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Getting a Grip on Stainless Steel

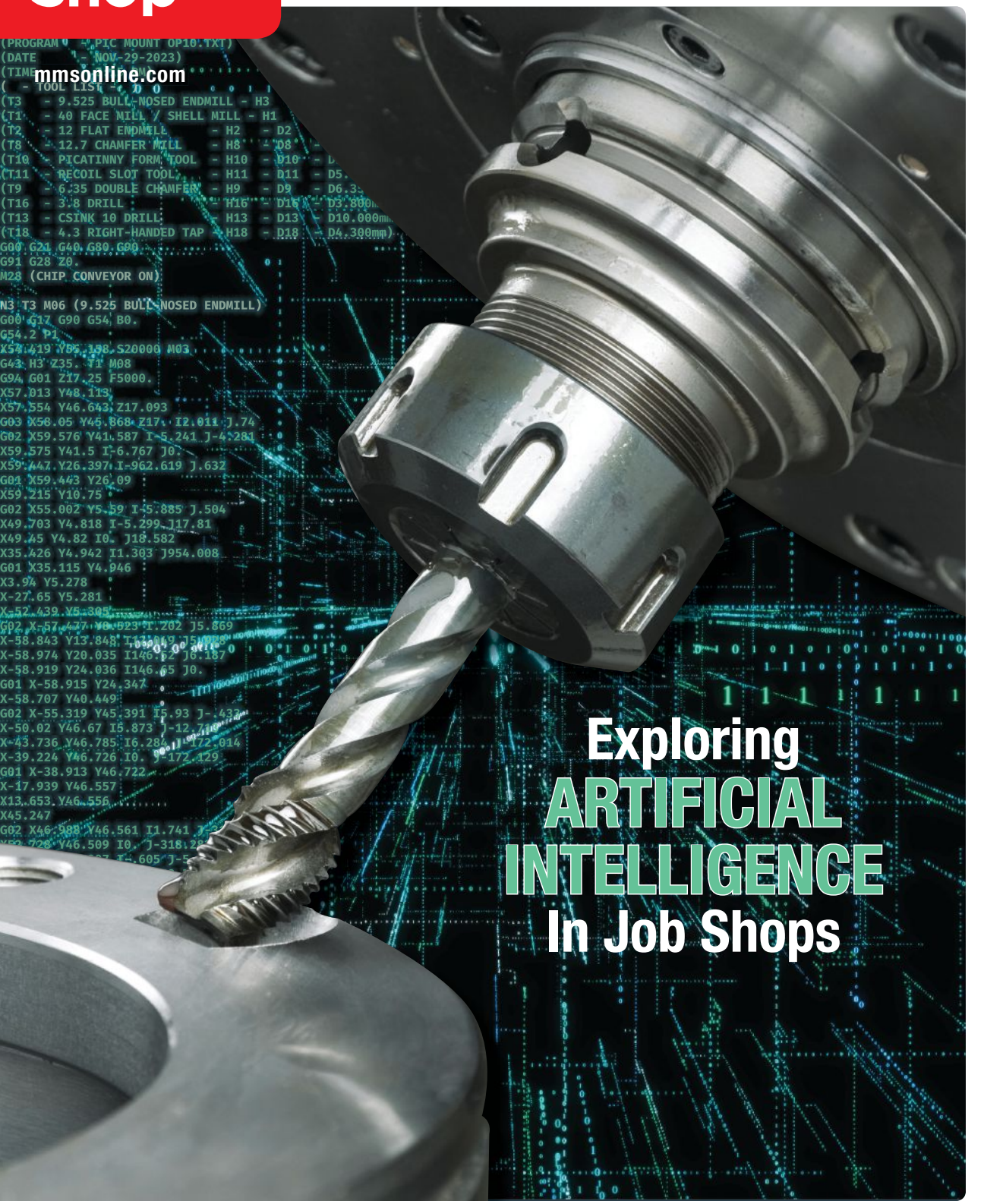
Mastering stainless steel requires a concentrated approach pg. 30

AI-Assisted CAM Simplifies Coding

Specialized EDM control simplifies G-code programming pg. 71

Meet "Machine Tool Google"

Doug Schulte shares how he made it in manufacturing pg. 96



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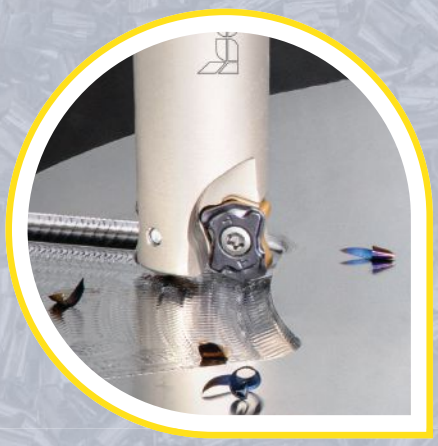

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This CNC enables EDMs to switch between G code and an integrated CAM system to make lights-out manufacturing more attainable.

BY ELI PLASKETT

TOOLING

5 Common Mistakes Shops Make With ER Collets

Collets play a crucial role in the machining process, so proper tool assembly and maintenance is important. Here are five pitfalls to avoid when using ER collets.

BY JULIA HIDER

From the MMS Editors

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| ABOUT OUR COVER | ***Exploring Artificial Intelligence in Job Shops***
Artificial intelligence chatbot ChatGPT can write G code, but are the programs it produces accurate? How practical is it to use? Does it have any other uses in the job shop? In this article, we ask a CAM expert for his assessment of ChatGPT's capabilities, and what the future holds for AI-assisted programming.

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55 MIN.

PODCAST | Made in the USA

In the linked episode of Made in the USA, Editor-in-Chief Brent Donaldson and Editorial Director Peter Zelinski cover Janus Motorcycles' hyperlocal supply chain. Janus Motorcycles' core components and assemblies are produced in-house or with the help of nearly a dozen suppliers within a five-mile radius of the company's headquarters in Goshen, Indiana.

LISTEN: gbm.media/janus0124

5 MIN.

ARTICLE | Sizing Adjustments for New CNC Users

On pg. 26, Mike Lynch, founder and president of CNC Concepts Inc., discusses how keeping operators from having to manually make sizing adjustments will free them up to do other things, regardless of how many sizing adjustments are required. In the linked article, Lynch covers several points to keep in mind when training new CNC users on sizing adjustments.

READ: gbm.media/sizing-adjustments0124

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Brent Donaldson
EDITOR-IN-CHIEF

Humans > AI

The January 2024 issue of *Modern Machine Shop* contains several firsts. From new features to new topics and presentation styles, the debut issue of the year reflects not only a changing landscape of machining strategies, but also the stories behind the people who innovate them.

Buckle up.

When I think about 2024, that thought comes to mind. There are simply too many events of global significance taking place this year to make 2024 a forgettable ride. To wit: It is estimated that 76 countries plan to hold elections this year, possibly making 2024 "the biggest election year in history." In addition to elections taking place around the world, NASA's Artemis II is scheduled to take humans on a flyby of the moon. A total eclipse of the sun will be visible across much of North America. The quadrennial drama of the Summer Olympics will descend upon Paris. And those are just a few of the known events.

Then there are the wildcards.

In its 96 years of existence, *Modern Machine Shop* has never explored artificial intelligence (AI) — a wildcard of epic scale — as one of our central cover topics. But given the rapid advance of machine automation that our writers focus on every day, it feels like the right time. In her feature on page 58, Senior Editor Julia Hider presents a fascinating interview with Mike Wearne, a CAD instructor and CNC programmer who has researched and published studies and videos about ChatGPT's potential for programming G code. In Hider's article, she describes the challenges of machine programming via ChatGPT through its existing interface, including the sheer volume of information ChatGPT requires to create a successful program. Without giving anything away, the money quote in Hider's piece is this (emphasis added on the last sentence): "Anything beyond that is not doable. *At least, not yet*."

We also explore AI and AI-adjacent topics in two other articles this month. On page 18, Editorial Director Peter Zelinski explores AI's potential through an examination of intelligence itself — "real" versus "artificial" — and the role humans will necessarily still play even as AI advances far beyond its current capabilities. And on page 71, Senior Associate Editor Eli Plaskett examines dynamic programming and the ability of machines to autonomously generate code — after humans program the part geometries and cutting paths. While referring to dynamic programming as "AI" is dubious at best, Eric Ostini, GF Machining's head of business development for North America, puts it this way: "Dynamic programming enables the intermediate or beginner operator to function at the level of a skilled programmer and enables the skilled programmer to make more efficient use of their time."

Rounding out the rest of the feature contributions to this issue, on page 68, Associate Editor Nathaniel Fields examines a briquette manufacturer that revamped its machining and cutting tool arsenal for faster production. In this case study, the combination of a Mazak Integrex turn-mill machine with a two-pallet changer and automated pallet-stocking system, coupled with indexable carbide tooling from Ceratizit and Mastercam's 3D tool paths, was a game changer across several aspects of production. And on page 62, Associate Editor Evan Doran tells the story of entrepreneurs who used their lack of manufacturing experience to their greatest possible advantage, creating a business strategy that involved trusting machinists and taking a hands-off management style. The strategy allowed company leaders to take more risks and find success at a faster pace.

Finally, I'm excited to announce that the January 2024 issue of *Modern Machine Shop* includes two brand-new feature presentations. First, we're »

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debuting a full-spread visual feature we've dubbed "The Cut Scene." Put one way, "The Cut Scene" is a two-page photo feature accompanied by text callouts that describe an interesting production setup and machining activity. Put another, it is a visually compelling photo involving a machining production scene that's meant to evoke a call-and-response: What is that, and how is it made?

In this debut of "The Cut Scene," we're examining a snapshot from one step of Vektek's production cycle for its hydraulic clamp bodies. These complex parts must be leak-free with precision fits and excellent surface finishes, and producing them at volume requires repeatable and flexible workholding to change parts quickly. To see the solution Vektek found, turn to page 56.

Also making its debut this month is "How I Made It," a new Q&A-style feature that takes us behind the scenes with fascinating personalities in our industry. "How I Made It" takes a step back from technology topics to focus on origin stories — family upbringing, career highlights, personal or professional epiphanies, wild anecdotes, lessons learned or random nuggets of wisdom. This month, we're featuring Doug Schulte, senior product manager for Select Machining Technologies and a man known by friends as "Machine Tool Google," due to his encyclopedic knowledge of machine tool specs and mechanics. On page 96, Schulte talks about his early introduction to the industry through his father, who began his own career at the LeBlond Machine Tool Company in the early 1950s. Schulte's wisdom on the importance of having curiosity, his philosophy on selling and the bravery of asking questions, and his shared joy of working in the metalworking industry all make for a worthy read.

In the coming months, the *Modern Machine Shop* team plans to provide more new offerings to our audience, offerings you'll find both in print and in the world of multimedia. (We're also excited to announce that we're already working on Season 3 of our podcast, "Made in the USA" — stay tuned.) Until then, we hope you enjoy this issue as we all buckle up for the ride ahead.

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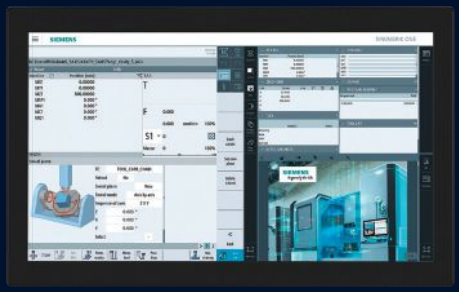

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Peter Zelinski
EDITORIAL DIRECTOR

Can AI Replace Programmers? Others Face Similar Questions

Writers are being asked this, too. The answer is the same for both. AI performs sophisticated tasks, but falls short of delivering on the fullness of what the work entails. This will always be the case.

Our cover story this month, Julia Hider's feature on page 58, explores the use of the artificial intelligence (AI) tool ChatGPT as a means of automatically generating G-code programming. That article flirts with the question of whether AI can replace CNC programmers. Spoiler alert: It can't, even though it can aid them by automating certain aspects of what they do.

That implied question in the article leaps out at me, because it reminds me of a very similar question that Julia and I, and all the writing staff of this magazine, face in our own work. Indeed, I suspect this question arises more frequently, because while many have explored programming via ChatGPT, a larger number have seen this resource produce readable text in response to prompts. The question that arises is: Can AI replace writers?

AI can compose a G-code sequence based on input parameters. But that input is the precondition.

My response, which in a sense also applies to programmers (I will come back to them) is this: It depends on what you imagine writers to be doing.

AI can definitely write. As anyone who has played with ChatGPT knows, the platform produces credible composition. It now seems apparent that if there is any formula to a category of writing, no matter how subtle, AI can find and follow the formula. The rules of grammar and the expectations of sentence rhythm and paragraph structure are followed, and formal and informal rules of style are followed as well. ChatGPT can write in the form of haiku, essay, a technical paper and more. That the writing it generates is "credible" does not mean the composition is accurate or useful to the spirit of the prompt, yet even success along these measures will improve.

But does any of this suggest that AI has the capability, or even the potential, to take over for writers in the fullness of the work they do?

Here is what I think my work as a writer entails: I am to see and explore developments and ideas it would be valuable for my readers to understand. I am to cultivate curiosity about what interests them, so I can pose questions they would ask if they were with me. I am to find the meaning in what I am experiencing and convey that insight to them.

There is a lot in that description. First, there are the readers, the human beings my writing serves. Then there is meaning, which I hope to discover and convey. What we call "artificial intelligence" is a machine of a sort — a set of algorithms able to craft new algorithms as part of the way it calculates toward the solution to a specified input problem — but it still needs that input problem. And I don't need this. Instead, I am learning about human beings as part of my life, and learning how to better serve them as part of my life's work.

You might sense how far this analysis goes. For writers, for programmers — for everyone — the questions about the possibilities for AI come down to whether "artificial" intelligence can take over for what real (for lack of a better word) intelli- »

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gence does. I mentioned *meaning*: Where does this come from? Is meaning to be found, or can meaning "emerge" from an algorithm's written piece that is sufficiently complex? This question, and its answer, are similar to the question of where intelligence itself comes from. Can "real" intelligence emerge from a sufficiently complex algorithm?

You did not come here expecting a philosophy treatise, so let me skip ahead to my answer: I think I am a soul, not a machine. And I think a soul is what you are, too. Therefore, for me, I understand machine "intelligence" to be a tool, but something that can never come to actual intelligence in terms of crafting its own inputs so that people are truly served. Machines computing faster don't make souls, and by extension, machine outputs cannot merely generate the kind of meaning these souls seek and share with one another.

This brings us well beyond writers and writing. Serving people, finding meaning — not just writers do this, but artists, craftspeople, inventors, scientists and CNC programmers, among many others.

AI can program. Yet it can't replace programmers. It likely can compose the G-code sequence for a hole pattern based on input parameters, and in the future, it will reliably compose more complex code than this. But that input is the precondition. The programmer is the one considering questions such as: Are we assuming the right setup and sequence of operations? Are our priorities right, or would a different balance between cycle time and tool selection make sense? Do I know something about other parts in the shop that relates to how this one should be run? And sometimes: Is machining even the right process? All this is part of the exploration that allows programming to realize its purpose for people (the people who want these parts), and all of this is part of the meaning surrounding any particular problem in machining. Thus, while we *MMS* writers will continue watching and reporting on the advance of AI as a programming tool, it can only be the case that we will always do that writing for the programmer, the human, who is using that tool.

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Digital Comparators are More Than Just Readout Devices

Modern digital comparators often combine the performance of touchscreen phones, LVDTs, digital amplifiers and even small PCs into the size of a standard dial indicator.

