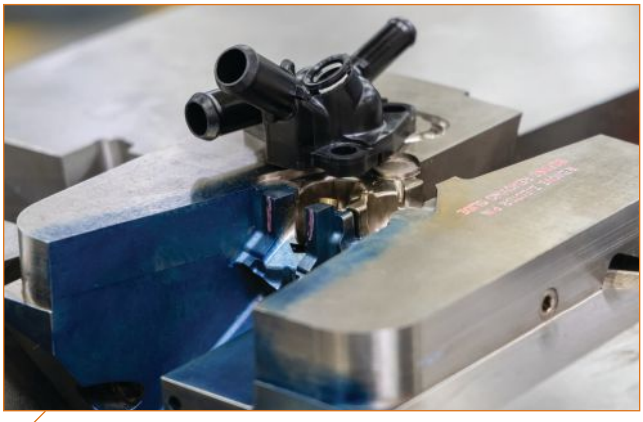
Communication through the right channels among everyone who touches the mold is key to managing a complex mold like this one—what you do and when you do it. You can't underestimate the management of over 400 pieces that must all come together at a certain time for assembly and fitting.



This automotive under-the-hood water outlet mold consists of 420 manufactured parts, 24 of which are moving. The mold has two cavities, each having 12 moving parts (slides, lifters, guides, pins, etc.), making a total of 24 moving parts for a part that's only the size of your fist.

Although everyone in the shop handled some aspect of this mold at one time or another, the core team to take it on was established with one-on-one training based on a two-minds-are-better-than-one attitude. This team worked together with engineering on part design to provide the optimal design for manufacturing (DFM) to keep maintenance costs down and to make the mold more manufacturing-friendly.

Pro Mold's sweet spot is four- to eight-cavity complex plastic injection molds, two-shot molds and family molds with six or eight different parts. Pro Mold's Dave Long explains the true complexity of this water manifold mold to *MMT* Editorial Director Christina Fuges.



A quick look at this water manifold makes this part appear fairly simple until you look at the mold.

"If you don't manage it properly, you could spend an awful lot of time and not need those parts for 12 weeks down the road. You can't miss anything either because you cannot order any of the parts overnight. It is the project manager's job to manage what is needed when and see that it's done," President and Co-Owner Walter Schaub says.

Pro Mold's strategy includes regular project manager and engineering meetings using a Gantt chart that shows a mold project with target dates from design to shipping. It lays out the functions and processes for each part. This chart also hangs in the conference room where the team meets every morning at 8 am for a 10-minute stand-up meeting to discuss needs. Then every Monday morning, the president and owner hold a sit down meeting for about an hour to review the Gantt chart, set priorities for the day and plan the entire week. The customer also receives a copy of the Gantt chart with the delivery date and is welcome to stop in at any time.

"The key is to measure against your time to see where the team is and that resources are being used to get the right parts at the right time," Schaub says.

Communication through the right channels among everyone who touches the mold is key to managing a complex mold like the two-cavity automotive under-the-hood water outlet mold. Pro Mold's strategy includes regular project manager and engineering meetings using a Gantt chart that shows a mold project with target dates from design to shipping. It lays out the functions and processes for each part.

> The team *dual manages*. Basically, one part of the team was *managing* the design and manufacturing of the 420 parts while the other was *getting it done*.

Getting Organized

Although everyone in the shop handled some aspect of this mold at one time or another, the core team to take it on was established with one-one-one training based on a two-minds-are-better-than-one attitude. A seasoned project manager/lead moldmaker took a young next-generation apprentice moldmaker under his wing. After six years, they both understand each other's strengths and weaknesses. They are dialed in when it comes to communication. "It's like a left hand and a right hand," one of them said.

Together they both had the confidence in their abilities that they could get this particular job done given enough time. This team *dual manages*. Basically, one part of the team was *managing* the design and manufacturing of the 420 parts while the other was *getting it done*.

A mold project of this magnitude, with different people making different components all due at specific times, demands diligent management of each part's location and status so that the team completes the mold on time. Otherwise,

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the mold builder can miss five parts that take four weeks to build. The engineering manager's idea to provide detailed 3D drawings of the 12 different moving components proved absolutely beneficial to the project manager, mold builder and the rest of the Pro Mold team.

"He itemized each of the 12 components in detail (slide 1, slide 2, slide 3, etc.) He took each slide assembly, broke it all down and made diagrams (instead of detail #293) in 3D, not blueprints. This helped the team know what does and does not need to be good," Long says.

'Needs to be good' refers to the fact that the design for this project did not have the running clearance, which means the project manager and moldmaker had to handle that. These 24 moving parts (slides) each with six or seven components equals 70 or 80 components that are not moving square. Multi angles and ports are coming out at different angles for which the Pro Mold duo had to provide the clearance number, which is quite an accomplishment with all those angles, as opposed to straight slides.

"To put it in perspective, consider a slide that needs to travel, and if you made the slot in which it travels five inches on the design, the slide is five inches, and that won't work. So, finding the correct clearance is critical, and for this job that falls on our team," Long says. Plus, this mold runs on 320-degree

Twenty-five employees work in a 30,000-square-foot facility armed with modern software, and high-speed machining equipment prepped to deliver 24-hour continuous operation for designing and building injection molds, and die-cast dies that range from small to large complex parts with multiple side actions and plates for the automotive, appliance, household, lawn and garden, and medical device markets.

The holes on this automotive defroster vent appear to be round, but each hole actually has five sides, making the manufacturing very complicated. The file size alone is over 2 gigabytes.

pressurized water, so they had to factor in the heat of that component, and thermal expansion and distance to provide the clearance.

On top of that, they are working with different materials (beryllium copper, S7, H13, etc.) with different coefficient of expansion, which means running at that same temperature, you have to use different clearance values on them. Otherwise, you'll accumulate errors if you build clearance on everything. You have to put clearance in the right components so that it stays aligned correctly.

> A mold project of this magnitude, with different people making different components all due at specific times, demands diligent management of each part's location and status so that the team completes the mold on time.

Making the Difference

Being organized and detailed, made this complex job much more manageable, but it was the Pro Mold team that got this mold to the finish line *early*. Maybe it was the seasoned mold maker/next-generation team approach that made the difference. All I know is the project manager admitted to me that this mold was "a little intimidating at first," but when I asked if this was the most complicated mold that the young mold builder worked on, he replied, "I don't think it's that complicated." Now, *that's* an attitude we want all next-generation mold builders to have, and maybe it will rub off on the seasoned ones, too. MMT

FOR MORE INFORMATION

Pro Mold & Die / 630-893-3594 / promolddie.com

By Marc Sanders and Robert Fothergill

How to EDM Steel and Copper Alloy Simultaneously

A strategy for machining details when the part geometry falls across multiple workpiece materials.

"Can I die sink EDM two different workpiece materials at the same time?" is a frequently asked EDM question, especially in mold manufacturing where tool steels and copper alloys are often involved. Although plastic injection production molds are typically made from common tool steels, copper alloy inserts are common in detail areas to dissipate heat and improve molding cycle times. The challenge mold builders face is machining the details when the part geometry falls across both materials.

Machining these materials separately requires multiple part setups (one for the tool steel and one for the copper alloy) and additional electrodes for separate burns with different EDM operations. This approach increases machining time for both electrodes' fabrication and EDM, which leads to higher manufacturing costs. Also, all this added effort could result in the two details not matching up in the mold correctly, causing a mismatch or an out-of-tolerance part that would then require additional machining, or possibly the remanufacturing of the detail inserts.

The question becomes: What do EDM operators need to know to effectively and efficiently machine these materials at the same time?

Work Metal Properties

Work metal properties and characteristics will alter the EDM approach. Understanding the difference between the physical

Understanding the melting temperature (in red) and thermal conductivity (purple) of the work metal is key to the EDM approach to adjust parameters such as on-time, amperage and polarity.