GEORGE SCHUETZ | COLUMNIST

Digital comparators are one of those devices whose full potential is rarely appreciated by their owners. Digital comparators are often used simply as replacements for dial indicators or old Mikrokators where a higher degree of resolution is required. This ignores numerous opportunities to make gaging more efficient and productive.

Today's digital comparators often combine the performance of touchscreen phones, linear variable differential transformers (LVDTs), digital amplifiers and even small PCs into the size of a standard dial indicator. Features typically delegated to bench amplifiers or electronic column gages now fit into a compact but powerful, all-in-one readout device. With an LVDT integral with the display, modern digital comparators combine the typical probe and bench amplifier into one compact unit. Since an LVDT is the basis for the comparator, selectable resolutions of 0.1 µm are possible. Thus, one gets all the performance and power of the bench amplifier in a compact device with a lot more value.

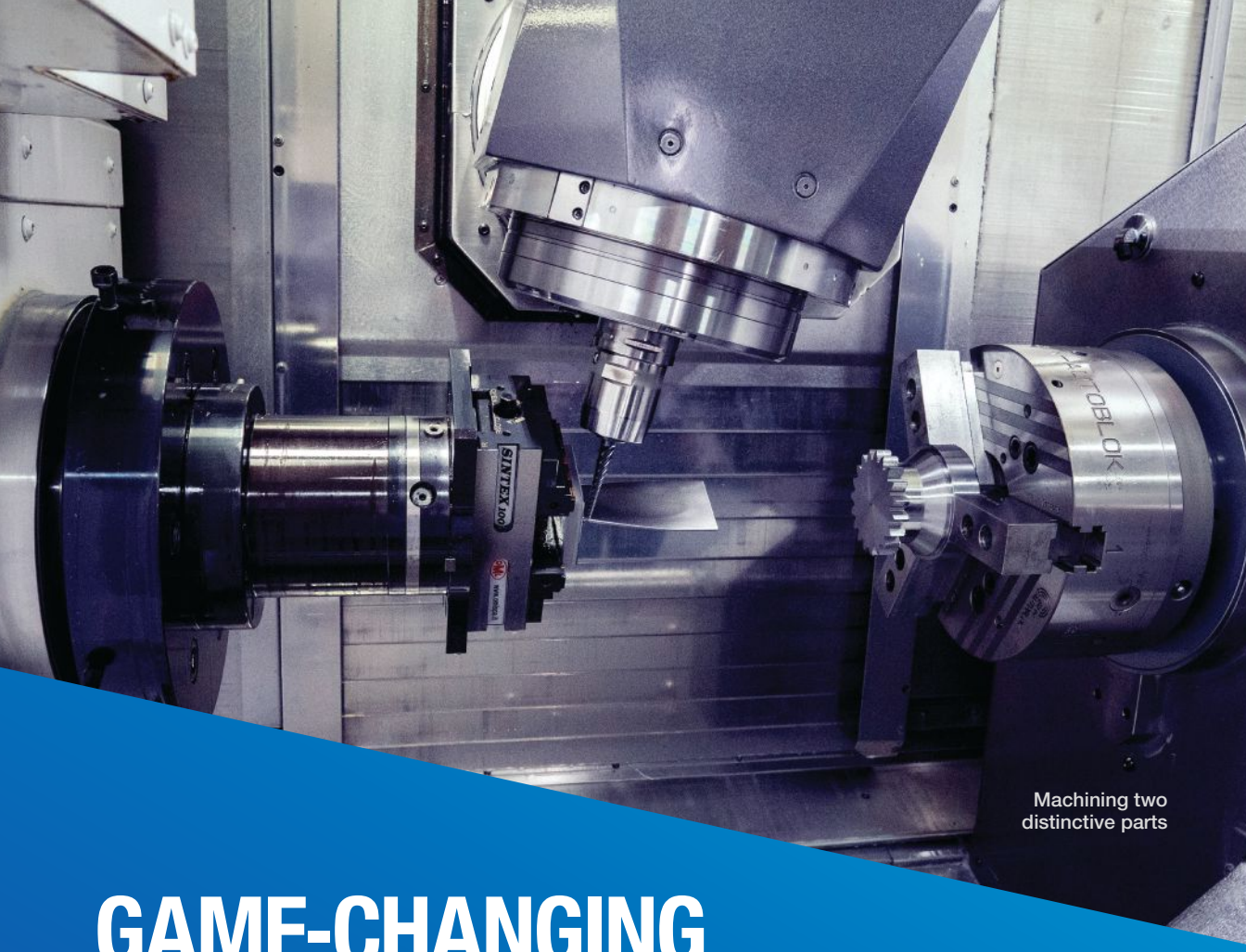
Photo Credit: Mahr Inc.

Despite the rugged design, putting any electronic device on the shop floor at the point of manufacture is always a bit of concern. Similar to a touchscreen phone, digital comparators eliminate buttons, which can be a major source of potential contamination. A sealed touchscreen bezel, even operated with gloved hands, eliminates sources of ingress, and with the marking under the glass, there is no chance of the labeling being erased by harsh chemicals.

Features typically delegated to bench amplifiers or electronic column gages now fit into a compact but powerful, all-in-one readout device.

Most digital comparators also incorporate dynamic measurement capabilities, including minimum, maximum and total indicated reading (TIR) functions. The comparator "remembers" the highest and lowest points measured on a part and displays either or both or subtracts the minimum from the maximum to calculate TIR. This is useful when gaging round parts in a V-block fixture or measuring the height of a flat surface. The operator can quickly turn a shaft through a complete revolution or move a flat part around under the gage head without pausing to read the display. When manipulation of the workpiece is complete, the operator may select to display the maximum or minimum ID, OD, height, depth or runout.

Other advanced functions can speed gaging »



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setups. The "auto-zero" function is the electronic equivalent of the rotating bezel on mechanical dial indicators: the operator brings the gage head into rough contact with the master and simply zeroes the comparator, eliminating the need for ultra-careful positioning of the gage head. A "master deviation" function enables the addition of a known master offset to the zero setting. Say your spec calls for a nominal dimension of 1.99980 inch, but you've only got gage blocks handy for 2.00000 inches. No problem. Simply set your zero at 2.00000 inches, master the gage, program in a deviation of +.00020 inch to all measurements and voila! Quick and easy mastering without the hassle of post-measurement arithmetic.

Furthermore, a "preset value" enables switching between comparative and absolute measurements. In other words, instead of gaging deviation from the nominal, the comparator displays actual part dimensions. (In the above example, if a part is 0.00010 above nominal, the display will read 1.99990 inch.)

The digital comparator also enables the user to establish tolerance limits, and some incorporate green, amber and red lights to indicate "in tolerance," "approaching limits" and "out of tolerance" conditions. Data can be transmitted to data collection systems through digital output ports. These digital output ports represent a great benefit of modern comparators. With some integrated wireless features built-in, they can eliminate the need for wired cabling and transfer data directly into data collection systems.

However, not all digital comparators incorporate the features listed here. When selecting a new comparator, one can readily identify the product features needed to meet the requirements of the application. For those currently using high-resolution dial indicators or dial comparators, it may be worthwhile for the performance of a digital comparator to determine if the process may be updated and improved and provide more information for the user.

AUTHOR | George Schuetz
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Automatic Sizing Adjustments for High-Volume Lathe Work

Keeping operators from having to manually make sizing adjustments will free them up to do other things for as long as each finishing tool will last, regardless of how many sizing adjustments it requires.

MIKE LYNCH | COLUMNIST

All cutting tools start to wear from the very first workpiece they machine. As the tool machines, a small amount of material wears from its cutting tool edge(s). This causes machined surfaces to grow (or shrink) in the direction of the cutting edge(s).

With small tolerances, machined surfaces will grow or shrink to the point that they approach a tolerance limit long before the cutting tool gets dull. When this happens, a sizing adjustment must be made. With long running jobs, CNC operators get pretty good at remembering how many workpieces can be machined before a sizing adjustment is required, as well as how many workpieces can be produced before a cutting tool gets dull. While this is the case for any kind of CNC machine, it is especially true with multi-bar-fed turning centers that can run unattended for long periods of time. If not for dull tools and the need for sizing adjustments, the machine could run for many hours — possibly — without an operator.

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While there is not much you can do about the need to replace dull tools, this article will show a way to keep operators from having to manually make sizing adjustments, which will free them up to do other things for as long as each finishing tool will last.

This technique requires that you know the same kinds of things mentioned earlier about how cutting tools behave. For example, say you know the new finish turning tool in turret station number 5 can machine 50 workpieces before a diameter sizing adjustment of X-0.0003 inch must be done. And after each additional 50 workpieces, another X-0.0003 inch sizing adjustment is required. And you know the cutting tool can last for 300 workpieces before it must be replaced. Note that many companies provide this kind of information for long-running jobs in production run documentation so operators know how to deal with cutting tools.

Consider this program segment that commands the sizing adjustments to be done automatically:

- 00001 (MAIN)
- .
- .
- N250 T0505 M42 (Finishing turning tool)
- N255 G96 S500 M03
- N260 G00 X3.0 Z0.1 M08
- .
- .
- (Finish turning tool finish machining)
- N265 G65 P9030 T5.0 W50.0 D300.0 A-0.0003 V542.0
- N270 M01
- N275 T0606 M42 (Next tool)
- .
- .
- N600 M99

Look at line N265. It is after the cutting tool's machining commands and just before the next tool is commanded and calls a custom macro. The arguments (variables) in the command specify how sizing adjustments must be made based upon our proven method.

Arguments:

- T: Wear offset number for sizing adjustments
- W: Number of workpieces before each adjustment
- D: Number of workpieces before dull tool
- A: Adjustment amount and polarity, negative in our example for external turning »

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• V: Permanent common variable number used for counting

Arguments T, W, D, A are self-explanatory and values have been set as described above.

Argument V specifies the permanent common variable number (#542 in our case) that will be used to count the number of workpieces prior to a sizing adjustment and the number of workpieces prior to the cutting tool gets dull.

A few notes about the application:

• During setup, the setup person must manually set the value of the permanent common variable (again, #542 in our case) to the number of workpieces the cutting tool can machine before it gets dull (argument D, 300.0 in our case).
• This variable counts down. An operator can monitor the value of this variable to know how many workpieces can yet be machined before the cutting tool gets dull.
• When the counter reaches zero, a dull tool alarm will sound that stops the machine and places the message (REPLACE/INDEX INSERT) on the display screen.
• When this happens, the custom macro resets the counter (to the value of the D argument).
• To continue, the operator replaces/indexes the insert and must restart the program from the next tool (the tool after turret station 5 in our case).
• This custom macro makes sizing adjustments for diameters. It could be modified to additionally handle critical faces.
• Only use this to make automatic sizing adjustments for finishing cutting tools that require sizing adjustments. If this is required of more than one finishing tool, simply include another call to the custom macro.
• If you wish to provide a dull tool alarm for tools that do not require sizing adjustments (like roughing tools), make argument W the same as argument D.
• The custom macro calling command (G65 command) must be placed after the cutting tool does its machining in order for the countdown variable to work properly.

AUTHOR | Mike Lynch
Founder and President, CNC Concepts Inc.

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Mastering Stainless

When getting a grip on stainless steel, make sure you are very specific in how you talk about it and understand the pertinent information you need.

JOHN MILLER | COLUMNIST

Reader Question:
Our shop has grown from primarily aluminum machining to now working in a diverse range of materials. Some we've figured out quickly, but stainless steel seems to be the most difficult for us to master. Can you offer some advice on managing tool wear in stainless?

Miller's Answer:
Your struggles are understandable. In my opinion, of all materials we are faced with as machinists, stainless steel is the most difficult to understand. Nonferrous materials are easy to machine, while irons and carbon steels are, if nothing else, predictable. Super alloys are very difficult, but by comparison, the portfolio of materials under this umbrella is much smaller, so there is less to solve, and you know it will be difficult. Stainless has the unique position of a diverse range of alloys, but also being very sensitive to the processing of that alloy. This means stainless steel as a genre can be uniquely described as being soft or super hard, free machining or gummy, as well as cheap or expensive.

Due to this diverse genre, the most important thing when trying to get a grip on stainless is to make sure you are very specific in how you talk about it. I find machinists often oversimplify stainless as a singular type (304, 416 and so on) without understanding the more pertinent information they need, or their tool vendor needs to help them.

To solve the problem of discussion, it can be simplified to classification, special characteristics, forming type and hardness.

Classification is simply the alloy's name, and it gives us some general information. This would be 304, 416, 17-4 and so on. You may also see terms such as austenitic, martensitic, ferritic, precipitation hardened and duplex used. These rank from easiest to machine to hardest, respectively, and refer to the family of alloys based on them.

Special characteristics are those letters you see after the alloy number. 304"L" and 316"L", for example, are low carbon versions of the same base alloy, while "H" would be high carbon. Some alloys have added sulfur to enable more efficient chip breaking as well. Therefore, if you have a baseline recommendation from a speed and feed chart for a certain material, you can use these special characteristics to tune it.

After establishing the alloy, the **forming type** is the most important — and most overlooked — aspect when discussing stainless steel. The problem of ignoring the forming type is that an alloy like 316 can be annealed (heat treated to reset the material to its base hardness), or it can be forged (or cold rolled), and work hardened up to more than double its original hardness. Therefore, it's not enough to simply say "it's 316L" and expect a magical combination of speeds and feeds. The cutting solution for something at 180 Brinell is entirely different than something at over 400.

Lastly, **hardness** is as simple as the above point. When in doubt about the material, just find the real hardness from the material certification and base your starting speeds and feeds there. A softer stainless can be treated more like a low-carbon steel, and a harder one has many parallels to titanium. There may be some further tuning required if you witness premature tool wear, especially chipping and built-up edge. However, those are much easier to solve as you refine your process, rather than scratching your head with the wrong initial cutting parameters.

Once you are talking about stainless with the right mindset, next you must address process specific issues that could be hindering your performance, or ability to adapt to stainless steel and its many forms.

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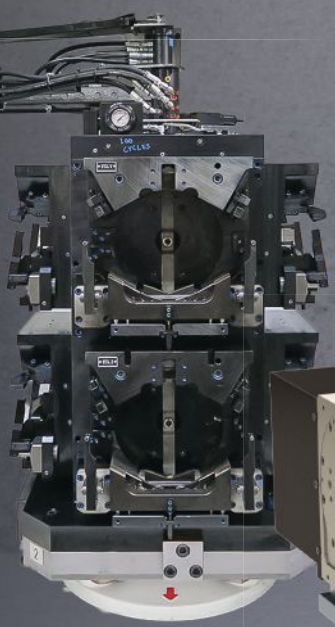

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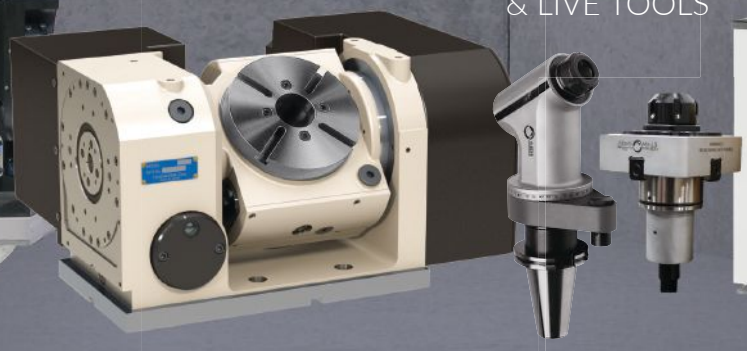

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machining or minimum-quantity lubricant (MQL), you can continue with these processes, but be aware of new potential for built-up edges compared to standard steels. If coolant is used, it must be applied in large amounts. High pressure and volume are a must with any material that makes long chips, and especially when those chips are considered sticky. If you feel your coolant is inadequate for the task, it may be time to upgrade that system, or look into a machine with through-spindle coolant.

Next is to explore your tooling. For the most part, end mills can cover a broader range of materials. There is a lot of overlap for steel and stainless-steel solid end mills and drills. However, for inserted tools, whether it's turning or milling, you will need to source material specific inserts. Due to the gummier nature, a dedicated insert for stainless will be slightly sharper to combat this and reduce the cutting forces for harder applications, thereby reducing chatter and protecting the machine long term.

While it may not be technical, some headache you may be experiencing is administrative in nature. Being late on an order because of mishaps at the machine is a pain and will make the mastery of stainless feel more cumbersome. Planning for this new venture with some sensible spare tooling will go a long way. A shop should also allow adequate time for jobs at first, until you get your standard processes settled in. Lastly, make sure your people are a part of this as well. Any new business strategy takes time to develop, so while some may see training events as time away from the shop, that small time away from the shop can shorten the learning curve in a big way.

Do you have a machining question? Ask the expert. John Miller leans on more than a decade of industry experience to answer machining questions from *MMS* readers. Submit your question online at mmsonline.com/MillersEdge.

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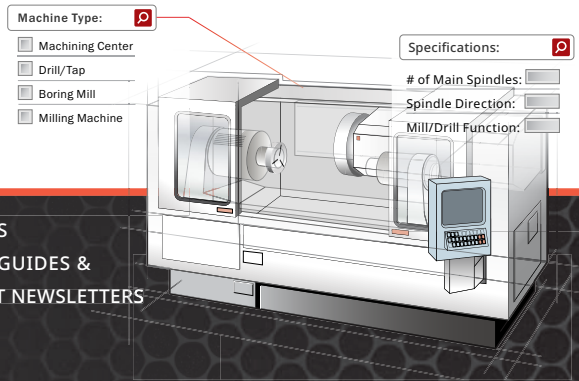

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Incorporating AFSD Into Hybrid Manufacturing Processes

Additive friction stir deposition (AFSD) is a new, solid-state additive manufacturing process that provides an alternative to beam-based AM processes.

TONY SCHMITZ | COLUMNIST

Hybrid manufacturing combines additive manufacturing (AM) to deposit a preform, metrology to determine the geometry of the printed preform and CNC machining to obtain the final part geometry, surface finish and tolerances. Hybrid manufacturing process planning can include seven key steps: 1) digital part design; 2) path planning for the AM process; 3) metal deposition using AM to produce the preform; 4) measuring the preform to determine its geometry and identify its coordinate system using available (for example, the edge of the build plate) or added (for example, tooling spheres) features or fiducials; 5) path planning for CNC machining by importing the measured preform geometry and using it as the stock model with its predefined coordinate system; 6) CNC machining the preform to its design dimensions and surface finish using the coordinate system established by the fiducials; and 7) measuring the machined part to ensure conformance to design.

A new AM process is additive friction stir deposition (AFSD). AFSD is a solid-state AM process that provides an alternative to beam-based AM processes, which melt the material locally to obtain the desired near-net shape geometry. AFSD accomplishes solid-state deposition through plastic (permanent) deformation of a square cross-section, ductile metal alloy feedstock. A tool-spindle assembly containing a square bore constrains the feedstock as it is fed axially through the spindle and rotated against the build plate or previous layers. Spindle rotation provides heat generation through friction between the deposit and build surface and, subsequently, a reduction in the stress required to flow the material. The feedstock is deposited during movement of the tool at the selected tool feed velocity along the prescribed motion path. The feedstock feed velocity through the tool spindle is also specified. The combined tool rotation and feed motion enable layers to be bonded to the build plate and previous layers to deposit the desired preform geometry; see Figure 1.

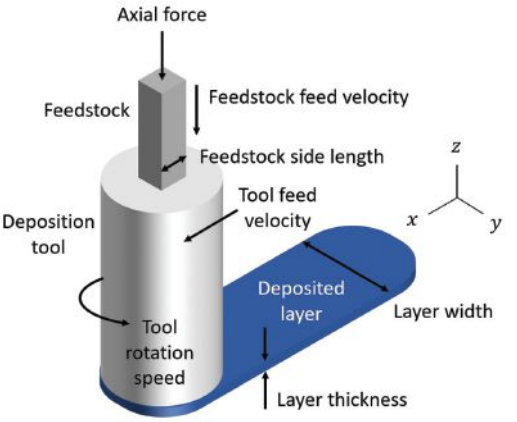

Figure 1: AFSD where the feedstock is deposited in a layer-by-layer fashion to obtain metal preforms.
Figure Credit: Tony Schmitz

To demonstrate hybrid manufacturing using AFSD, structured light scanning (to measure the preform geometry) and CNC machining, a hexagon-cylinder geometry was selected and a demonstration part was produced. AFSD was completed using a Meld Manufacturing L3 machine. As shown in Figure 1, 9.5-mm square metal feedstock was forced through a rotating spindle using a screw-type actuator located above the spindle. The actuator enables rotation of the 0.5-m long feedstock with the spindle while simultaneously providing the axial force and material feed against the build plate or previous layer. The printed material is constrained axially by the gap between the rotating tool and build plate/previous layer (1 mm to 3 mm). Milling was completed using a Haas VF-4 three-axis CNC milling machine. Turning was completed using a Haas ST-15 CNC lathe. Structured light scanning was performed using a »

Zeiss/GOM ATOS Q.

The hexagon-cylinder processing sequence included a two-sided 6061 aluminum deposition and intermittent machining approach. The hexagon was deposited first on a square, 25-mm thick 6061 aluminum build plate. The origin was set at the build plate top corner for the helical interpolation tool path to generate the hexagon shape using a 2-mm layer height. On the L3 machine, the spindle and edge finder were used to set the work coordinate system at the build plate top corner. Deposition then proceeded on the top surface of the build plate, which was clamped to the machine table using four toe clamps. The initial layer was deposited using a spindle speed of 300 rpm, material feed rate of 139.7 mm/min, and tool feed rate of 132.1 mm/min. Subsequent layers were deposited at 160 rpm with the same feed rates.

After deposition, the hexagon preform and build plate were scanned. The part design and preform were then aligned using the origin at the build plate bottom corner and the milling tool paths were generated by CAM software with the imported scan used as the stock model. The build plate was clamped in a pair of pre-aligned vises on the CNC milling machine table. The machine probing cycle was used to set the work coordinate system at the build plate bottom corner and the milling tool paths were completed to produce the desired hexagon geometry. Finally, the hexagon was inverted and the extra build plate material was machined away to obtain the final hexagon dimensions. This inversion and machining step in a second vise setup motivated the location of the origin at the bottom of the build plate for the first setup. When turned over, the origin was located at the top of the part and could conveniently be identified using the machine probing cycle to set the new work coordinate system.

To read the full column and see photos of the hybrid manufacturing process in action, visit gbm.media/afsd-0124.

AUTHOR | Tony Schmitz
Professor, University of Tennessee, Knoxville
Joint Faculty, Oak Ridge National Laboratory

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Metalworking Activity Remained on a Path of Contraction

Steady contraction of production, new orders and backlog drove accelerated contraction in November.

jschafer@gardnerweb.com

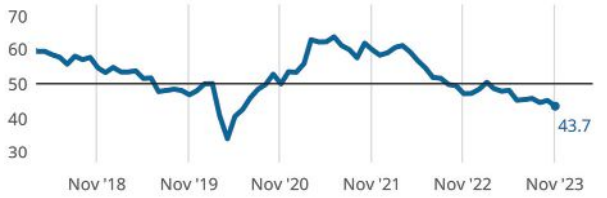
Jan Schafer, MBA
DIRECTOR OF
MARKET RESEARCH
GARDNER INTELLIGENCE

Jan is an established professional in research and analysis. Her insights have been informing business decisions for 30+ years and guiding Gardner Intelligence for over seven.

The path has not been direct, but the trend is consistent, with metalworking activity contracting since March 2023. November was no different, closing at 43.7, down 1.7 points relative to October.

Steady contraction of three closely connected components — production, new orders and backlog — drove accelerated contraction. Employment held its own, contracting at the same level since its first real contraction in August, still to a lesser degree than all the other components. Exports were similarly steady in contracting, and supplier deliveries lengthened again in November, but at a slower rate.

METALWORKING GBI



Metalworking GBI zigzagged down again in November.

PRODUCTION, NEW ORDERS AND BACKLOG

The three most direct drivers of metalworking activity posted accelerated contraction in November, which they have done fairly consistently since March of 2023 (3-MMA = three-month moving averages).

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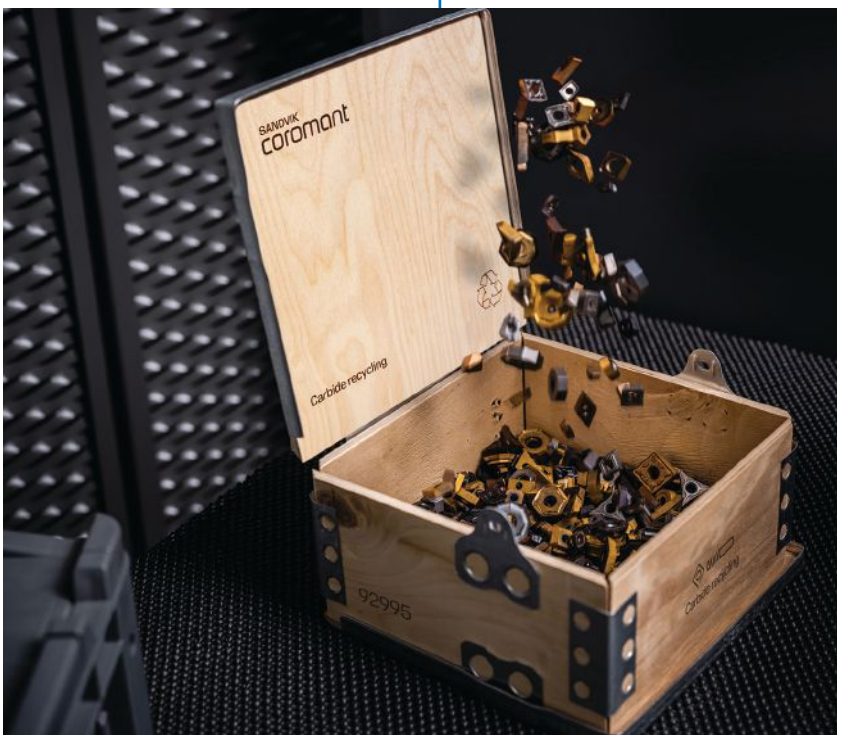

Photo Credit: Sandvik Coromant

Sandvik Coromant Furthers Sustainability Commitment

Sandvik Coromant has committed to near-term, company-wide emission reductions in line with the Science Based Target initiative (SBTi) as part of the organization's commitment to reducing its greenhouse gas emissions and practicing responsible manufacturing.

A collaboration between global nonprofit CDP, the United Nations Compact, World Resources Institute (WRI) and the WorldWide Fund for Nature (WWF), SBTi defines and promotes best practices in emissions reduction and net-zero targets in line with climate science. The initiative works alongside businesses to help them take the necessary steps to reduce carbon emissions.

Alongside the wider Sandvik Group, Sandvik Coromant first committed to set targets in line with the SBTi's criteria in December 2021, beginning a rigorous validation process during which the SBTi worked with the team to help update its targets. Now, following validation from the SBTi, Sandvik Coromant is working toward several revised sustainability goals.

First, the organization is committed to reaching net-zero. When considering net-zero, greenhouse gas emissions are split into three scopes. Sandvik Coromant plans to reach net-zero for scopes one and two — which include emissions produced directly within Sandvik Coromant's operations and those produced indirectly through heating and power — by 2035. It aims to reach net-zero for scope three emissions — those that result from activity »

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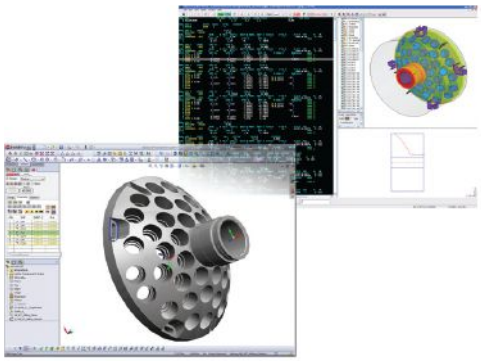

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that takes place beyond facility walls, such as the production of raw material and emissions generated through the supplier network — by 2050.

Sandvik Coromant is also working to become more than 90% circular by 2030. The company's third sustainable business goal relates directly to people, with a pledge for women to make up a third of Sandvik Coromant's management team by 2030.

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Emuge-Franken End Mill Receives ANCA's Tool of the Year Award

Emuge-Franken USA has announced that the research and development team at the company's global headquarters won the ANCA 2023 Tool of the Year Award. Emuge-Franken received the award for its specialized, accurate and versatile tool based on the new Franken Cera-Cut end mill design and manufacturing from a combination of carbide and ceramic. Each year, ANCA invites cutting tool manufacturers to compete for the most innovative cutting tool, demonstrating expertise in design and production using ANCA technology.

ANCA reportedly selected the Franken end mill due to it being the closest to the specified nominal tolerance in terms of diameter and profile among all the competitive tool submissions. Also, the Franken end mill is said to have delivered the best results in the profile and 3D edge radius measurements.

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Walter AG Partners With Heller to Integrate Machining Solutions

Walter AG and Gebr. Heller Maschinenfabrik GmbH have entered into a technology and development partnership. The collaboration focuses on integrated customer solutions for the machining industry. The companies aim to test, optimize and market their products through the joint development of sustainable machining processes.

The two CEOs of the Germany-based companies say they are looking forward to working closely together and are convinced that this is a win-win strategy. Heller CEO Thorsten Schmidt says, "Walter is an excellent technology partner with extensive tooling expertise and a wealth of

experience in machining. In addition, Walter provides the necessary tooling technology to give Heller's customers a direct productivity advantage in metal cutting. Together with the strengths that Heller brings to the table, we are able to forge a strong partnership in the areas of development and technology."

Christoph Geigges, president of Walter, says, "We see many opportunities in working with Heller, as they have the knowledge and experience in setting up and machining various workpieces, as required. Together, with our large assortment of cutting tools, we can provide the ideal package for customers. To work with Heller on specific application projects, covering components in the automotive and aerospace industries around the world, is an exciting development which will bring benefits for all parties."

Walter has reportedly been a partner with Heller for many years, both as a customer and as a supplier. Several Heller machines are already in use at its technology centers and production facilities.

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ModuleWorks and Mitsubishi Electric Announce Partnership

ModuleWorks has announced that Mitsubishi Electric has joined its Strategic Partner Program.

According to ModuleWorks, the Strategic Partner Program represents a commitment to driving the development of intelligent, integrated manufacturing solutions by fostering collaboration and innovation between ModuleWorks and key technology providers. Mitsubishi Electric is the latest addition to the growing network of partners.

Mitsubishi Electric has previously collaborated with ModuleWorks on its shopfloor digitalization strategy. By joining the Strategic Partner Program, Mitsubishi acquires a minority investment in ModuleWorks equity, which enables both companies to further their cooperation and accelerate »

the development of Mitsubishi's next generation automation and industrial control solutions.

"As part of our business strategy for factory automation systems, we aim to help solve diverse challenges in modern society," says Toshie Takeuchi, president of the Factory Automation Systems Group at Mitsubishi Electric. "As a result of this agreement for partnership and investment, we expect to deliver solutions that are easier for customers to use, and thereby help to address challenges such as labor shortages and knowledge transfer throughout the engineering chain."