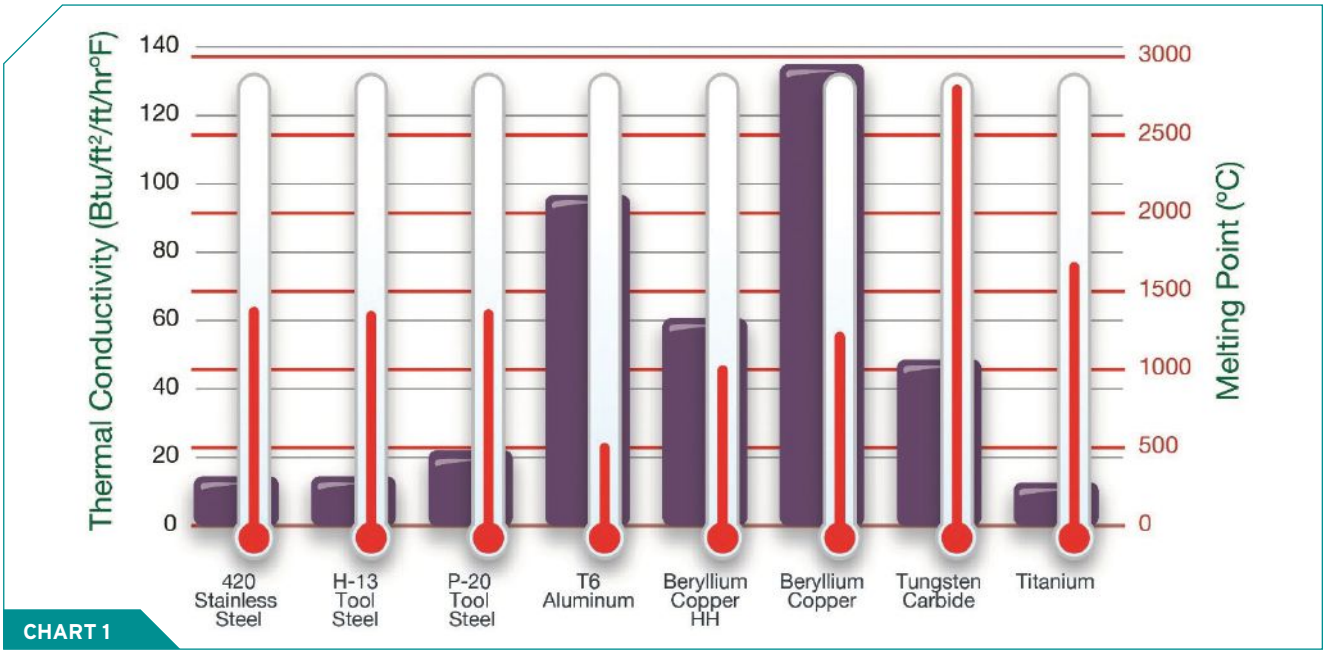

CHART 1

Chart courtesy of Poco Graphite.

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CHART 2

	Material	Program Parameters	MRR (cu. in/hr)	End Wear %
TEST 1	Standard Graphite	Tool Steel (+ polarity)	0.047	20%
	Copper Impregnated Graphite	Tool Steel (+ polarity)	0.06	63%
TEST 2	Standard Graphite	Copper Alloy (- polarity)	0.07	27%
	Copper Impregnated Graphite	Copper Alloy (- polarity)	0.085	18%

These are test results between standard graphite and copper impregnated graphite on the simultaneous copper alloy and steel burn at the different program parameters. Tool steel parameters used 65 microseconds on-time, 20 peak amps and positive polarity. Copper alloy parameters used 12 microseconds on-time, 80 peak amps and negative polarity.

properties of the two work metals in use and the way each will affect EDM performance is the first step (**Chart 1**).

The melting temperature and thermal conductivity of the work metals may vary from one to another, and EDM operators may need to adjust parameters such as on-time, amperage and polarity. If the same EDM approach is used regardless of the work metal, the end result could be vastly different.

Thermal conductivity is the physical property that makes the biggest difference in EDM for the same reason it helps reduce molding cycle time: higher thermal conductivity dissipates the heat of the spark during EDM.

Power Setting Parameters

To overcome any disparity in the thermal conductivity of the work metals, three primary power setting parameters may need to be modified:

- *On-time.* The duration time of the EDM spark measured in microseconds.
- *Peak current* (amperage). The maximum current available from each pulse from the power supply/generator.
- *Polarity.* The designation of positive or negative electrical potential to the electrode.

Typically, the EDM power settings for tool steel are positive polarity and an on-time value between 50-100 micro-seconds. These settings provide the optimal combination of speed and electrode wear. A higher on-time and positive polarity will yield lower electrode wear. This result is achieved with a "replating" process during which molten particles from the workpiece follow the electrical current flow to the electrode and plate themselves to the surface of the graphite electrode, reducing the amount of wear caused by the EDM process.

When working with copper alloys, negative polarity and lower on-time values (12-20 micro-seconds) are most effective. "Replating" of the electrode does not occur because the flow of electrical current is reversed and now travels toward the workpiece. The molten metallic particles are not forced to the electrode surface. Graphite particles cannot replate the workpiece since graphite does not melt; it transitions from a solid to a gas. This is called sublimation.

The operator determines amperage by the size of the frontal surface area for the detail being machined. The amperage value will be higher when burning a copper alloy workpiece to maintain the same spark intensity. Spark intensity is the amount of energy in the spark that is controlled by the on time, peak current and voltage (on-time x peak current x voltage = spark intensity).

For example, we are currently using 50 sec of on-time and 20 amps to burn a detail. We decide to lower the on-time down to 20 sec. In order to keep the same spark intensity, we need to increase the Amperage from 20 to 50.

Material Choice

The decision to use either a standard graphite or copper-impregnated graphite electrode requires a look at how each material will handle the conditions of both the machining of the electrode detail and EDM process. A few factors to con-

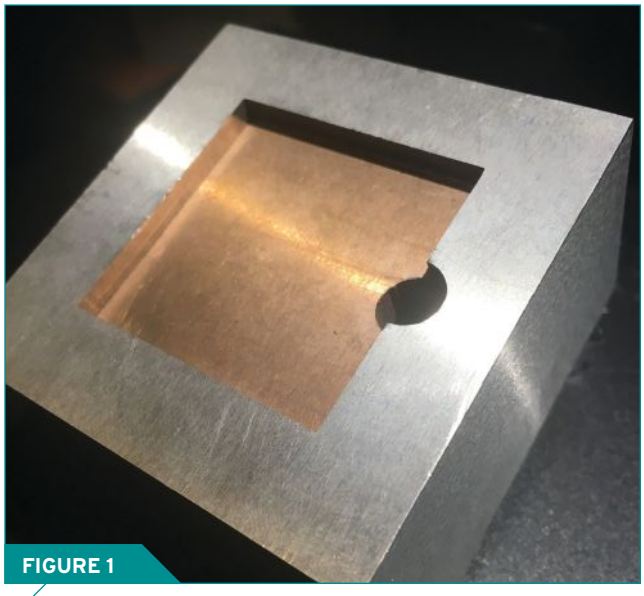

FIGURE 1

Tool steel cavity with a copper alloy insert used in testing to mimic the mold manufacturing environment.

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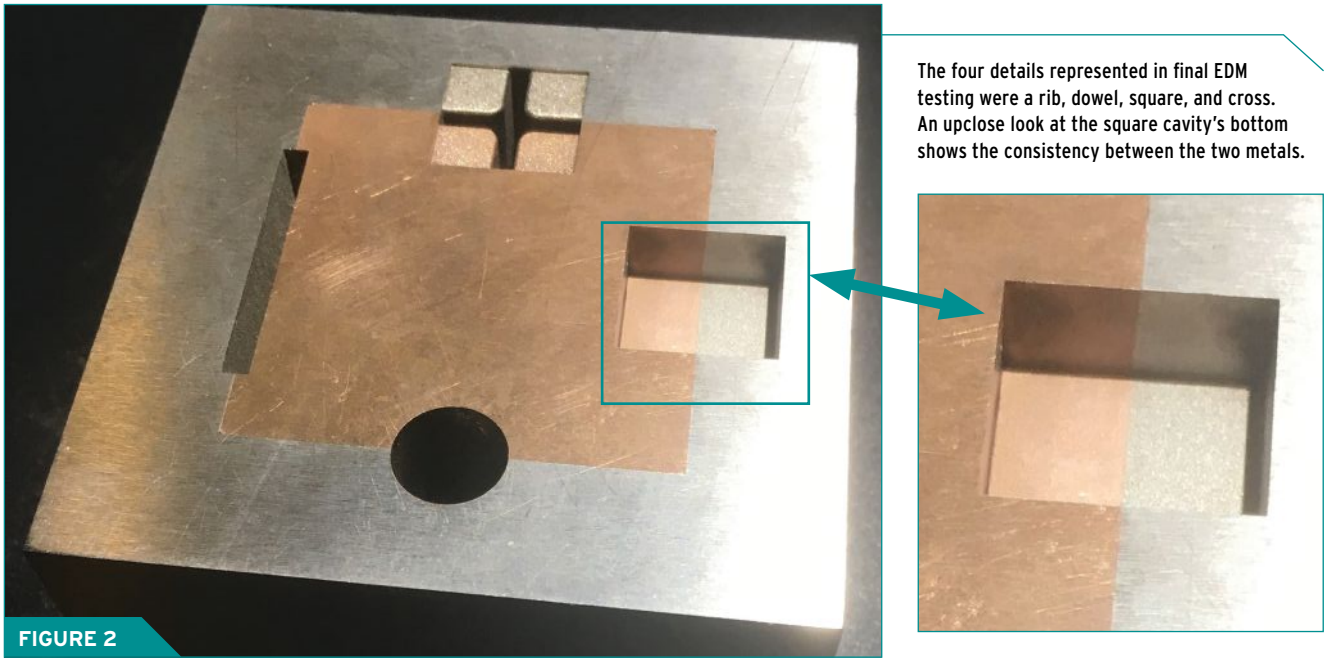

FIGURE 2

The four details represented in final EDM testing were a rib, dowel, square, and cross. An upclose look at the square cavity's bottom shows the consistency between the two metals.

sider include electrode size, detail and fabrication time, cost, performance during the EDM process, meeting job priority expectations (speed, wear and surface finish) and the number of cavities to burn.

Traditionally, a standard graphite would be used when EDM tool steel in positive polarity to achieve lower electrode wear. When burning a copper alloy workpiece in negative polarity, a copper-impregnated graphite electrode is preferred. This is due to a lower electrical resistivity value that allows for a greater percentage of the amperage to penetrate through the electrode and into the burn area.

The material decision is not as abundantly clear since more than one metal will be EDM at the same time. Operators must consider the aforementioned factors when selecting the most effective electrode material to optimize the EDM process and to improve overall performance.

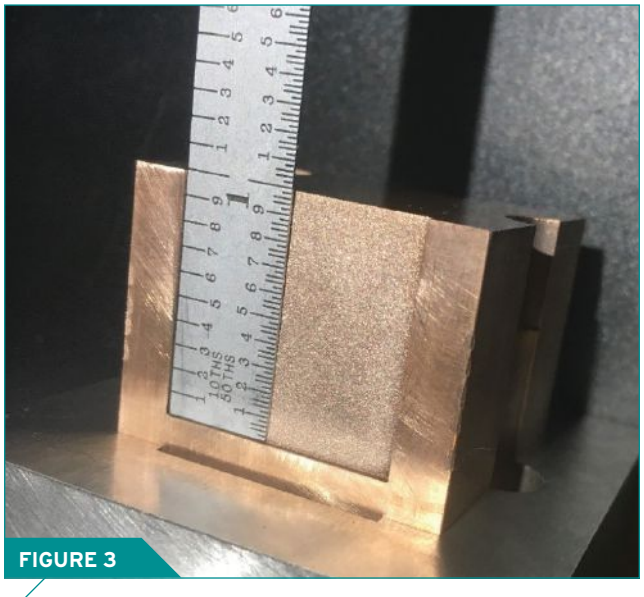

FIGURE 3

Inside look at the cavity from the rib detail.

Testing Matters

A team of application specialists performed a series of tests to validate the impact of materials and EDM parameters on the simultaneous die sinking of a tool steel and a copper alloy. The objective was to determine what power setting and electrode material would achieve the best metal removal rate (speed) and lowest electrode wear and identify any dimensional or surface finish variances from one metal to the other.

The team performed initial tests using a 0.500-inch square electrode with both standard graphite and copper-impregnated graphite programmed with steel settings of 65 microseconds on-time, 20 peak amps and positive polarity. They used side flushing and a jump cycle to keep the cutting condition clean. The operator stopped each test after one hour and took measurements. Overall, the metal removal rate was lower and the electrode wear was higher than expected for steel machine settings (**Chart 2**).

The team then conducted a second set of tests using the same testing parameters but programmed with machine parameters more applicable for a copper alloy: 12 microseconds on-time, 80

peak amps and negative polarity. Both the standard and copper-impregnated graphite showed improvement with these settings as compared to the steel settings in the first test (**Chart 2**). The combination of proper machine settings and the copper impregnated graphite electrode showed the best overall performance.

The team's next step was to mimic a tool steel cavity with a copper alloy insert and EDM different details (**Figure 1**). Four details were burned into the top surface along the parting line of the two workpiece materials (**Figure 2**):

- Rib: 0.040 by 1.000 by 1.000 inches deep 24 VDI (**Figure 3**)
- Square pocket: 0.500 by 0.500 by .250 inches deep 20 VDI
- Dowel pin hole: 0.375 dia by 0.500 inches deep 20 VDI
- Cross shape: 0.500 by 0.500 by 0.520 inches deep. 27 VDI

The EDM tests indicated that machine parameters for copper alloys provided the most optimum performance. The final end wear was slightly higher on the portion of the electrode EDM the tool steel section than on the copper alloy.

Since the tool steel portion of the burn resulted in higher electrode wear, an additional electrode was required to ensure consistency between the tool steel and the copper alloy. Overall, the team used four electrodes to fully complete each detail. The final measurements of the test burn confirmed that dimensional integrity and surface finish was consistent for both materials.

Results Are In

In the end, the answer to the frequently asked question is, "Yes, you can die sink a tool steel and copper alloy at the same time." Preliminary testing showed that both standard graphite and copper-impregnated graphite can be used to accomplish the part detail. The difference was in the overall performance during the EDM.

Deciding which graphite to use requires a look at the full spectrum of the relative factors and will be unique to each company's objectives. The data presented are derived from feasibility testing, so an expanded investigation is planned to identify a more optimum means to EDM different metals at the same time. This investigation will include the most current machine technologies available and any industry input to assist this investigation is welcomed. MMT

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Marc Sanders and Robert Fothergill are EDM applications specialists for Poco Graphite.

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By Darcy King

Addressing Aluminum Tooling Objections

Mold builder shares the technical and financial advantages it experiences using aluminum tooling.

Mold builders need to ask themselves if their shops will be ready when an OEM or key tier supplier looking to remove costs from their operations suggest an aluminum mold.

There are sound technical and economic reasons why aluminum tooling is an appropriate choice for numerous automotive applications. OEMs who have studied aluminum, molders who have adapted their operations to realize the 30 to 50% cycle time advantages of an aluminum mold and mold builders who know how to design and build high-quality aluminum molds are reaping the benefits of this material.

However, if that's the case, why hasn't aluminum tooling seen more widespread usage in recent years? Aluminum is a mature material option that has been in use for high-volume applications for around 15 years, but many still do not use it.

Unique Tool and Gauge is one mold shop that is successfully building aluminum molds for automotive applications for several OEMs and tier suppliers with production runs of up to 2.3 million shots on the same mold. Our shop believes that in just about any medium-sized or large-part application, an aluminum mold will be the chief driver of manufacturing productivity, and its usage will guarantee a lower piece part cost.

Here is a breakdown of the technical and financial advantages Unique Tool has experienced with aluminum tooling.

True Material Costs

We hear the complaints that aluminum is much too expensive as compared to P20 steel. In fact, 7000 series aluminum grades might be three to five times more expensive than P20 steel. While that's true, typically an aluminum mold will be one-third the weight of a steel mold, which mitigates much of P20's cost advantage. The savings for aluminum mold construction through machining efficiencies can range from 5 to 15%.

Images courtesy of Unique Tool and Gauge.

Unique Tool and Gauge produced this high-volume aluminum tool for the front wheel well liner of the 2011 Honda Civic that was produced in the U.S.