"We are delighted to have Mitsubishi Electric join our Strategic Partner Program," says Yavuz Murtezaoglu, founder and managing director of ModuleWorks. "Working in close partnership accelerates technological development and drives digital transformation in manufacturing. We look forward to exciting new developments in our technologies."

- **Mitsubishi Electric Automation | 847-478-2500**
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- **ModuleWorks GmbH | +49 241 9900040**
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Kennametal Partners With American Precision Museum

Kennametal Inc. has announced its partnership with the American Precision Museum (APM) in Windsor, Vermont — home to one of the largest collections of historically significant machine tools in the country.

As part of this collaboration, APM is showcasing Kennametal tools in its makerspace, where visitors can explore and learn about different machining solutions. Kennametal will also contribute to historical exhibits showcasing the contributions of the company's founder, metallurgist Philip McKenna, and Kennametal's legacy in the manufacturing industry overall.

"Our partnership with APM is a natural fit to tell Kennametal's 85-year story of expertise and innovation across industries, while also showcasing where we're headed next," says Keith Mudge, Kennametal vice president of sales — Americas. "We hope our sponsorship will help APM continue its mission to inspire future generations of innovators with the help of our tooling solutions."

"It is particularly fulfilling to be supported by a world-class innovator of machining solutions. We look forward to »

presenting the story of Philip McKenna's development of tungsten carbide, and we are very fortunate to have Kennametal's ongoing support as we attempt to inspire next generations to develop careers in manufacturing," says APM Chairman Lee Morris.

Located at the renovated Robbins & Lawrence Armory in Windsor, Vermont, which is said to be the founding space for precision interchangeable parts in the U.S., APM focuses on using history as a learning tool to talk about modern concepts and technologies, while exploring today and imagining tomorrow. While its mission to inspire generations includes today's youth with a presence in over 45 schools through an education program, APM also focuses on workforce development, employment and more.

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Motion Industries Appoints New VP of Automation Group

Motion Industries Inc. has appointed Mike Esposito to group vice president of Motion Automation Intelligence.

Most recently, Esposito served as director of Motion Automation Intelligence's Engineering Assembly Solutions (EAS), having joined Motion as part of the Kaman Distribution Group (including Kaman Automation) acquisition. With over 25 years in industrial automation and manufacturing, Motion says he has developed a systems approach along with deep, cross-functional experience as an automation consumer, producer and supplier. Esposito's experience has enabled the development of solution-driven teams focused on positioning customers and internal stakeholders to be successful. Prior to joining Motion/KDG, he held senior management roles at iAutomation, CDF Corporation and SencorpWhite.

Motion Automation Intelligence solution technologies include robotics, motion control, machine vision, digital networking/IIoT, industrial framing, pneumatics and custom mechatronic systems. In his new role, Esposito will lead the Motion Automation Intelligence team, and his responsibilities will include the development and implementation of multiyear strategic business and marketing plans. He will report to Joe Limbaugh, Motion's executive vice president and chief operation officer.

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THE BENEFITS OF A CONNECTED SHOP ARE MORE ACCESSIBLE THAN EVER

RYAN KELLY | General Manager of AMT's San Francisco Tech Lab

In the second episode of Season 2 of the IMTS+ Original Series "Smart(er) Shop," brought to you by Autodesk, you'll discover how an accessible modern digital workflow provides big benefits to small and medium-sized shops.

In the episode, I visit Adam Allard, senior manager of technical environments at Autodesk Research, who oversees Autodesk Technology Centers in Toronto, San Francisco and Boston. I call on Allard in the shop at Pier 9, officially known as the Autodesk Technology Center in San Francisco. The shop uses many of the same CNCs found in industry for its applied technology research, and Allard's team members explain the benefits of a connected shop.

COLLISIONS ARE INEVITABLE — OR NOT?

With the world at an inflection point where implementing digital technology is easier than ever, the Autodesk team demonstrates the risk of clinging to a traditional workflow, such as a sticky note with the post processor written on it or transferring data with a USB. That workflow doesn't communicate anything about the machine setup, the fixtures, the tools, the part or its orientation. Hoping all the data gets manually entered correctly is not the best strategy and will likely lead to damaged tools, spindles, scrapping parts or worse.

"If you have a fleet of similar but not identical machines, it's only a matter of time before you accidentally load a setup for machine one into machine two, and then welcome to collision city," says Orion Beach, CNC machine shop supervisor at Autodesk Technology Center in San Francisco.

The shop at Pier 9, officially known as the Autodesk Technology Center in San Francisco, is the site of S2 E2 of "Smart(er) Shop."

IT'S LIKE A PRINTER DRIVER

When it comes to a "smarter shop," software such as Fusion 360 is the foundation because it enables an operator to select an output folder, select a post processor and then export data for tools, parts, fixtures and stock with simple clicks (it's similar in spirit to a printer driver). Communication between the machine and the software enables an operator to run simulations to verify the setup, preventing such mistakes as selecting the wrong tool.

Most importantly, a digital workflow can save 20 minutes to several hours on a single setup, improving margins and allowing more competitive bidding for smaller shops.

"Large manufacturers also benefit," adds Alana Mongkhounsavath, strategic relationship development manager at Autodesk Research. "In my experience, I had to do Gemba walks to make physical rounds and physically collect data. With a connected shop, some of that data is already on my PC."

To end the episode, the team summarizes how to connect a shop in four simplified steps and shows a plug-and-play solution that allows a small shop to get connected using a cellular modem — and take a hard pass on the sticky notes and USBs.

Watch Episode 2 at **IMTS.com/SmarterPier9**, and watch all episodes at **IMTS.com/SmarterShop**.

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SMARTER SHOP

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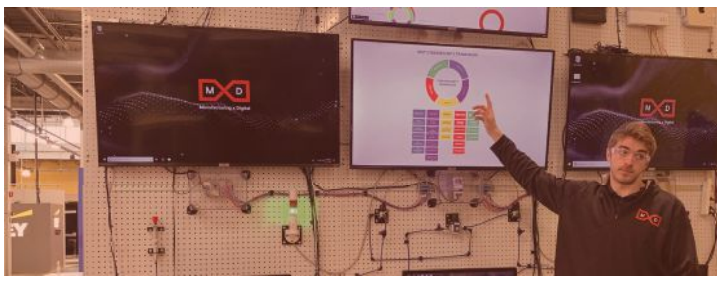
Get more effective and easy-to-implement solutions that will improve your shop floor immediately in Season 2 of **Smart(er) Shop, brought to you by Autodesk.**

This season, co-hosts Ryan Kelly and Adam Allard tackle cybersecurity at MxD, explore connected shops at Autodesk Technology Center at Pier 9, and discover quality control solutions with Rapid Robotics' rental robots paired with an AI-driven vision system. **Now playing on IMTS.com!**



WATCH SMART(ER) SHOP
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‘NOT YOUR TYPICAL MADE-IN-THE-USA JOB SHOP’ RESHORES WITH AUTOMATION

HARRY MOSER | Founder/President, Reshoring Initiative

The hazards of supply chain gaps and the advantages of domestic manufacturing became crystal clear during the pandemic, compelling companies to innovate and reshore production back to the United States.

Reshoring and foreign direct investment (FDI) manufacturing job announcements are outpacing recent records, adding 101,500 jobs in the first quarter of 2023. If the current rate continues, new job announcements will reach over 400,000 by the end of the year.

“NOT YOUR TYPICAL MADE-IN-THE-USA JOB SHOP”

Some 30-odd years ago, when I was president of Charmilles, an EDM machine tool supplier, I had the good fortune to be involved in the sale of EDM machines to the New England Die Company Inc. (NEDCO). That’s when I first met its president, Joe Almeida.

“It’s not uncommon to get panicked calls hoping we still make tooling, carbide tooling, polished carbide tooling,” Almeida told me recently. NEDCO produces tungsten carbide and hardened tool steel tools, plus some aluminum and plastic components. “I’m not your typical made-in-the-USA job shop,” Almeida says. “Business has been good for NEDCO.”

U.S. VERSUS CHINESE PRICING

China is the largest producer of carbide in the world by a wide margin, and it’s able to produce carbide products more cheaply without U.S. quality standards and stringent EPA environmental protections. China’s carbide product prices can range from 50%-75% cheaper than U.S prices.

NEDCO was finding it difficult to be competitive with Chinese prices, and long-standing customers were being forced to offshore to China to cut costs. One of NEDCO’s best customers was told by corporate to reduce spending by 25%. The buyer admitted the offshore quality was not good, but reluctantly offshored the work to China for the prices that satisfied the corporate budget.

A RESHORING SUCCESS STORY

Long-term manufacturing growth depends upon U.S. competitiveness and reshoring. With carefully chosen capital investment, process improvements and new technologies, manufacturers can increase capabilities, capacity and innovation, leading to new levels of efficiency, quality control and competitiveness. Building a competitive advantage unlocks more reshoring opportunities.

Almeida wanted NEDCO to become globally competitive and reshore its customers’ work, so he decided on a capital investment strategy and started working with Ryan Michels, regional sales manager for United Grinding North America. “Ryan was extremely knowledgeable and helpful in selecting the right machine and configuration for my shop’s needs,” Almeida recalls of his initial conversation.

Shortly after some trials and tests, NEDCO invested in a Studer S33 Universal Grinding machine with quick changeover capabilities that helped them achieve ROI — even with batch sizes of one or two workpieces. About one year later, the customer who offshored was so tired of reworking products from China that were “never right” that NEDCO was given a good-sized order for tools, still in small quantities.

“At NEDCO, the quantity had always been one,” Almeida says. “I looked at it as a new way of processing it with the new equipment investment. I was able to shave the cost over 25% while making more profit, and they bought on. He (the customer) told me, now they get a box of NEDCO tooling, and they gather around to open it up like it’s Christmas.”

Using the new automated machine with lot sizes of one, NEDCO cut labor hours per part by 90%. Manual labor took six to seven operator and machine hours per part. The Studer takes two machine hours and 0.5 operator hours

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Joe Almeida, president at NEDCO, and the Universal Grinding Studer S33.

per part. Scrap rate is down from over 10% to zero. Almeida has never scrapped a part on the machine. Automation enabled NEDCO to increase production while overcoming cost and skilled workforce availability issues.

Automation overcame two problems. First, pricing versus offshore. Second, skilled workforce availability. In the past, NEDCO had three skilled manual machine operators grinding these parts. All were lost to retirement, death or non-work-related injury. The Studer produces more per day than the three operators combined had achieved.

"I look at it strategically," Almeida says. "If you have a problem in China, where can you go to talk about repair, redesign? Are you going to travel 10,000 miles away? Battle language, equipment and quality barriers?"

Meanwhile, another one of NEDCO's customers made an economic decision to offshore to China when the margins got too tight on an arthroscopic tool for the medical industry. Almeida suggested he could be cost competitive. The customer was skeptical but willing to share the 1,000-piece order and Chinese invoice with NEDCO.

AUTOMATION HURDLES THE COST AND LABOR AVAILABILITY CHALLENGES

U.S. suppliers have typically kept the high-mix/low-volume work and lost the high-volume items to offshore. Through process improvements, innovation and new equipment, NEDCO was able to create a fixture that produced 30 tools at a time, compared to eight of the Chinese competitors, and produce them at a globally competitive price. NEDCO won the work and has since made over one million parts profitably. In total, work that has been reshored now totals 60%-70% of Almeida's business.

USE THE TOTAL COST METRIC

Total cost of ownership (TCO) is the best metric to use for comparative analysis. The Reshoring Initiative's TCO Estimator is an online tool that helps companies account for all relevant factors to compare the true total cost of domestic and offshore sourcing and siting. These factors include overhead, balance sheets, risks, corporate strategies and other external and internal business considerations. The factors Almeida mentioned (quality, travel and ease of communication of engineering and manufacturing) are included.

Using this information, companies can better evaluate sourcing, identify alternatives and even make a case when selling against offshore competitors. The impact of using TCO shows that shifting decisions from a price basis to using the free online TCO Estimator can be expected to drive reshoring of 20%-30% of what is now imported.

When new processes, technologies and strategies are factored into a reshoring project, companies can amplify resiliency benefits and reduce or even eliminate the offshore cost gap.

Learn more about reshoring at **IMTS.com/SupplyChain** and register now for IMTS 2024, Sept. 9-12, at **IMTS.com/Register**.

STRENGTHEN MANUFACTURING IN NORTH AMERICA

To learn more about the latest legislation updates and government resources, or how to convince your customers to reshore, contact Amber Thomas, vice president – advocacy at **Athomas@AMTonline.org**.

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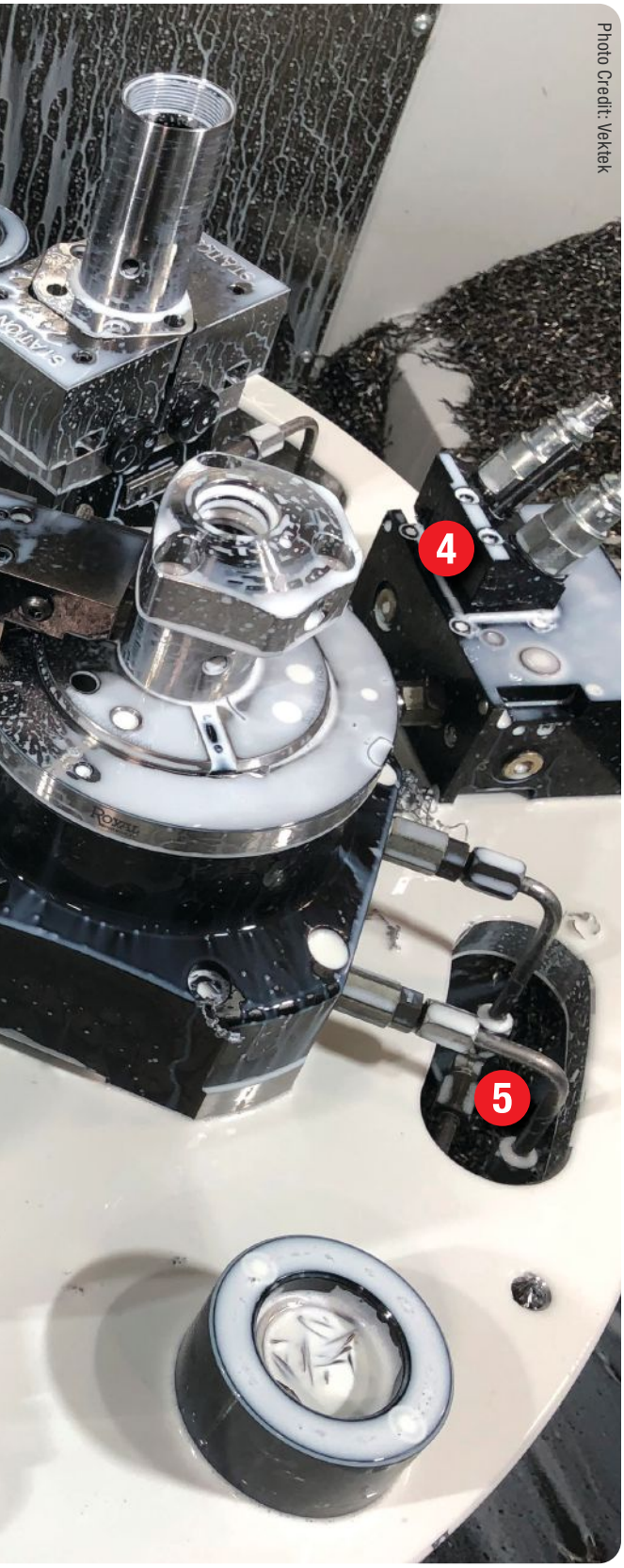


Photo Credit: Vektek

THE CUT SCENE

Machining Vektek Hydraulic Swing Clamp Bodies Using Royal Products Collet Fixtures

BRENT DONALDSON | EDITOR-IN-CHIEF

Vektek is known for hydraulic component engineering — specifically its high-pressure hydraulic holding products with automated clamping. Since these hydraulic clamps are required to be leak-free with precision fits and excellent surface finishes, Vektek needs to use repeatable and flexible workholding in its own production to machine and change parts quickly. Here's how the company uses Royal Products Power-Block Collet Fixtures (shown in positions 12:00, 4:00 and 8:00) to produce the set of parts shown here.

1 This is Op20 for the swing clamp body. The Power-Block collet chuck clamps on the OD of the cylinder where Vektek machines all the milled features. 2 This is a quick-change locating part that Vektek calls "the spider." On the ends are spring-loaded clocking pins that clock the part when the operator loads the body in the collet chuck prior to clamping in place. 3 This is Op30, when Vektek machines the bottom side of the swing clamp body, held in place with a hydraulic centering vise. It is clocked in an orientation, which requires enough tool clearance for an angled hole. The Power-Block collets for each station are designed to easily change to different swing bodies. 4 These are Vektek's pallet decouplers. The pallet decoupler has an internal pilot-operated check valve and accumulator that maintains clamp pressure. The operator connects hydraulics lines here, then activates its Advanced Workholding Pump to consistently clamp each station. There are three decouplers, so the table can be rotated to each station, allowing the operator to easily reach everything. 5 Hydraulic lines run under the plate to the corresponding chuck and vise to help reduce chip trap areas.

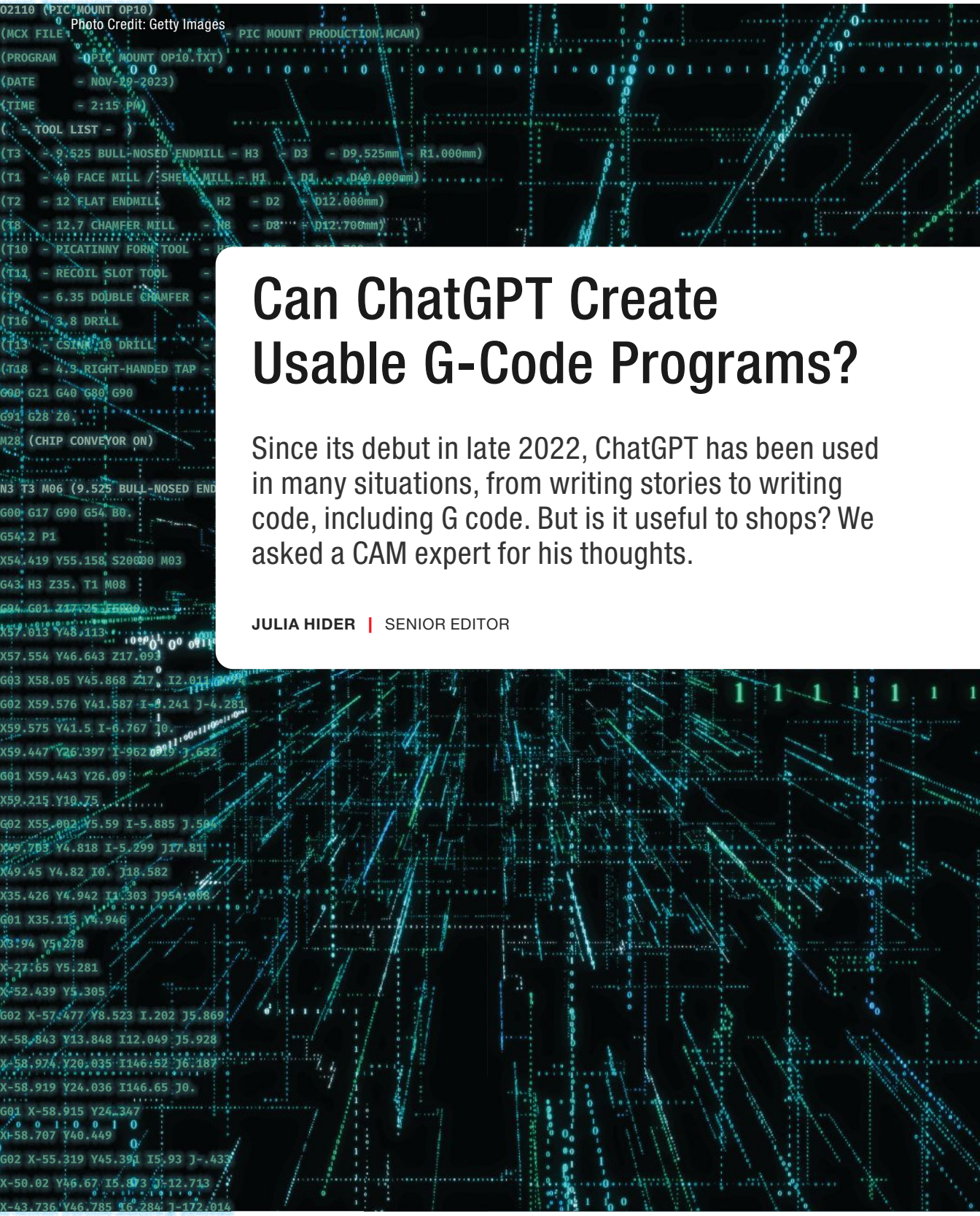


Photo Credit: Getty Images

Can ChatGPT Create Usable G-Code Programs?

Since its debut in late 2022, ChatGPT has been used in many situations, from writing stories to writing code, including G code. But is it useful to shops? We asked a CAM expert for his thoughts.

JULIA HIDER | SENIOR EDITOR

In early 2023, ChatGPT was everywhere, writing stories, articles, essays, recipes, poems — and code. The chatbot can create programs in a variety of languages, including G code. But are its programs any good? I spoke to a CAM expert who has tested ChatGPT's G-code programming abilities. Here's his take on what it can do now, and how AI might affect programming in the future.

Early Assessments

Mike Wearne is an educational content creator at CAMInstructor, which specializes in creating books, videos and online curricula covering CNC programming, Mastercam and SolidWorks for educational programs and manufacturers. As part of this, he has produced two videos (so far) on using ChatGPT for G-code programming. The first covered GPT-3, which was the latest version available to the public at the time. In the first video, he tests GPT-3's G-code programming capabilities by giving it simple tasks such as facing parts or drilling four holes evenly spaced one inch apart. Once ChatGPT gave him a program, he plotted the program with CIMCO Edit software to visually show the results, along with any issues in the code.

His take on the GPT-3 code? "If we use a basic program that's a 'drill four holes' sort of thing, and compare this to someone who's just learning G code, I would say it's not bad," he says. "I would give it a low B or a high C." The overall structure was there — it put the right codes in the right places, such as G20 and G21, to switch between metric and imperial units, and G90 for absolute positioning at the top of the program. "If you're new to G-code programming, those are usually the tough things to remember and to get in the right spot," he notes. However, it was missing some elements, such as tool changes and spindle speeds.

But GPT-3 has its limits. Notably, it can self-correct itself, but only to a certain point. Wearne says if you prompt ChatGPT to fix an issue in a program, it will make edits. But if you start a new chat or prompt for an entirely new program, you're starting from scratch. However, he thinks the biggest thing holding GPT-3 back is how much information users need to provide in order to get a good program, and how difficult it is for users to input this information. "For example, if you want to drill holes, you've got to tell it where the holes are, which size holes you want, what tool you're using, what material you're cutting and what kind of machine you're using," he says. "All of that is still very hard to get into a chat interface like ChatGPT." Users have to manually communicate all the information from a print into ChatGPT in a format it can understand.

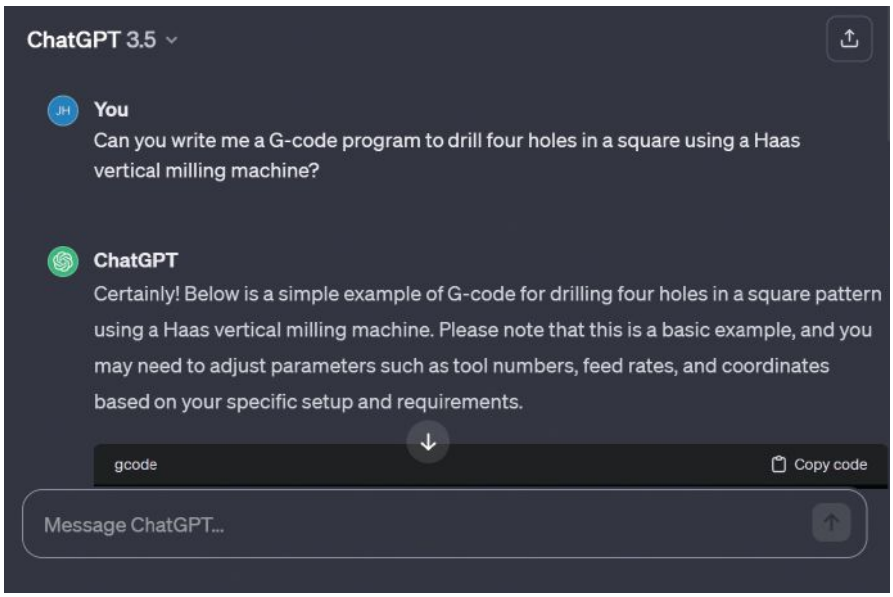


Photo Credit: Julia Hider, *MMS*

ChatGPT can, among other tasks, create G-code programs. Users of GPT-3.5, the latest version available free to the public, must communicate the information from a print via text so ChatGPT can understand it. GPT-4, the latest version available via paid subscription, enables users to upload image files, solving what CAM expert Mike Wearne says was one of GPT-3.5's biggest issues.

Raising the Grade

However, AI technology moves quickly, and while preparing this article, Wearne released a new video reviewing GPT-4's programming capabilities. (At the time of writing, GPT-3.5 is the latest version available for free, and GPT-4 is the latest version available to the public via paid subscription.) GPT-4 allows users to submit images, including prints, solving one of Wearne's biggest issues with GPT-3. "Describing your part through text was not really feasible," he says. "Uploading an image or print brings this much closer to being useful."

GPT-4 users can upload a variety of file types (including images and PDFs) into the interface, and from there, Wearne says the chatbot can tell what's been uploaded — the user just has to tell it what to do with the image. For example, if you upload a part file with four holes, you can tell ChatGPT to write a program to drill the holes. Wearne says it currently works for simpler parts and shapes. "Anything beyond that is not doable," he adds. "At least, not yet."

Wearne also noticed a marked improvement in the G code ChatGPT produces. "It's like GPT-4 can think more about its answers and GPT-3.5 just spits out whatever it comes up with as quick as it can," he explains. With its most recent update, Wearne says it can program simple parts almost perfectly. Whereas GPT-3 was getting a high C or low B as a grade for its code, "For the simple parts, if we're in G-code 101, GPT-4 is getting an A," he says.

Extra Credit

According to Wearne, the next step ChatGPT needs to make in G-code programming is tool motion during a cut. He adds that, on its own, this might be too complex for ChatGPT to handle. "I'm not sure it would be able to produce something like a dynamic milling operation on a large pocket," he notes. "The amount of code it would

The quality of the code ChatGPT produces varies by version. Wearne says, in general, he'd give GPT-3.5's code a high C or a low B for a grade. The overall structure is correct, but it's missing elements such as tool changes and spindle speeds.

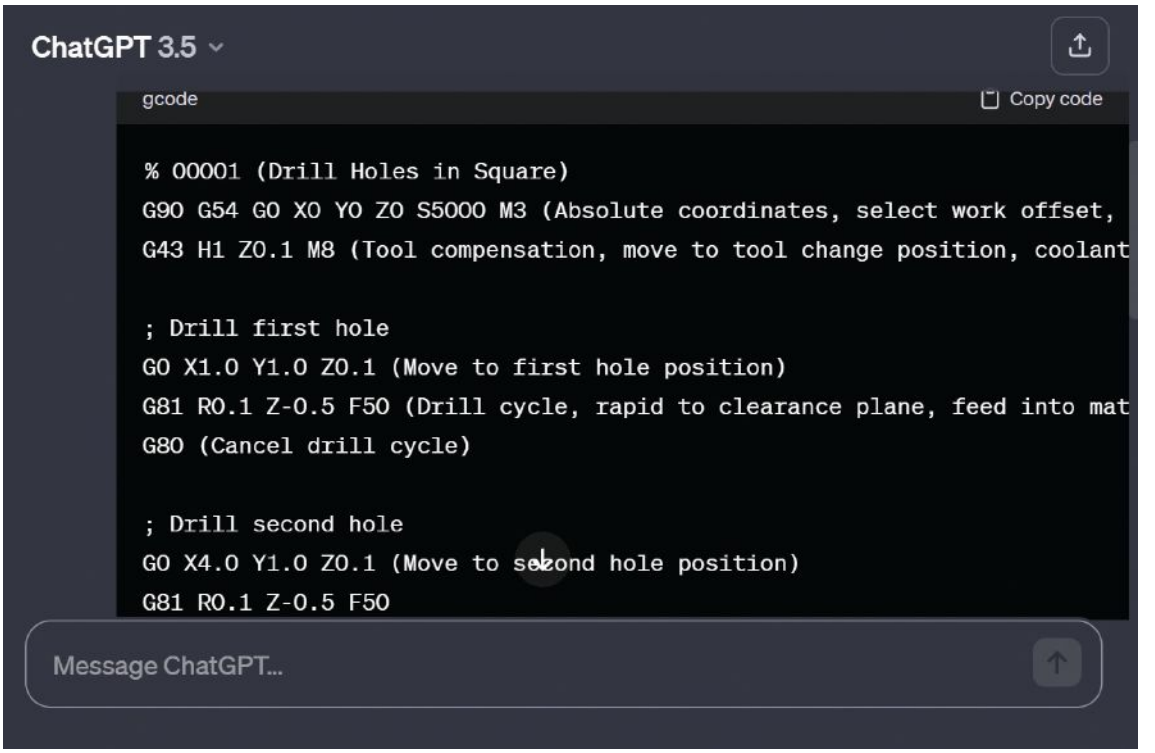


Photo Credit: Julia Hider, *MMS*

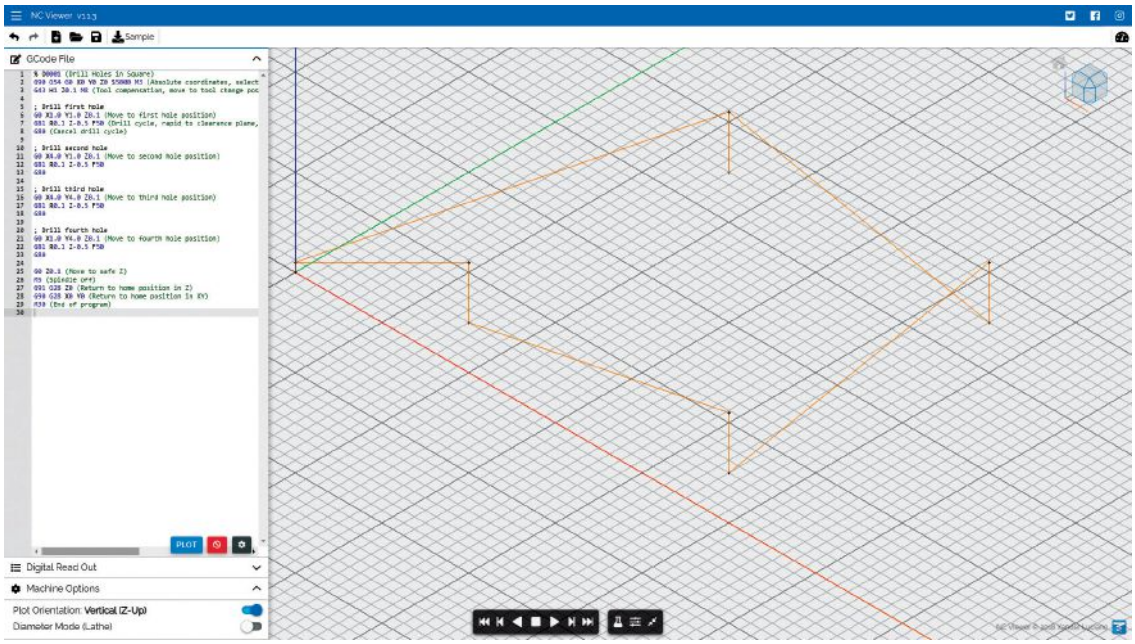


Photo Credit: Julia Hider, *MMS*

GPT-3.5's code plotted in a G-code simulator. Wearne says GPT-4's ability to write G code much better than 3.5. "For the simple parts, if we're in G-code 101, GPT-4 is getting an A," Wearne says.

need to generate would likely be beyond its scope." But integrating ChatGPT with CAM programming software such as Mastercam could provide the resources needed to generate complex toolpaths. "But then again, I don't think attempting to cut complex parts with GPT is the best use case for it," he says.