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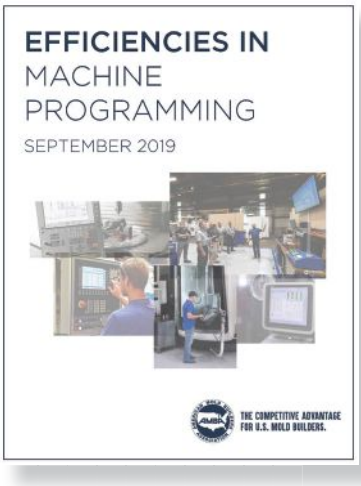

Recent industry data answers timely questions, including:

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- What is the economic outlook for the mold building industry? Do others share the same challenges I do?

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Unique Tool and Gauge machined the high-volume aluminum mold from the largest block of production tooling-grade aluminum supplied by Alcan Technologies (through a production license). Alcan provided an 11,000-pound forging of Alumold500 measuring 70 by 52 by 31 inches.

Aluminum also helps to reduce mold build and repair time. For example, molds that have more mechanisms and more depth will have more savings in aluminum versus P20, as machining, spotting, drilling and benching will require less time. Also, aluminum's higher electrical conductivity and lower melting point as compared to steel results in EDM at a rate four to five times higher than steel. The converse of this statement is that "cut and ship" molds for flat, relatively low-profile parts with little build hours due to lack of mechanics will have less of a cost-savings.

Lead times in mold production, whether in steel or aluminum, are a direct relation to build hours on a production mold. So, if mold build hours are reduced through efficiency, whether by material selection or by other means, lead times will be reduced as well.

For example, if a steel mold takes 4,000 hours and 18 weeks to complete, then an aluminum mold for the same part should take 3,400 to 3,600 hours and between 15 to 16 weeks to complete. This represents a 10 to 15% reduction in both build hours and lead time, which is based on Unique Tool's 15 years of experience with aluminum molds.

Production Costs

Any discussion of reduced costs using an aluminum mold needs to begin with cycle time reduction. For example, a steel mold running 75,000 shots per year with a 50-second cycle would need to run 250 days per year, producing 300 shots per day. An aluminum mold in that same application would have a substantially faster cycle time. Let's use a modest 30% cycle time reduction.

In this example, that same part would now require a 38-second cycle, equating to a production run of 192 days per year, which saves approximately 1,400 hours. This savings is a substantial reduction in production costs and overhead, or put another way, 175 extra eight-hour shifts of open capacity.

Unique Tool has also experienced reduced clamp tonnage with its aluminum molds. Smaller injection molding machines reduce costs, and the dramatic weight reduction in an aluminum mold also reduces wear and tear on equipment, such as cranes and presses. All of these reductions lower burden rates and overall piece part pricing.

Part Quality

Aluminum tooling also improves part dimensional stability or flatness, as the temperature variances in an aluminum mold are minimal. Plus, the part itself is measurably cooler upon ejection and closer to a fully cured part.

Injection pressure requirements affect both part economics and part quality. Of course, smaller molding machines are more economical, but there's an additional benefit to aluminum. Unique Tool's customers report fewer pressure requirements to fill an aluminum mold. The reason is the rapid transfer of heat from the resin to the molding surface, instead of the resin taking on the lower temperature of the steel before the heat transfer to the mold.

Aluminum tooling also improves part dimensional stability or flatness, as the temperature variances in an aluminum mold are minimal. Plus, the part itself is measurably cooler upon ejection and closer to a fully cured part.

This transfer creates a thinner "skin" of set plastic on the molding surface. For example, if a part is 2 mm thick and the steel gives a 0.25 mm thick skin, the fountain effect of the resin flow leaves 1.5 mm for the plastic to pass through. If that same part is molded in aluminum, the skin will be about 0.1 mm thick, leaving 1.9 mm for the flow. Less restriction in the mold means less injection pressure is required.

Aluminum tooling is a proven, robust mold material option for molding high-quality automotive parts in almost any volume and at an optimal piece part cost. It's time for molders and mold builders to take another, more serious look at aluminum tooling before your OEM and tier customers do it for you. MMT

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Darcy King is the owner, president and CEO of Unique Tool and Gauge.

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By Gene Granata

Eliminate Collisions and Over-Travels with Automated Toolpath Simulation

Toolpath simulation and optimization software simplifies moldmaking by eliminating collisions between the cutting tool or tool holder and the mold base.

Machining is a challenging vocation no matter what you produce. Aerospace shops deal with some of the toughest metals imaginable. Tool and die makers often meet tolerances best measured in microns. Medical manufacturers face complex, three-dimensional part geometries. Now take all three, throw in some deep pockets and long tool overhangs, and you understand the life of a moldmaker.

Granted, there's a fair amount of overlap among each of these machining specialties, and it's probably a little unfair to lump people into buckets in this manner, but the fact remains that moldmaking easily ranks among the most demanding of all the manufacturing disciplines.

Someone who can tell you all about it is André Chamberland, CNC programmer at M.I. Integration in Sherbrooke, Quebec, who said one way to make moldmaking life a little bit easier is by eliminating the possibility of a collision between a cutting tool or tool holder and an extremely expensive mold base. The tool he uses to accomplish this is Vericut toolpath simulation and optimization software from CGTech.

Taking on Industrial Moldmaking

The M.I. is short for moules industriels, which in Chamberland's native French means industrial molds. That description, though accurate, pays short shrift to the breadth of moldmaking-related services this 30-year-old company performs. In 1989, husband and wife team Claude Houle and Francine Guay opened their shop, one that specialized in sealing products for the automotive industry.

Moules Industriels quickly gained a reputation for its high-quality products, and in 1997, the two created a thermoplastic injection division—M.I. Plastech—to better service their clients in search of a turnkey molding solution. As demand rose, they moved the molding business to a new factory (also in Sherbrooke) in 2002, launching M.I. Integration four years later to act as the parent company to the two divisions.

Today, M.I. Integration employs more than 340 people and boasts four facilities, two

Images courtesy of CGTech.

Five-axis machining has become a mainstay of mold builders everywhere where extreme part accuracy is crucial.

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When mold shops have multiple control brands on the shop floor, there's a greater possibility of operator error as well as machine-specific cycles and subroutines—with Vericut, these complications are eliminated.

in Mexico and two in Canada. Francine Guay stepped down as president in 2014 and passed that role to her son Vincent Houle, with her daughter Marie-Claude Houle acting as vice-president of the board.

Protecting Machines and Avoiding Collisions

The company's growth has not been smooth sailing. Chamberland will tell you that sometime in 2010, management grew tired of replacing spindles on its Huron CNC machining centers. "We were experiencing way too many collisions, mainly because of our deep cavities and big parts, some of which measure 30 by 40 inches across and up to 10 inches deep," he says. "We needed a way to protect our machines and reduce the downtime and expense that comes with crashed spindles."

For example, there have been instances where the company replaced eight spindles in a single year, each one costing the shop a day or two of downtime, or even three to four weeks if a replacement spindle wasn't readily available. After looking at the available options, the team chose Vericut toolpath simulation and optimization software.

M.I. INTEGRATION

CHALLENGE: Replacing too many spindles due to collisions during deep cavity and large part work.

SOLUTION: Implementation of Vericut toolpath simulation and optimization software.

RESULTS: Collision and over-travel prevention, machine production, and downtime and expense reduction.

CNC programmer Andre Chamberland lends a hand on the shop floor.

Chamberland says there was more to the decision than simple crash avoidance. The team wanted the ability to simulate actual post-processed machine code. They wanted to see the entire machine, the spindle, fixtures and tool holding, not the partial view provided by the CAM software. They also wanted to know quickly whether there would be an overtravel condition if the program were placed on another machine tool. And lastly, they needed toolpath simulation software that could read the output from their Cimatron moldmaking software.

Vericut has done all that Chamberland and the other six programmers at M.I. Integration have required, namely preventing all crashes except the ones caused by "human-related setup errors" such as using a tool that is shorter than the one defined during simulation, or placing a fixture in the wrong position.

Going for More

Always on the lookout for improvement opportunities, the team then took Vericut one step further by automating its program simulations. This step eliminates the time spent watching the tool paths—something they already do in Cimatron—and provides a simple thumbs up, thumbs down message from the Vericut server, along with an indication of what tool and program line is causing the problem if one exists.

"I guess we're a little unique because we don't run Vericut on our personal computers," he explains. "Instead, we developed an interface that communicates with Cimatron. When we first got Vericut, this was unavailable, so we wrote our own. All we have to do now is indicate which posted program to verify, enter in the fixture location and the machine to be used and the software then creates a batch file that is sent to a queue on the server."

When complete, Vericut sends an email to the responsible programmers, telling him or her whether there were any collisions or other errors. The interface leverages standard Vericut functionality to capture images of problem areas and also sends a picture of the simulated part along with a link to a video, which can be checked with Vericut Reviewer. If changes are needed, the programmer requests access to the software, and the server makes the license available, allowing him or her to correct the problems with tool lengths or overtravels described earlier.

"Vericut has been very useful in preventing collisions, over-travels and other mistakes such as gouging or uncut material that we would prefer to eliminate from our moldmaking processes," Chamberland says. This has become even more important as the team adapts to five-axis machining with its new DMC 125 U duoBLOCK machining centers from DMG MORI. These

machines that, due to an unfamiliar axis configuration and machine control, present M.I. Integration with greater crash potential than their older machining centers. The company is also looking to integrate the new Force optimization module, which uses physics-based modeling to analyze and optimize the cutting conditions based on the material, slowing down where needed and speeding up when possible. The result is significantly shorter cycles times along with much greater tool life. MMT

CONTRIBUTOR
Gene Granata is a VERICUT product manager for CGTech.

FOR MORE INFORMATION

M.I. Integration / 888-336-3697 / mi-integration.com
CGTech / 949-753-1050 / cgtech.com/ Gene.Granata@cgtech.com

Offline tool presetting and tool dispensing centers are important components of success in today's mold shops. VERICUT toolpath simulation and optimization software from CGTech Inc. is another important shop component.

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By Cynthia Kustush

Succession Planning: Three Approaches

Three mold shop owners share their succession plan processes. Start sooner than later, hire a professional to assist and plan for more than your own benefit.

Image courtesy of Ameritech Die and Mold Inc.

Steve Rotman, center, is president of Ameritech Die and Mold Inc. His succession plan strategy is to allow his son, Mark (right) Program/Design Manager, and Plant Manager DJ Easter to slowly purchase equity in the company's Moorseville, North Carolina, facility. Meanwhile, Steve will slowly take a more active role at his Ormond Beach, Florida, facility as he prepares to fully retire in the next few years to a life of leisure and fishing.

Succession planning is something every company should implement, but many small businesses, like mold manufacturing companies, can be remiss when it comes to proactively thinking through the steps necessary to maintain continuity in the event of retirement, illness or worse, an untimely passing. It is a challenge, albeit not an exciting one (like solving a mold or molding issue). Still, succession planning is important.

MoldMaking Technology asked a few mold manufacturing business owners to share their succession plan experiences, including when and how the plans were developed, how they have evolved over time and lessons learned.

Several companies were asked to participate. Of these, there were some who said that they do not have a formal succession plan. Instead, it has simply been understood by those involved that ownership and management of the companies would pass from one generation to the next, through legal channels of course, and that is it. However, the three companies whose experiences we share here have taken more in-depth actions for succession planning and following are their stories.

Promoting from Within

Steve Rotman is enjoying the idea of easing into retirement and spending more time in Florida, where he can enjoy fishing while also overseeing operations at his Ormond Beach moldmaking plant. But first, he must work on how best to pass on the leadership and responsibilities of running Ameritech Die & Mold (ADM) North, his Mooresville, North Carolina, mold manufacturing facility, to his son Mark, program/design manager, and DJ Easter, plant manager. Both gentlemen are 34 years old.

"When I first began working on a succession plan, I had never considered trying to bring any of my three kids into ADM," Rotman says. In 2006, he realized that there could be an opportunity for his oldest son, Mark, to join the ADM team. At the time, Mark was just getting ready to graduate with a four-year degree in business/finance from Appalachian State University. "When I proposed the idea to him, explaining what his employment might be like being the owner's son, Mark accepted the challenge. He started out on the floor and worked his way up to running and programming our CNC machines, wire EDMs and working in the assembly department."

In 2014, Rotman was given an opportunity to put his hope and plan into action. "We encountered several vacancies in the management staff that needed to be filled in order to not disrupt our operations or customer relations." Among the employees considered for the positions, Mark and DJ enthusi-

astically stepped up to the plate, ensuring that no ripple effect was ever felt in the transition. Since then, they have become a strong team, complementing each other well, he says.

Today, Rotman is working on developing a contract that would give Mark and DJ equity positions in ADM North, enabling them to begin what Rotman calls "the real journey." "I am taking them on as partners in the business where they will be buying equity," he says. "While the contract is not ready to be signed yet, I have been discussing the plan with Mark and DJ and grooming them to become partners in the business. I will continue to be present and support them for the next three to five years while they slowly gain equity and get comfortable with making administrative/financial decisions. Eventually, when enough equity is built, they will take over the full banking/financial responsibilities."

> I am taking them on as partners in the business where they will be buying equity.

Asked about his plans for ADM South, the Ormond Beach, Florida, facility, Rotman says nothing concrete has been formed regarding his exit strategy there. "My first priority is to get Mark and DJ on solid ground in North Carolina, and then see what might happen with South," he says. "The slower sale of South also fits with my exit strategy. I can still have some involvement in a company and in the one that I have not been as involved with day to day before I step out completely. It also supports my goal to be in Florida a little more, particularly during the winter months. It's a softer landing for me, with those strategies for both North and South, than just abruptly retiring and going fishing 24/7!"

As for lessons learned, Rotman says he would not have changed any of the steps he has taken to ensure continuity for ADM North. "Building from within the company goes along with our strong apprenticeship model," he says. "With Mark and DJ moving up, there is a vacuum behind them to fill that will allow others to step up to management positions.

"My goal is to leave Ameritech in sound financial shape, as well as give the company the financial strength to afford the buyout without affecting all the great employees that support it every day," Rotman concludes. "ADM will continue to look and feel like a family owned business, and a strong, proud American moldmaking company."

Partnerships: A Meeting of the Minds

Ryan Katen, general manager at Micro Mold Co. in Erie, Pennsylvania, says there are different ways to go about succession planning, depending on the specifics of the individuals involved and the company that is transitioning its leadership. For Micro Mold, Katen says the initial succession plan involved cooperation between two owner-partners, Timothy Katen (Ryan's father) and David Mead, who cofounded the mold manufacturing company in November 1978.

Katen and his older brother Philip, who is now general manager and president, joined the Micro Mold team in 2007. He says the succession transition process began in 2009. At that time, Ryan, Philip and one of Mead's sons were made junior partners in the company. The transition was completed in 2011 when Tim and Dave fully retired. Eventually, the Katens bought out Mead's son, and today, they lead the company along with another junior partner.

Katen notes that he and Philip were not involved in developing the first succession plan, but more recently, they did participate in planning for the future transition of ownership for Micro Mold and sister company, Plastikos Inc., a custom molding company that was established in 1989 by Tim Katen, Dave Mead and a third partner, Gary McConnell. He shares some important insights based on his experience with the process where multiple shareholders are involved.

"First and foremost, before talking to an attorney, meet with all shareholders to ensure that you understand what each person's individual goals are and what their visions are for the company," Katen says. "This should be treated like any problem or challenge in that you work together to develop a plan that you can all get behind." Some factors to consider

Image courtesy of Micro Mold/Plastikos.

For the Katen family, succession planning for their companies Micro Mold and Plastikos (Erie, Pennsylvania) is about building and maintaining partnerships—and the company—together. Pictured from left are Ryan Katen, his wife, Halle, and their daughter, Hadley; Mom Betsy Katen; Christina Katen, wife of Philip (holding son Jude); and company founder and president Tom Katen, in 2018. This year, the family announced the opening of its new medical molding facility.

include the age at which each shareholder wishes to retire, and what happens if something unexpected occurs. For example, Micro Mold's succession plan stipulates that should a shareholder become unable to work full time, the other shareholders would buy him out over a set number of years.

Regardless of how a company passes the torch, Katen says the shareholders must have a cohesive plan and vision that will not financially cripple the company. "I've seen that happen to other companies," he says, stressing that while the previous owner deserves to reap the financial benefits from building and running the company, it is also in his best interest to not cause the company to fail because huge monthly buyout payments prevent the new shareholders from reinvesting in the business.