Wearne has found other uses for ChatGPT in manufacturing. "It can give you ideas for things to try, especially if you're stuck on something," he says. He believes ChatGPT is particularly helpful in creating macros, which are a way to store a series of commands in a program and repeat them. "Surprisingly, GPT-4 is pretty good with error codes," he adds. Instead of Googling the error code and searching for the answer on a website or forum, he says you can give ChatGPT the machine type and error code and it will tell you what the error code is and how to troubleshoot it.

GPT-4 also enables users to create and train their own GPTs. Wearne has used this feature to create a custom chatbot trained on a Haas CNC mill programming manual. "When I asked it to program a part that contained a simple pocket, it was able to tell me I need to program it with a G150 command and also provided the variables for that canned cycle and what they controlled," he says. He believes that creating the roughing motion for a pocket would be difficult for GPT, but the chatbot knew it could perform the task with Haas's built-in code. "The custom GPTs are quite useful," he says. "The limitation is your imagination and the data you can feed it." For example, GPT-4 users can train a custom GPT using a machine manual and ask it for information such as alarms and G-code variables.

Overall

According to Wearne, "GPT-4 is a tool shops can use now," and not just for programming. This is just the beginning for AI in machining, he believes. "It will be extremely interesting to see where this is in a year from now," he says. "I would guess most will be using some sort of AI within the next few years, whether that's GPT or something built into existing CAD/CAM. And I mean real AI, not a simple algorithm labeled as AI."

OpenAI (the maker of ChatGPT) has not announced a timeline for releasing its newest version, GPT-5, but work on it is underway. "GPT-4 was close to or mimicking what humans are capable of, but GPT-5 is supposed to be 'super intelligent,'" Wearne notes. "Where this takes G code, who knows? Maybe we won't even need code then!"

CAMInstructor | caminstructor.com

Building a Successful Machine Shop With No Experience

AMPG can't help but take risks — its management doesn't know how to run machines. But these risks have enabled it to become a runaway success in its market.

EVAN DORAN | ASSOCIATE EDITOR

AMPG's Star Swiss machines fill up multiple rooms at its facility. Rather than sorting them by number, the team has nicknamed each machine after famous television and film characters.
Photo Credit: AMPG.

No one in management at Accurate Manufactured Products Group (AMPG) has a manufacturing background. For the most part, they don't know how to run machines. But rather than see this as a weakness, the team views it as a starting ground for experimentation, working with a skilled team of machinists to succeed even when making choices contrary to conventional manufacturing wisdom.

Niches and Experiments

Matt Goldberg, president of AMPG, founded the company in 1987 as a New York-based distributor of hard-to-find parts. By 2001, some of these parts had grown hard enough to find that he bought manufacturing equipment to make them in-house. He moved the business to Indianapolis and began putting together a team, including his son Alex Goldberg (managing partner and vice president of sales), his son-in-law Nelson Cruz (vice president of manufacturing) and Linda Thompson (vice president of finance and operations). None of them had much experience with manufacturing — Cruz even came straight into his management position from a marketing job — but with Matt Goldberg's advice to trust in the machinists and not manage too closely, they have found great success. Matt Goldberg, Alex Goldberg and Cruz all say that this is not counterintuitive, but stems directly from their lack of experience.

"We don't know what can and can't be done on these machines, or in the shop, or any shop in general," Cruz explains. "So we always challenge it. Someone with more experience knows what's 'possible,' and maybe doesn't take that risk."

This includes selecting AMPG's niche: specialty fasteners and components, made with Star Swiss machines. While the parts are more expensive than the average fastener, the process is still what Geoff Dugan, process engineer, describes as "delivering pizzas with a Ferrari."

Premium Price, Premium Process

One reason AMPG can command higher prices is speed: it turns around most parts within a week. The shop works heavily with distributors, but its ultimate clients typically need small quantities or prefer just-in-time parts. These clients work in a vast array of industries, from robotics to architecture to spaceflight, requiring lot sizes around 300 pieces. AMPG fulfills about 400 of these orders a day, at tolerances down to 0.0005 inch.

To do so, it makes use of a fleet of 60 Star CNC Swiss machines. These machines handle fasteners smaller than a 1.5-inch diameter, while six DN Solutions lathes and two larger Hyundai lathes handle larger parts. The shop also uses one vertical and one horizontal Hyundai mill for parts that require additional operations, as well as several manual machines.

Like its tooling, each type of stock at AMPG corresponds to a barcode. This helps AMPG's team track material usage and restock only when necessary, which is useful, given the wide variety of materials and sizes the shop uses.
Photo Credit: AMPG.

This is an expensive group of machines; Matt Goldberg says each Star Swiss machine can cost around $600,000, while the parts may sell for around $2. This situation may not immediately appear viable, but he says that the high-end machines ensure his team doesn't fight with machinery and tolerances on the shop floor. Instead, he says they produce high-quality parts quickly, fulfilling the shop's promise of "beautiful parts, right now."

Still, this is a hefty number of machines, and AMPG runs two shifts with only 12 Swiss machinists; four people on secondary operations such as thread rolling and manual work; and six people on support for cleaning oil, washing parts, bringing material, setting out tools and the other tasks that keep the shop floor running. It does so by eliminating paper processes and implementing digital aids — namely, adding machine monitoring software, digitizing QC data and designing a seamless information flow between the machines and the engineering department.

AMPG uses SMOOSS-I, an in-house machine monitoring software built into its Swiss machines. According to Star's representatives, AMPG might be the only shop in North America using the software. SMOOSS-I enables machinists to see the status of jobs on machines in real time, a functionality the shop uses for scheduling, staffing and customer status reports. It is also starting to use this software to monitor tool life on jobs with hard materials to ensure they can run lights-out. The goal is to match the performance of the shop's 316 Stainless jobs, which are already optimized for full lights-out work.

Innovating with Automation and More

These optimizations are just the latest steps AMPG has taken on its automation journey. The shop uses multiple automation methods across its machines, which together enable it to efficiently produce around 50,000 different part numbers.

For the Star machines, AMPG makes use of bar feeders and complex macros. Because its part families tend to differ only in length, the shop has found it simple to program subroutines where the only variables are the length of the part and the number of parts. These machines can then run unattended for the length of the full routine, which currently lasts up to five subroutines — though the shop is hoping to expand this out to 25 subroutines (five groups of five). This automation could send the shop from its current 16- or 17-hour uptime to full 24-hour production.

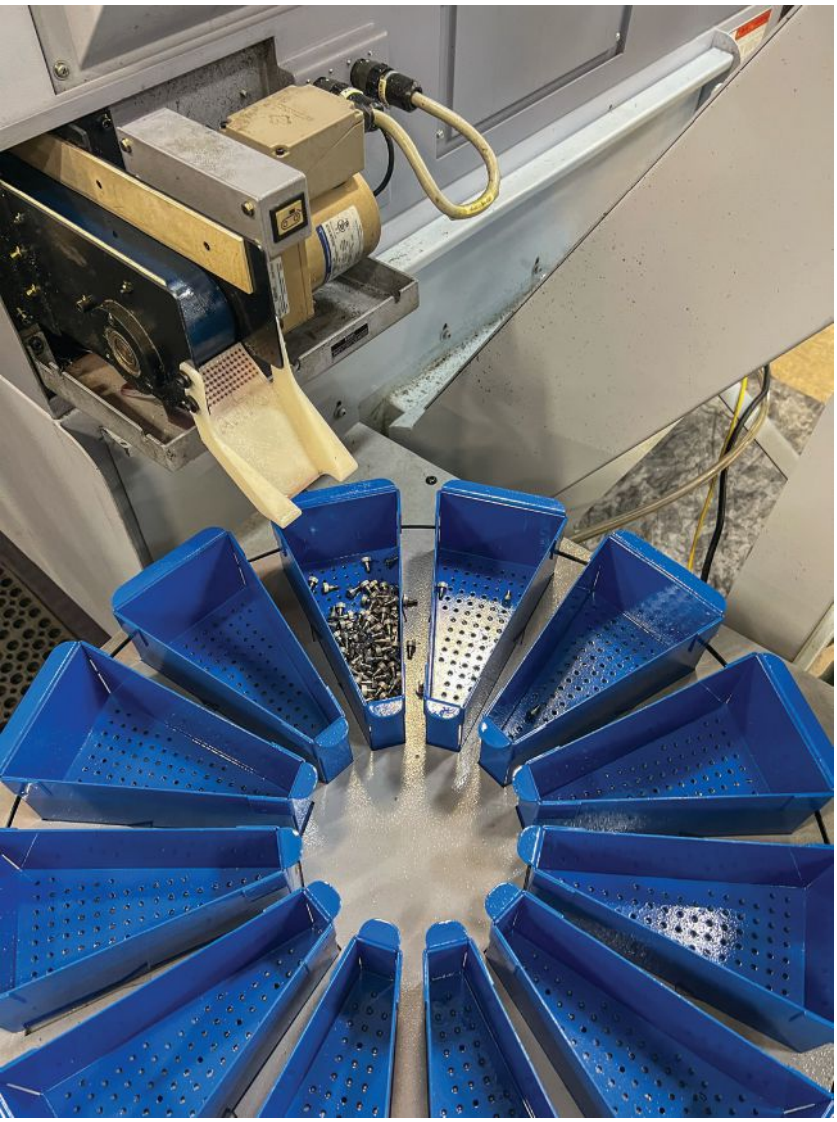
There are limitations to this design, but AMPG has been working to address them as they come. For example, initial runs of the five-subroutine programs would produce parts in order, but deposit them in a single tray where they would be jumbled together. The shop introduced a table to keep the parts separate, but it was programmed

separately from the machine, so resetting one or the other due to an error threw the system out of sync. Now, both are controlled via a single M code in the program so they work in sync. The shop would also like to automate its Swiss machines to work on different part families in the same program, but it is still developing methods to compensate for its limited tooling positions on each machine.

Another potential issue with this automation method? The size of the resulting parts. Programming for length is simple, but dealing with different diameters and thicknesses requires another solution: machining stock of the largest common size. This has its limits: reducing ¾-inch bar stock to ¼-inch bar stock is just too inefficient, for instance. But using ¾-inch barstock for a combination of jobs requiring ¾-inch and ⅝-inch barstock works well for the shop. As with using expensive Swiss machines for fasteners, this may not make sense at first blush. But while using larger stock is more expensive and can slow cycle times, the gains on setup time make up the difference.

AMPG also relies on polymer 3D printers. The shop originally bought a printer for a part where they couldn't waste the material, but it gathered dust until the COVID-19 pandemic. In the pandemic's early days, they used the printer to help produce face masks. One of the shop's engineers soon took an interest in the machine and began experimenting. This quickly turned into in-house development of support and repair parts, and an attitude of, "If we can't get it right away, can we 3D print it?" according to Cruz. Whether holders for tools, parts for an in-house oxidization station, repairs for a broken fan or grippers for a robot, the printers are in constant use for facilitating smoother work processes. The shop now owns four printers and has an in-house waiting list for 3D-printed time-savers and gadgets.

To meet tight tolerances on all its equipment, AMPG has



Now that an M-code controls both the machine and the part collection table, either can be reset without mixing up parts from different subroutines.
Photo Credit: Evan Doran, *MMS*.

expanded the importance of its testing and quality control department. Every part number that comes off a machine gets its first and last parts tested, as well as representative parts for longer runs. A wide array of equipment is already set up in the shop's quality control center, but AMPG also plans to expand this with a climate-controlled A2LA-certified quality control lab.

Collaboration and Community

Giving space to AMPG's small staff to manage all these machines would be impossible without a culture of trust, responsibility and collaboration. AMPG's leadership says they try to lead by example, listening to shopfloor employees' ideas and deferring to them when possible. Even machine monitoring data is meant for improving machines rather than for examining any one machinist's productivity, according to Cruz. As a result, the shop's leadership team says an openness to collaboration has rubbed off on shopfloor employees without an official, top-down mandate to work together.

This collaborative model differs from most traditional machine shop processes, and the shop has let go experienced employees who haven't fit into this culture. That said, it has found success hiring through word of mouth from its current employees and turning to people with no experience in the industry.

More important than experience has been hiring for attitude and personality, and management has developed its own character requirements and personality tests to try screening for this. Most important, though, is the actual interview, where all the leads for the job candidate's department interview the applicant, rather than the heads of the company. As Cruz reasons, the department heads need to collaborate with the new employee, not him. Only when the team reaches unanimous agreement does management proceed with hiring.

This strategy requires that employees all have the company's best interests at heart when conducting interviews. In addition to the shop culture, Alex Goldberg credits the shop's monthly profit-sharing program with helping instill this desire for the company's best interests. Every employee is invested in having disciplined coworkers who are easy to work with, as it improves how much they take home with the program.

Once candidates are hired, they shadow experienced employees and follow along using a textbook

AMPG does not produce customer-facing parts with its 3D printers, but the time-saving devices and repair parts the shop prints have streamlined processes and ensured it can continue producing high-quality parts quickly. Photo Credit: Evan Doran, *MMS*.

For automating non-Swiss machines, AMPG has taken its first steps with cobots. One cobot is stationary, assigned to one of the DN Solutions lathes, while the other is taken to different places around the shop as the need arises.
Photo Credit: AMPG.

that shows entire setups step-by-step, with room for notes. The shop doesn't have a strict timetable for when new employees must work independently, only requiring that they are enthusiastic about improving. As time goes on, they learn and take on more complicated tasks. Collaboration on the shop-floor means this learning never really ends. The machinists of AMPG continue to train each other and help one another grow.

Beyond the workplace, AMPG also takes some unorthodox interests in the local community. While sponsoring the robotics team that one of its engineers coaches may not be all that surprising, the shop is also quick to donate parts to art installations and to the schools that employees' children attend. Multiple people in management also have connections to Indianapolis' music scene, and the shop recently sponsored an international violin competition held in the city.

It is these unorthodoxies which give AMPG its strength. Decisions and investments that seem counterintuitive at first have become central to the shop's processes and success. A culture that diverges from traditional manufacturing (and indeed, general business) truisms has led to higher morale and productivity. Alex Goldberg is quick to describe AMPG as more of a technology company than a manufacturing shop, but whatever he calls it, it is successful.