Katen says that once a plan is in place, an attorney and an accountant should be consulted to make sure that the plan makes sense from not only a legal standpoint but tax-wise as well. "For example, there are differences in how you are paid for your shares based on how the company is incorporated. You might pay more in taxes, too. The plan should protect you legally and tax-wise."

Additionally, because aspects of the plan can change over time, it is crucial to revisit it every so many years. An example is a shareholder changing his mind about when to retire. Company visions and goals also can change over time. "We try to revisit our plan every five years," Katen says, adding that everyone must understand and agree with what they are signing because if something happens, that document is legally what is going to be acted upon.

"Partnerships are like a marriage," he concludes. "You're not always going to see eye to eye because you have different ideas or desires than your partners have. It's important to try to respect each other and allow a little bit of give and take in order to ultimately come up with a plan everyone can live with."

Laying A Solid Foundation for Succession

Legacy Precision Molds in Grand Rapids, Michigan, is a family-owned company in the truest sense. Tom VanRee, president, founded the company in 1995. His wife, Mary, worked alongside him, serving as bookkeeper and providing administrative support—a role she continues to play today. Fifteen years ago, son Tyler entered the family business right out of high school and is now vice president and a co-owner. He was followed by his brother, Seth, who came on board 10 years ago. Seth is a three- and five-axis CNC operator.

"My parents went through an extensive, year-long process of working

Image courtesy of Legacy Precision Molds.

Mary and Tom VanRee are flanked by sons Seth, at left, and Tyler, right. The VanRees founded Legacy Precision Molds in Grand Rapids, Michigan, in 1995. In 2013, Tom and Mary completed the arduous but necessary succession planning process to ensure that their business will continue to thrive long after they have gone. Tyler is now a partner and Seth, who is a three- and five-axis CNC machinist, may eventually step up to help lead the company.

through both their estate and business succession plans, finalizing the details by early 2013," Tyler VanRee says. "They partnered with a professional who was experienced in all facets, including estate planning, business sale and acquisition, succession planning, tax planning and accounting. He helped develop a solid plan with several options that worked well for everyone involved."

In a podcast interview with *MoldMaking Technology*'s Editorial Director Christina Fuges on The Manufacturing Alliance, Tom VanRee shares his thoughts on the process of building a succession plan. "First off, I had to bare my soul, basically," he says. "We started from the ground up, figuring out all the dynamics of how we are going to do this for the rest of family. But it has been an eye opener, too. At the tail end of the process, we brought Tyler in, and we met with him

THE MANUFACTURING ALLIANCE PODCAST
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Listen to the MMT/The Manufacturing Alliance Podcast with Tom VanRee, President, and Tyler VanRee, Vice President, at Legacy Precision Molds at short.moldmakingtechnology.com/podcasts

as a team and made him a partner." While son Seth is not a partner, that could change in the future." Tyler says that at the time, his brother did not have an interest in ownership. "But he plays an important and vital role in the business, and there is a lot of value in that," he says.

While Tom and Mary VanRee did not involve Tyler in the finite business of working with the consultant, they did make sure to explain to him what they had in mind and ask him if he was comfortable with the plan that was developed. "I applaud them because after that was all done they called a family meeting around a dinner table and mom and dad basically said, 'hey, this is how it's all going to unravel over the next five, 10, 15 or 20 years, and this is what we've done to make sure it's fair for everyone involved."

"Communication is critical," Tom says. "I've seen businesses implode due to lack of communication."

Asked what advice he would give to a fellow business owner who has not yet ventured into creating a succession plan, Tom says, "Just do it. Get started. It's a big step. I thought about it for two years. Once you start going through the process, you learn a lot about yourself and your business and how they tie together." He adds that even for those who may not have a son or daughter to take the business on, it is important to put one's affairs in order such that it would make the business entity look more attractive to a potential outside buyer.

Tyler says the consultant raised another important consideration that was eye opening. "He said that before the transition between dad and me fully takes effect, it's wise for me to already have a succession plan in place. I was thinking to myself why in the world would I want that? Why wouldn't I just wait 20 years and figure that out when I'm about to retire? But tomorrow is never guaranteed for anybody, and if I'm going to take ownership, I'm responsible for every team member I have out there. I'm supporting families, and if I don't do my due diligence to ensure that this business can be sustained without me, then I failed them." MMT

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Index Increases on Production Gains

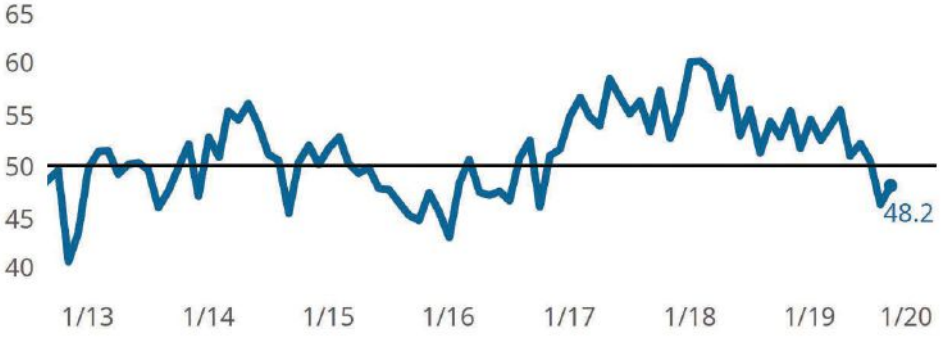
September 2019 – 48.2

The Gardner Business Index (GBI): Moldmaking reported slowing contraction in September with a reading of 48.2. Index readings above 50 indicate expanding activity while values below 50 indicate contracting activity. The further away a reading is from 50, the greater the change in business activity. Gardner Intelligence's review found that expanding production and supplier delivery activity were the primary drivers of the Index's higher reading. Steep contracting activity in employment and particularly backlogs prevented the Index from moving higher. Many of the changes experienced by the Index in recent months have been generally predictable, particularly between new orders, production and backlogs. However, this month's strong contractionary employment reading was unanticipated. Historical data suggests that employment activity tends to lag the other components of the Index as manufacturers tend to delay reducing employment levels given the difficulties in finding talented labor when business conditions improve. September's data marks the first time since 2011 that the one-month reading for employment has been more than four points lower than the overall Index reading during a time when the Moldmaking Index was contracting. MMT

ABOUT THE AUTHOR

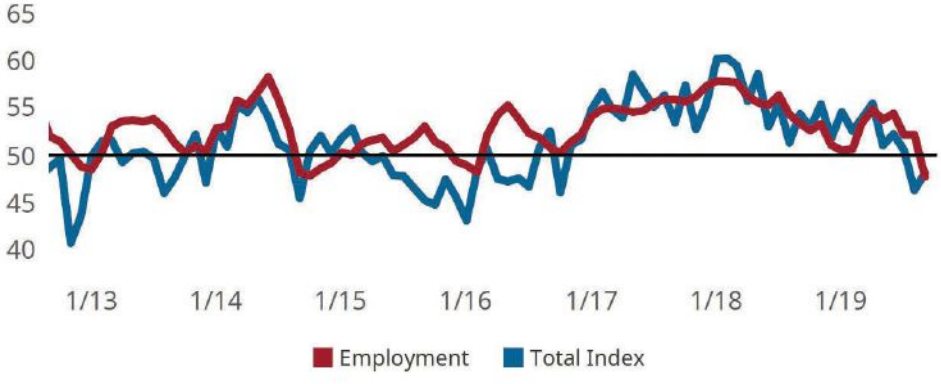
Michael Guckes is the chief economist for Gardner Intelligence, a division of Gardner Business Media (Cincinnati, Ohio, United States). He has performed economic analysis, modeling and forecasting work for nearly 20 years among a range of industries. He is available at mguckes@gardnerweb.com

Gardner Business Index (GBI): Moldmaking



The Moldmaking Index reported slowing contracting during the month. Contracting backlog and employment activity offset expansionary activity in production and supplier deliveries.