Sometimes delivering pizzas in Ferraris is the right call.

DN Solutions | dn-solutions.com

AMPG | AMPG.com

Star CNC Machine Tool Corp. | starcnc.com

Briquetting Manufacturer Tools Up for Faster Turnaround Times

To cut out laborious manual processes like hand-grinding, this briquette manufacturer revamped its machining and cutting-tool arsenal for faster production.

NATHANIEL FIELDS | ASSOCIATE EDITOR

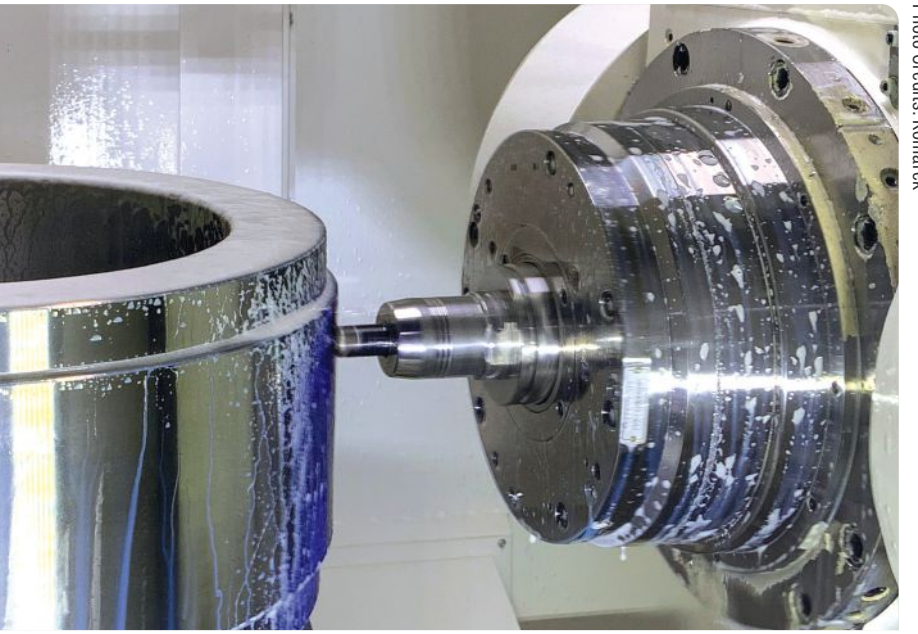


Photo Credits: Komarek

To speed up its briquette roll production process, Komarek purchased a Mazak Integrex i-630 turn-mill machine to pair with Ceratizit tooling and machine alloy, stainless and tool steels.

Briquettes are dense blocks created by compressing certain materials. For instance, charcoal and water softener salt are prepared as briquettes using charcoal dust and sodium chloride, respectively. These blocks can be compressed in cantilevered removable cutting rolls like those machined by K.R. Komarek, a Wood Dale, Illinois, company whose founder, Gustav Komarek, patented briquetting processes in the early 1900s to make coal less dusty and easier to transport.

With a wide variety of briquette designs, sizes and materials, machining these rolls is a demanding task for machine tools and, in particular, tooling. To overhaul a lengthy, hands-on process, Komarek paired a Mazak turn-mill machine with Ceratizit ISO-P-grade tooling to reduce production cycles and eliminate an arduous hand-grinding process.

A Historically Hands-on Process

In Komarek's design, two rolls run in opposite directions while the material runs down the middle to be compacted. Materials for these cutting rolls — which measure from 12 inches up to 28 inches in diameter — range from stainless

steels to alloy steels and tool steels with hardness from 25 to 40 RC.

Until recently, Komarek's manufacturing process relied heavily on drilling and high-speed milling to rough each roll, turning the rolls in two operations on one machine, then moving the workpieces to a horizontal mill. The shop would then hand-grind its roll pockets and rely on lengthy hand-polishing operations to achieve the necessary surface finish. This labor-intensive process made unattended operations impossible, which in turn meant that a single roll took three workdays to produce on a one-shift, eight-hour schedule. Even then, the manual operations made high-quality surface finishes and other specs more difficult to attain with high repeatability.

Modernizing Milling and More

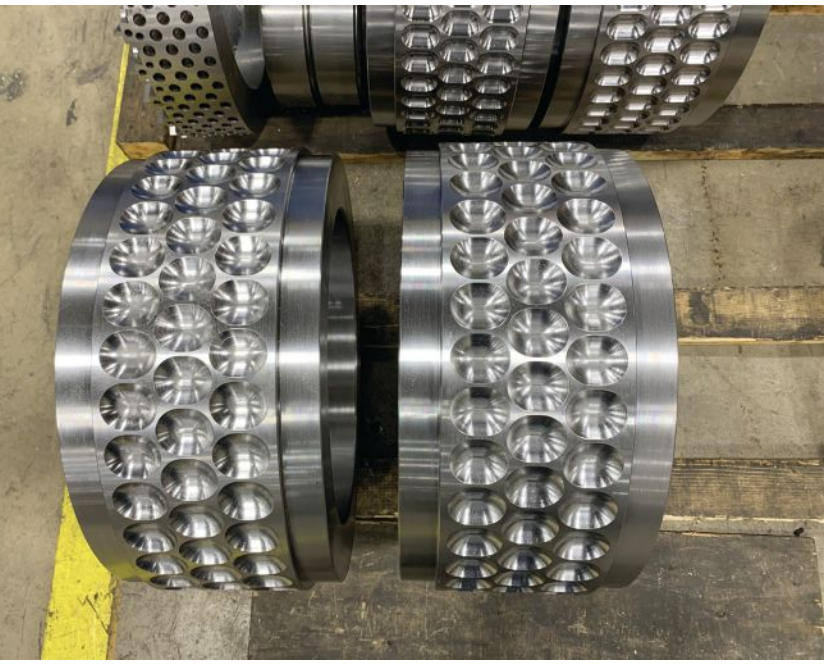
Growing the company would require a smoother, more repeatable production cycle. Komarek decided to replicate its existing process as a milling operation with two setups. To achieve a surface finish of 16 Ra for all pockets, the company invested in a Mazak Integrex i-630 turn-mill machine with a two-pallet changer and modular automated pallet-stocking system. The machine incorporates an 800-mm pallet size, plus a tilting spindle and rotary table for simultaneous five-axis operations and multiple-surface machining of large, complex parts up to 28 inches in diameter and 27-inches high. With some rolls containing up to 50 pockets, a machine that could handle complex maneuvers while holding large parts was ideal for Komarek's workload.

In addition to a versatile machine, Komarek needed durable tooling that could machine its complex roll pockets. Operations Manager David Rammacher came to Komarek from a position at Ceratizit, so he was already familiar with the company's indexable carbide tooling. He believed that using a version of this tooling with round inserts could improve milling performance on the roll pockets.

Komarek now relies on some of Ceratizit's ISO-P grades. These include HSK100 CNMG holders and CTCP135-P carbide turning tools for rough turning with interrupted cuts. For finish turning, HSK100 DNMG holders with CTCP115-P ISO-P15 wear-resistant grades provide optimal resistance to high temperatures for ideal tool life during steel machining at high speeds. Additionally, to handle milling chores, Komarek chose Ceratizit's K2002 ball-nose indexable cutters in diameters ranging from 8 mm to 32 mm mounted in HSK100 hydraulic chucks.

In addition to this new tooling arsenal, Komarek brought in Mastercam and

Once Komarek added new equipment on its shop floor, the company called on Ceratizit to assist with tool-drawer setup for inventory management.



The briquette rolls Komarek machines can have anywhere from 20 to 50 pockets, depending on the material that is getting compacted and the machine the roll will be used in.

began utilizing 3D tool paths after previously relying on 2D tool paths. Rammacher says the ability to utilize more complex tool paths in conjunction with new tooling helped achieve an improved surface finish, so much so that Komarek eliminated the need for hand grinding, the most labor-intensive process in the production cycle. At the same time, the palletization abilities of its new machining center enabled the company to run lights out, which lengthened production days without increasing demands on staffing. What once required three eight-hour workdays became a one-day job.

"We can save hours and even days just (eliminating) the pocket grinding," Rammacher says. "And nowadays, finding somebody that's willing to do that day after day, it's increasingly tougher."

Employees who formerly would have been tackling manual tasks on the briquetting roll production line can now work in Komarek's reconditioning and repair department. These new processes also eliminated the potential for human error from hand-ground pockets, and by previewing milling paths through simulation features within Mastercam, Komarek is seeing less than a thousandth of an inch of variance in pockets. Tool life has also become much more predictable.

"Now, we can predict tool life on each material," says Dan Diemer, CNC machinist at Komarek. "Our process improvements include huge gains in repeatability and reliability."

Rolling Out Orders

At any given time, Komarek has 40 orders in its shop for two-roll sets, of which it typically produces up to three each week, more than it was machining under the old processes.

"It wouldn't have been three going from start to heat treat in a given week," Rammacher says. "It would've been maybe two. It could even be less, depending on the rolls."

Not only do customers need replacement and spare cutting rolls, but briquette shapes change frequently and some jobs call for the addition of lettering or logos to the briquetting pockets. Some Komarek customers process steel, which requires a high roll hardness. Some operate on corrosives such as salt or cyanide, which can eat away at the roll material. As a result, the processed material itself, as well as the desired final shape of the briquettes, determines the specifications and size of each roll.

With new machining and tooling support, Komarek has cut its production steps, boosted its accuracy and repeatability, and increased overall efficiency throughout the shop. "What we've been doing is working. We're just trying to reduce costs and bring value to the customer," Rammacher says. After seeing the results of the company's new approach, Komarek ordered a second Integrex i-630 machining center to continue to optimize its production process.

| Ceratizit USA Inc. | ceratizit.com

| Mastercam – CNC Software Inc. | mastercam.com

| Mazak North America | mazakusa.com

Changing the Dynamics of Wire EDM

This CNC enables EDMs to switch between G code and an integrated CAM system to adapt to changing conditions and make lights-out manufacturing more attainable.

ELI PLASKETT | SENIOR ASSOCIATE EDITOR

Photo Credits: Evan Doran, *MMS*

The Uniqua control is a hybrid between GF Machining's G-code CNC and HMI control with an integrated CAM, enabling the user to switch between programming G code and using the CAM. The company sees it as a way to encourage users to experiment with dynamic programming, which can dramatically reduce time spent programming parts and makes lights-out manufacturing more accessible.

Automation often focuses on the movement of parts to keep machines cutting, but more and more systems are enabling manufacturers to automate tasks once thought too cerebral for a computer to handle. For GF Machining, this is taking the form of dynamic programming, which enables the company's EDM controls to save and automatically generate toolpaths.

A Tale of Two CNCs

For years, GF Machining has provided two options for EDM controls: a G-code CNC and a control with an integrated CAM system and human-machine interface (HMI) that enables the user to reset priorities at the machine. While many users prefer the simplicity and familiarity of the G-code control, the CAM system enables the user to fluidly adapt to changes in parameters thanks to dynamic programming.

Dynamic programming enables the control to adjust priorities with minimal user input, autonomously producing G code to fit the needs of the job. The control saves part programs and cutting paths in a database accessible at the machine, which enables users to make changes on the fly. "Say you programmed the machine to make the A cut, then B, then C," explains Eric Ostini, GF's head of business development for North America. "With dynamic programming, you can change it from A-B-C to A-C-B. Or if you need to suddenly prioritize a different workpiece, or if a wire is slightly out of position, you can make those changes immediately."

This feature is excellent for operations that need close operator oversight. For example, users can alter how they enter or exit a part at the control. "Let's say you start out wanting to cut the part straight-on," Ostini says, "but a large

burr forms where you would exit. You can quickly change the wire path to exit the part radially to avoid the burr." The control uses algorithms to determine the specific movements necessary, enabling users to avoid the burr without having to program the G code needed to do so.

While these capabilities are useful, many users still prefer the G-code control, especially for simpler jobs. "Sometimes you just need to make a couple slices, and you don't want to navigate a menu for that when you can just plug in the G code," Ostini says. "As rewarding as it is, the CAM system can be difficult to learn."

Hoping to bridge the gap between its G code and CAM customer bases, GF developed the Uniqua control, which incorporates both the G code and CAM systems in a single control.

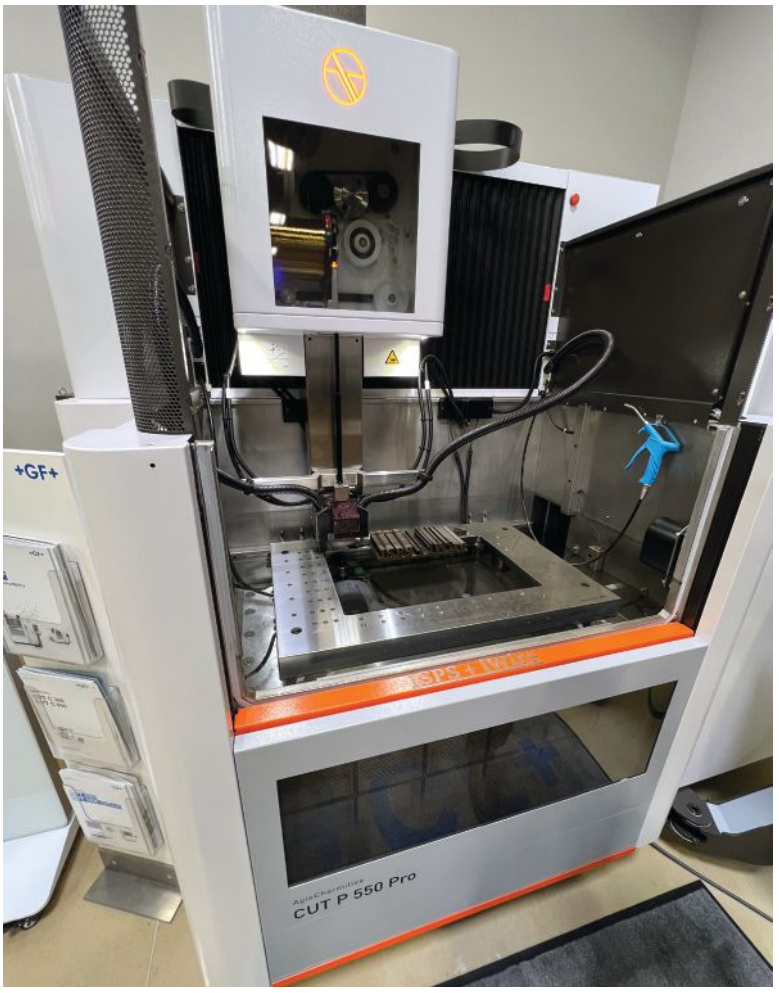
Uniqua offers users the opportunity to quickly switch between a G-code CNC and a simplified version of the company's CAM-integrated control. This enables users to benefit from both the simplicity of a G-code CNC and the adaptability of dynamic programming. "We see Uniqua as a way of providing customers with a familiar control while also making dynamic programming options more accessible to users who aren't familiar with it in practice," Ostini says.

Making these options more accessible matters because Ostini sees dynamic programming as an important step toward automating EDM for lights-out manufacturing.