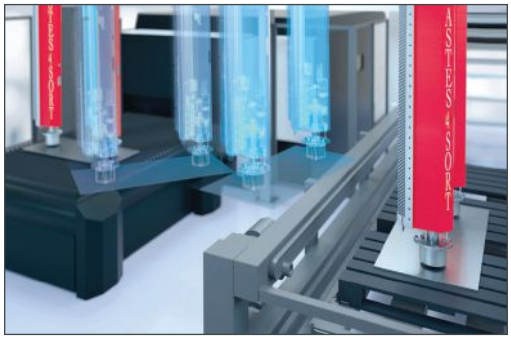
Employment and Total Index (3-Month Moving Average)



The one-month reading for employment activity was nearly 4 points lower than the overall index reading. This marks an unusual move for a component that tends to respond more slowly to changes in business conditions given the difficulty and lengthy time often required to replace talented labor.

AUTOMATION

Automation Amplifies Machine Sophistication and Speed



MC Machinery Systems displays its Advanced 800 eX-F series fiber laser with upgraded ASTES4 automation, featuring integrated automated sorting solution enables less manual loading, unloading and sorting for higher productivity and efficiency. The company's BH13530 with automatic tool changer includes a larger control, improved cycle times and the diamond BH "Dual Drive" system, which controls high-speed up and down movement. The automatic tool changer provides quicker and more precise tool setup for maximum machine uptime. Additional press brakes, the BB6020 with Videre and the compact BB306 include an AC servo motor and ball screw mechanism for high-speed productivity and repeatability. Videre streamlines setup and work handling, improving productivity by reducing bending defects.

MC Machinery Systems, Inc. / 630-616-5920 / mcmachinery.com

Robot Cell Developed for Flexible Production of Different Batch Sizes

The **Fastems** RoboCell One features adaptable and flexible machining, particularly heavy workpieces within batches of different sizes. The robot cell is designed for handling workpieces weighing up to 176 lbs. and for automating up to two machine tools of the same type, either lathes or milling machines. The cell offers an optional automated gripper change system and can be fitted with single, double or special grippers. Up to six different grippers may be used for handling workpieces in specific production operations. The robot automatically changes its grippers for loading/unloading respective units.

In combination with the company's manufacturing management software (MMS), the cell provides advantages for production operations. The MMS automatically plans the entire production process based on the production orders, including the changes of workpieces for batches of different sizes and taking account of all needed resources. The software shows current production status in real time, calculates the machinery capacities for outstanding orders and shows machinery retooling operations that are needed. This means that throughput times are cut and production costs per workpiece are reduced.

The robot cell requires no previous knowledge of robotics and is configured through parametric programming via the MMS, simplifying production, especially for groups of components. The necessary values and/or parameters for workpiece handling are stored in the control system via the MMS interface. New parts master data and orders can be produced both quickly and simply during production operations, i.e. while the machine is running.

Fastems LLC / 513-779-4614 / fastems.com

Electrode Changing Robot

GF Machining Solutions showcases the AgieCharmilles Form X 400 die-sinking EDM solution paired with the **System 3R**'s WorkShopManager (WSM) and WorkPartner 1+ (WPT1+) compact part and electrode changing robot.

The Form X 400 features the intelligent speed power generator, so users can utilize the machine series' discharge circuit to provide spark erosion power modulation for high flexibility and maximum material removal. The Form X series also includes the latest generation of the AC Form human-machine interface. The series' software ensures greater reliability, improved machining efficiency and less unproductive time for the highest level of precision and machine performance. Additionally, the machine body is thermally isolated from the high-speed Z axis, and all moving parts are fully disassociated from the loading and machining area, all of which ensures that temperature variations and particularly heavy or light workpieces cannot affect machining and measuring accuracy. With its central database, the System 3R WSM keeps production running on the Form X 400 with standardized procedures and manages the automation process. Job lists can be interrupted with WSM so urgent parts can be machined; upon completion, the cell automatically returns to the list of jobs to be executed. Additionally, WSM helps eliminate the need to have all parts and electrodes 100% ready before executing a job. Machining can start while the parts and electrodes are being measured and loaded into the robot magazine, and WSM seamlessly updates the information about the running job as parts are loaded.

To accommodate all the Form X machines, the System 3R WPT1+ is available in nine modular models that meet the needs of a broad range of milling, grinding, EDM and laser micromachining equipment. The system can serve one or two machines in a production cell with its flexible one, two or three-magazine capacity, and its pneumatic control for gripping devices and table chucks is fully integrated. The WPT1+ offers maximum magazine capacity in minimal floor space and is efficient for both one-off and serial production due to magazine doors for loading and unloading and rapid change cycles.

GF Machining Solutions / 847-913-5300 / gfms.com/us
System 3R USA LLC / 847-439-4888 / gfms.com/us

Octagon Face Milling Cutter Boosts Feed Rates

The M2028/M2029 octagon face milling cutters from **Walter** delivers high feed rates and lower tooling costs for a wide variety of roughing and finishing applications, thanks in large measure to their stable, negative, double sided inserts that feature 16 cutting edges.

The versatile M2028 for roughing and M2029 for finishing are suitable for use with ISO material groups P, M, K and S in a broad range of automotive, aerospace, energy, railway and general machining applications. The M2029 shows tool life increases in the number of machined parts from 30 to 80 for a turbo housing. It also yields a machining time reduction of 31%.

The inserts, which are available in Tigertec Gold, feature marks on the top for easy recognition of geometry and a depth of cut. Depending on the cutter, the geometries available are the D57 geometry for stable cutting at high feed rates in unfavorable conditions, the F57 geometry for universal use under medium conditions and the light cutting F67 geometry for low cutting forces and medium feed rates under good conditions. These geometries are available in grades WKP35G, WSP45S and WSM35S.

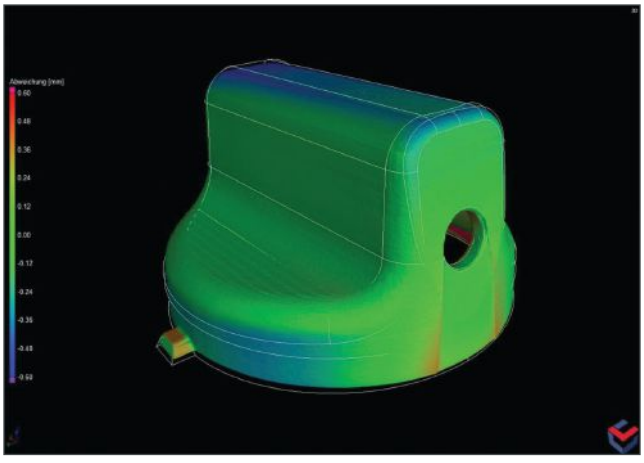
Walter USA, LLC / 800-945-5554 / walter-tools.com/us

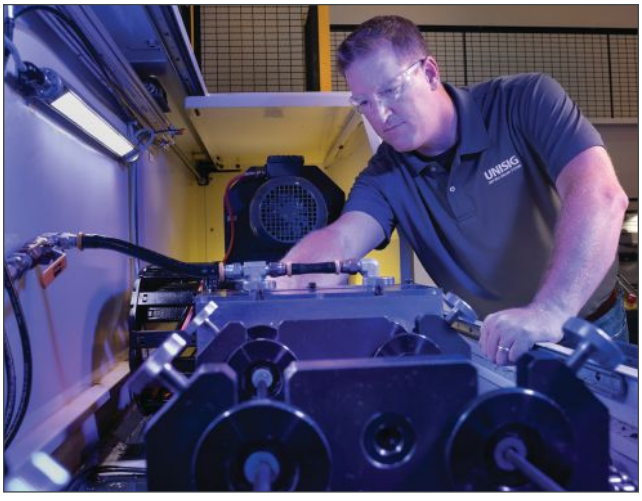
Computed Tomography Data-Analysis Software Brings Expertise in Quality Assurance

Volume Graphics brings expertise in quality assurance and process optimization via its advanced industrial computed tomography (CT) data-analysis software. Industrial CT has been an indispensable technology in tool and mold inspection for years, enabling non-destructive testing of manufactured components. The software provides a deeper look into CT results, revealing flaws that may be invisible to the naked eye, comparing as-manufactured parts to their original designs and simulating the performance of part geometries to guide design and/or manufacturing corrections. Comparisons between CT and CAD datasets reduce molding-tool corrections for defects and warpage to a minimum.

The latest versions of the company's CT analysis software packages VGStudo Max and VGMetrology provide a manufacturing geometry correction module, which has been specifically developed for tool and mold making and additive manufacturing. Part shrinkage, distortion or other dimensional deviations detected in the CT data set can be transferred to the CAD model of the tool in order to analyze and redesign the relevant contour so that it 3D-prints correctly.

Volume Graphics Inc. / 704-248-7736 / volumegraphics.com





Machine Series Engineered to Simplify Gundrilling

UNISIG's next generation of UNE series gundrilling machines deliver operational flexibility, improved performance and effortless operation. The series is engineered and designed to simplify gundrilling, well-suited for various industries, including firearms, automotive, medical, energy, defense and aerospace. Each machine can fit in close proximity to a shop's existing machining center, lathe or Swiss-style machine for efficient part-processing strategies. For added flexibility to grow with future production needs, all UNE models are robot-ready. The single main spindle servo motor delivers necessary horsepower for two-spindle machines. The series features a programmable flow-based coolant delivery system designed to provide the right amount of coolant to the tool's cutting edge, so users can predict tool breakage and spend less downtime recovering an interrupted process. UNE series machines feature intuitive controls that give operators a full process picture at a glance on a rich color interface with touchscreen capabilities. All UNE bases are FEA optimized and machined on five sides in a single setup for the highest overall precision, enabling simplified installation with no foundation work required, and 3-point leveling on machines rated up to 1,000 mm length.

UNISIG / 262-252-3802 / unisig.com

Coordinate Measuring Machine Operates Without Compressed Air

Mitutoyo America Corporation announces the release of the MiSTAR 555 CNC shop floor coordinate measuring machine to its CMM product line that operates without compressed air and on conventional 120V 20 amp electrical service. The CMM is a compact, space-saving in-line or near-line CNC coordinate measuring machine designed for high-speed, high-accuracy measurements with accuracy assurance from 10°C to 40°C. It features an open-structure design with a single support moving bridge enabling users to mount workpieces from the front, rear and right for installation and a walk-up inspection station for easier operability. The modular control unit and PC are stored in the base of the main body structure, reducing the installation area to approximately 70% from a conventional moving bridge model for location flexibility. The CMM also uses a scale detection system with a high resistance to airborne contaminants, eliminating the need for costly environmental controlled enclosures.

The CMM features several Industry 4.0 integrations, including the company's smart measuring system, which enables monitoring the operation state required by smart factories and a status monitor that retrieves current CMM status features using the MTConnect protocol. Condition monitor provides a system that collects and evaluates different operational information such as measuring, movement lengths, machine error, probe functions and more for long-term preventative maintenance and machine use statistics.

Mitutoyo America Corporation / 888-648-8869 / mitutoyo.com

Software Collects Machine Data on the Shop Floor

Predator Software reseller **Shop Floor Automations** shares updates about Predator Machine Data Collection (MDC), an on-premise machine data collection software solution which enables users to track activity from machines on the shop floor. Equipment can be interfaced over wireless, ethernet and RS232 cabling to extract rich data. The software includes charts and reports for users, who can then make informed decisions to improve plant performance based on observations. View machine data live on dashboards across the production floor or do a presentation in the conference room. Seeing machine data with the software can help to make better operating decisions so a company is able to pursue goals of lean production, continuous improvement and overall quality enhancement.

The software includes Predator DNC, which enables for better machine program communication and part program revision control. Predator DNC also includes state-of-the-art networking tools for Windows-based controllers called Secure DNC. The solution can also be integrated with ERP and MES software. Operators can replace bar code readers and handheld terminals for simplified data collection with Predator Touch HMI, a button interface that can be integrated with Predator MDC. The software enables several protocols such as MTConnect, Fanuc Focas, Okuma Thinc, OPC UA and more to communicate with a wide variety of equipment.

Shop Floor Automations, Inc. / 877-611-5825 / shopfloorautomations.com

THIS MONTH ON SOCIAL MEDIA

YouTube Videos

When Pro Mold & Die co-owner Dave Long talks about mold complexity, he means a lot of moving parts and a level of work that must be dimensionally perfect.
youtube.com/c/moldmakingtechnology

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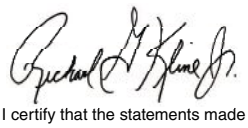

Richard G. Kline, Jr.
President
September 30, 2019

I certify that the statements made by me above are correct and complete.

MOLD MAINTENANCE

How to Improve **Tooling Supply Chain Transparency**

By Dr. Jongsun Kim

When OEMs outsource their parts production to external suppliers, they are dependent on their suppliers to precisely track the number of units that will arrive, quality issues and expected delays. Many large OEMs still lack visibility into their tooling supply chain and struggle to track the exact status of their tooling.

For example, consider a large OEM that gives its tooling to a supplier and asks them to produce 100,000 parts within a month. Between the OEM sending the order and the supplier producing the products at the other end, the supplier does not provide updates and information. When the deadline hits, only 90,000 parts arrive on time, then three months later the tooling breaks down, and the reason for the early breakdown goes unidentified due to a lack of data.

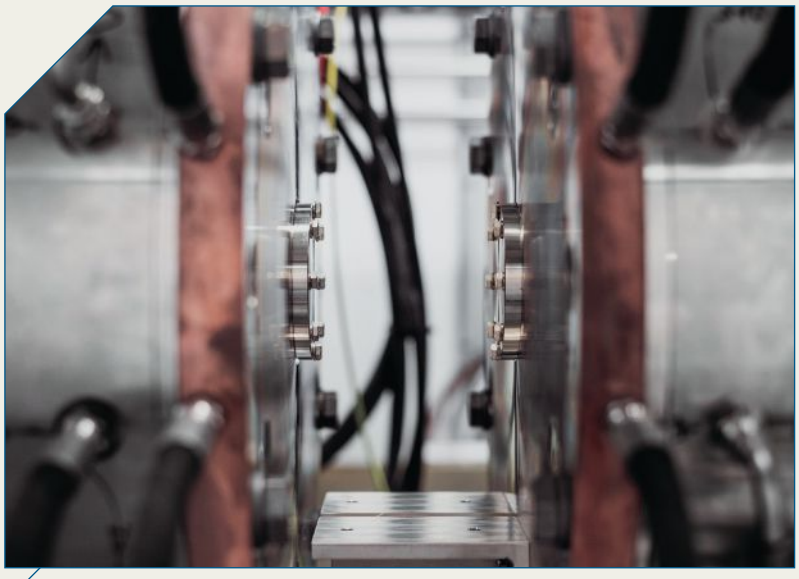

Image courtesy of eMoldino.

Automated tooling supply chain management allows OEMs to analyze their tooling performance and maintenance schedules in real time.

In this case, the molder may have used the tooling improperly to produce parts faster than recommended, which can lead to quality issues, or they may have used the tooling to create counterfeit parts to sell and make a side profit in secondary markets. These costly problems can be prevented.

Here are a few recommended steps to increase the transparency and efficiency of the supply chain:

- Implement an automated tooling supply chain management system that uses software and counters installed directly on the molds to collect all relevant tooling data, eliminating a tooling engineer's redundant data collection and analysis work. Consider a system with hardware that automatically collects raw data from each mold, which is then wirelessly sent through a terminal to the software. From there, the software automatically analyzes the raw data and produces graphs offering users strategy options in real time (every 10 minutes) that are accessible anywhere in the world via the cloud.
- Use the real-time data collected by the automated tooling supply chain management system to conduct a regularly scheduled analysis of tooling performance and to analyze the areas of the supply chain that need improvement. For example, one supplier may be consistently under maintaining the molds, leading to breakdowns or stoppages in production.
- Employ protocols that monitor mold maintenance, such as date of last PM, to identify potential disruptions in the tooling supply chain as early as possible.
- Once the data from the mold counter reaches the automated tooling supply chain management system, it will send a notice to the engineering department indicating the need for new tooling to replace the deteriorating product, which will save suppliers time and ensure that OEMs receive their parts on schedule.

Employ protocols that monitor mold maintenance to identify potential disruptions in the tooling supply chain as early as possible.

These steps will ensure that each link in the supply chain spends less time collecting basic data and makes fewer assumptions about disruptions. Instead, each company in the supply chain will use and analyze the data collected by the system to determine root cause and then make the necessary improvements, reducing the risk of repeating the same mistake. MMT

CONTRIBUTOR

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