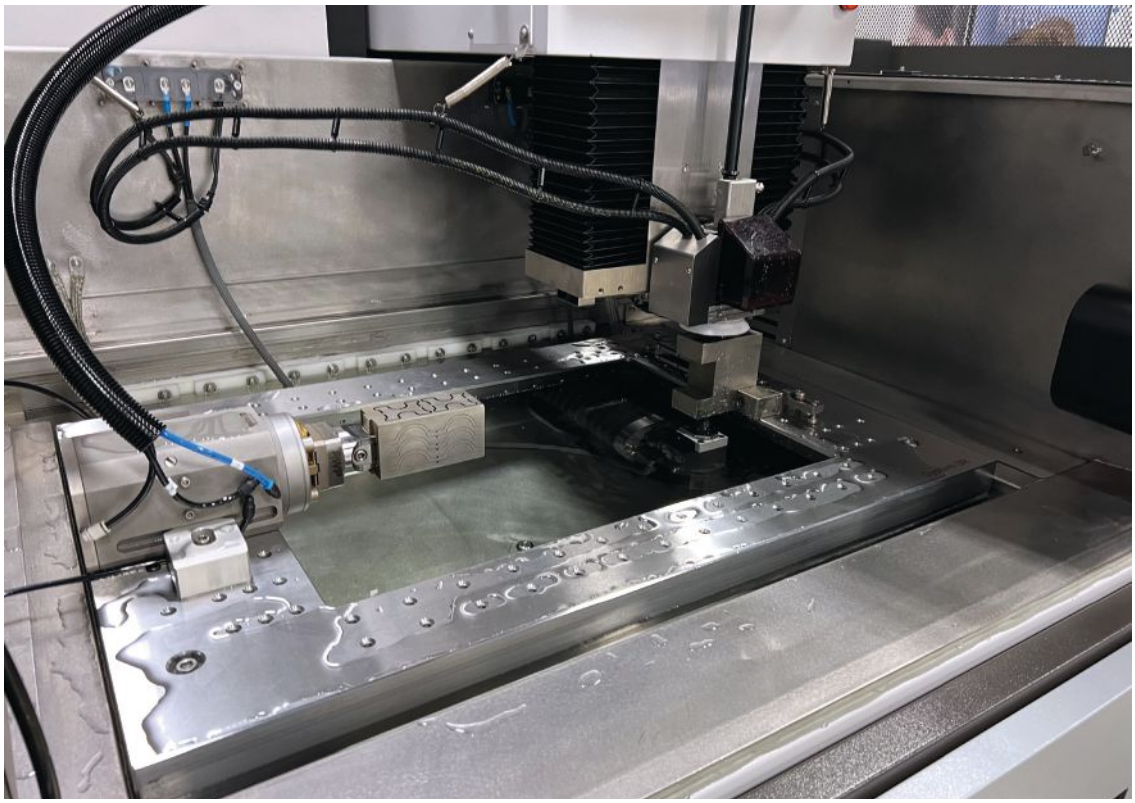
Dynamic Programming and Unattended EDM

One of the clearest examples of the usefulness of dynamic programming is the Early/Late capability. "Let's say on a Friday afternoon, an operator puts a workpiece on each side of the machine," Ostini explains. "Together, they have twenty cavities to cut, but the operator's shift ends in two hours — only time to cut one cavity." Normally, an operator in this situation has two options: reprogram the entire job to run over the weekend unattended or do what they can in two hours and finish most of the work on Monday.

"With dynamic programming, the operator can switch to a late capability and walk out the door," Ostini says. With the late



Dynamic programming enables the user to quickly change priorities at the control by automatically generating G code to make the desired changes. This feature is available on GF Machining's Uniqua control, which is available on many of the company's machines, including this Cut P 550 Pro.



Programming G code can be time-consuming, especially for complicated parts. However, the ability to save, recall and adjust G code automatically makes dynamic programming an attractive option for many shops.

capability, the control independently reorganizes the program to complete as much work without operator intervention as possible. Not only does it find an efficient way to make as many cuts as possible, it recognizes which steps require the operator's physical intervention and leaves them for Monday, when returning workers will find two nearly finished parts waiting.

Additionally, EDM programmers planning for lights-out operations can dramatically reduce the time it takes to program parts.

Unlike machining, which can benefit from numerous part-moving technologies, unattended EDM work relies almost exclusively on batching — setting up multiple workpieces in a single work envelope. One limiting factor for this method is the programming: With standard controls, users have to separately program each part, including programs for moving the wire between workpieces. This means that even programming identical parts involves programming separate sets of coordinates and wire movements, including code to move the wire back to the origin point.

Using the dynamic programming function, users can highlight saved jobs, input the part positions and hit start. The control automatically generates the code for the program, including all non-cutting movements. "Even skilled programmers can benefit from that kind of time saving," Ostini says.

While not rising to the level of artificial intelligence, these capabilities enable the machine to autonomously generate code, saving the operator time. Users must still program part geometries and cutting paths into the machine using their expertise to identify efficiencies that benefit the shop. However, the control's ability to save this information and generate code for later use eliminates redundant work for skilled programmers, enabling them to get machines running faster and move on to more work. As Ostini puts it, "Dynamic programming enables the intermediate or beginner operator to function at the level of a skilled programmer and enables the skilled programmer to make more efficient use of their time."

GF Machining Solutions LLC | gfms.com/us

Collets put the grip in toolholding, so it's important to assemble and maintain them properly. ER collets have features that eliminate a main source of collet damage, but like any piece of equipment, they're still susceptible to damage when not used properly.

Photo Credits: Rego-Fix.

5 Common Mistakes Shops Make With ER Collets (And How to Prevent Them)

Collets play a crucial role in the machining process, so proper tool assembly and maintenance is important. Here are five potential pitfalls to avoid when using ER collets.

JULIA HIDER | SENIOR EDITOR

Collets, like any other piece of equipment, aren't immune to wear and tear or damage. However, proper use, tool assembly and maintenance can minimize these effects. This is important because, according to Jonathan Harvey, marketing specialist at tooling supplier Rego-Fix, the collet, not the toolholder, plays the bigger role in machining accurate parts. Using damaged collets can result in damaged tools and toolholders, reduced clamping force, excessive runout and bad parts.

Rego-Fix's Hi-Q ER clamping nuts are chemically impregnated with materials to improve their lifespan and increase clamping force without wearing. These clamping nuts can be used with any ER system, enabling users to increase clamping forces without investing in a whole new tooling system.

ER collets were designed to eliminate a major source of collet damage. An extraction groove on the outer rim receives a lip on the clamping nut so users don't need to hammer or punch tools out of the collet. But even with this feature, ER collets are still susceptible to damage when not used properly. Harvey says these are the five most common mistakes Rego-Fix sees from users of ER collets, and provides tips on how to avoid them.

1. Insufficient Bore Length

One the most common mistakes shops make in tool setup is failing to use enough of the collet's bore length and gripping surface. According to Harvey, shops should use at least two-thirds of the collet's gripping surface. Often, the tool is not inserted deep enough into the collet because operators are trying to extend a cutting tool's length farther than recommended.

Most ER collets are made of fairly soft steel – about 45 Rockwell Hardness C, Harvey says. When used with cutting tools made from much harder materials, such as carbide, the machining process exerts a tremendous amount of force at the toolholder collet cavity edge, which is its weakest point. These forces are almost certain to crack the toolholder, damage the collet or both. Failing to use the proper shank and bore length also prevents the collet from achieving its proper gripping force. The resulting tool deformation causes excessive runout and decreased part quality.

To solve this problem, shops should always use the proper tool length and opt for a longer one if necessary. The ER collet system has a substantial cavity behind it, so the collet base can accommodate excess tool length.

2. Incorrect Torque Values

In most instances, operators torque their setups to what they "feel" is a good value. While this method might produce the proper torque value in some cases, it often results in over-torqued nuts, which can encourage collet deformation and lead to runout.

To avoid improper torque values, Harvey says shops should use quality torque wrenches and appropriate charts. An alternative solution is the Rego-Fix Torco-Block, which serves as both a fixture and torque measuring device. Users set the diameter of the tool, then tighten the nut with a spanner wrench until the dial reaches the proper torque value.

The clamping nut itself also plays a role in proper torque. Plain metal ER nuts wear quickly as they're torqued down, Harvey says. Nuts that are coated with a material such as black oxide are more resilient, but still wear with use. ER nuts can also be chemically impregnated with materials to make them harder and more durable, such as Rego-Fix's Hi-Q line of ER collet nuts. This increases lubricity between the surfaces of the collet and nut for improved lifespan

Rego-Fix's Torco-Block serves as both a fixture and torque measuring device for simplifying tool assembly. Users set the diameter of the tool, then tighten the nut with a spanner wrench until the dial reaches the proper torque value.

Coolant, dirt, chips and other foreign material can make their way into the collet cavity or onto the collet face, which can impact performance. Operators should clean collet cavities with a brass brush and cleaning agent, while compressed air and a thorough wipe down will take care of the collet face.

of the system and increased clamping force without wearing. The company says testing has shown that the lubricity of the Hi-Q nut increases clamping force by 180% over a standard clamping nut. Clamping nuts are interchangeable, so manufacturers experiencing problems resulting from low clamping forces can switch to a high-performance ER nut without investing in an entirely new ER assembly.

3. Faulty Assembly of Collet and Clamping Nut

Incorrectly assembling the tool by placing the collet in the holder before the clamping nut is installed can cause runout of up to 0.001 inch, Harvey says. For proper assembly, users should place the collet into the nut, insert the tool, and then screw the nut onto the holder.

Another common mistake operators make is holding the collet incorrectly, causing it to fall off the eccentric ring or lip inside the clamping nut. If the misalignment is not noticed, the ring is pushed over the collet nose's 30-degree taper, damaging the collet and causing excessive runout. "Making sure the collet is properly seated within that nut is tantamount to proper assembly," Harvey says. The Rego-Fix Hi-Q ER nut has a retaining ring profile that snaps the collet in place. When operators hear and feel the snap, they can be confident the assembly is correct.

4. Improper Use of Backup Screw

Some holders use a backup screw to assist with adjusting tool length by allowing the tool to rest against the screw. "We recommend not using the backup screw," Harvey says. It can interfere with proper setup if the tool is pushing against the screw during assembly. During a normal setup, the collet will pull back almost 0.003 inches from hand-tight to full torque value. If the collet cannot pull back, the collet can lose as much as 50% of its clamping force, he explains, and runout increases. This won't be an issue for everyone — most suppliers have removed backup screws from toolholders. Those whose toolholders do have backup screws can remove the screw completely, or loosen it from the back end after hand-tightening it.

5. Not Cleaning Collets

With increasing production demands, operators may be tempted to remove one tool, insert another and get back to machining. However, Harvey says one of simplest things shops can do to ensure toolholder performance is to keep their collets clean. Regularly used collets may collect deposits on their tapered areas. These deposits can be caused by a variety of factors, including dirty coolant, dirt in the toolholder and foreign material making its way into the collet cavity. A cleaning agent and brass brush are excellent cleaning tools.

The collet face is also prone to collecting chips. Any foreign matter collecting in the collet slots diminishes its ability to collapse on the tool shank and is another cause for runout and loss of clamping force. Blowing the components out with compressed air after disassembly followed by a thorough wipe down and drying will take care of most cleanliness issues. Simply stated: cleanliness is critical.

Rego-Fix Tool Corporation | rego-fix.com

CHRIS PASION | MANAGING EDITOR | cpasion@mmsonline.com

Sandvik Coromant Milling Tool Boosts Productivity in Steel Machining

Sandvik Coromant has launched a new milling concept — CoroMill MR80 — designed for challenging roughing operations in a wide range of face and profile milling applications.

CoroMill MR80 is a double-sided round insert concept with a higher number of inserts compared to regular round insert cutters. It is said to be ideally suited to low depth of cut — up to 3 mm — in face milling and profile milling applications in steel and stainless steel.

Originally designed for machining cast stainless components such as turbochargers and exhaust manifolds in the automotive sector, this product has been further developed to cater to steel milling applications, which require the security of a round cutting edge — such as the mold and die segment. As a result, CoroMill MR80 offers both higher productivity and economical machining in a wide range of operations, with no compromise on security, according to the company.

CoroMill MR80 features double-sided inserts with 12 indexing possibilities when operated within a 3-mm depth of cut. A higher number of inserts on the cutter body also enables a higher table feed and increased productivity. Additionally, the overall security and reliability means less damage to the cutter body and inserts, which helps cut costs.

Due to its lightweight cutting geometry, it is also possible to use CoroMill MR80 as a problem solver in difficult machining situations, even with long overhangs.

The CoroMill MR80 assortment offers cylindrical and arbor cutter bodies, with diameters from 32 to 100 mm, 3 to 12 cutting teeth, and even pitch and shim protection. All cutter bodies feature internal coolant supply. The double-sided E-L50 inserts offer true and easy indexing (6 + 6), with a 3 mm recommended depth of cut.

Sandvik Coromant | 800-726-3845
sandvik.coromant.com

Tungaloy-NTK America Key Bits Improve Drill Body Service Life

Tungaloy-NTK America Inc. has increased its size options of KHS key bits that are developed for easy management of DrillMeister drill body service life.

The DrillMeister exchangeable-head drill system is said to combine the precision of solid carbide drills with the flexibility of modular tooling. According to the company, for users to reap the full benefits, accurate management of the drill body service life is vital. Conducting release torque tests for the drill bodies is an effective way to predict the fatigue life while eliminating the risk of loose connections and losing the drill heads in the machines. The KHS key bits enable easy measuring of the drill head release torque: The bits can be attached to commercial torque screwdrivers equipped either with manual adjustable preset torques or with a digital display, which enables accurate torque measurements.

Two new key sizes have been added: KHS-TID6-9.99 covers the drill diameter range from 6.0 to 9.9 mm (0.236" to 0.340"), while KHS-TID20-25.99 covers from 20.0 to 25.9 mm (0.787" to 1.020"). In addition to the »

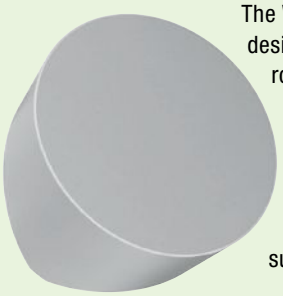
key size that already exists for 10.0 to 19.9 mm (0.394" to 0.783"), these three key sizes cover the diameter range from 6.0 mm to 25.9 mm of the DrillMeister drill heads.

Tungaloy-NTK America Inc.
888-554-8394 | tungaloy.com/us

Walter Turning Grades Reduce Machining Times

Walter's new TigerTec Gold WKP01G and WPP05G grades are tailored for maximum performance when turning high-alloy, high-tensile strength steels. According to Walter, the turning inserts can reduce machining time by 20-30%.

Walter developed the WKP01G for finishing high-tensile steel and cast iron (ISO P01 and K01 workpiece groups) at the highest cutting speed. The grades feature a hard substrate that provides the highest flank wear resistance, while the multistage post-treatment process produces a smooth rake face to reduce friction and improve toughness. A sharp cutting edge with thinner chemical vapor deposition (CVD) coating provides precise chip breaking for finishing operations.



The WPP05G grade is designed for medium and rough turning of steels at the maximum cutting speed. The substrate is made of a carbide with the highest hot hardness, making the insert suitable for both dry and wet machining, and the highest crater wear and flank wear resistance.

Both grades feature the TigerTec Gold coating technology. The multilayer, medium-temperature titanium carbo-nitride (MT-TiCN) coating is said to improve the elastic property of the highly aligned crystals, which do not detach from the substrate like a conventional TiCN coating, to offer more wear resistance. The coating increases toughness and resistance to the flank face. In addition, the coating on the WPP05G grade has a highly textured aluminum oxide (Al_2O_3) coating to minimize crater wear. According to Walter, the coating increases tool life by up to 50% on average.

Both WKP01G and WPP05G grades are ideal for continuous cutting and occasional interrupted cuts in high-tensile materials (approx. 280-410 HB or 130-200 ksi). Ideal applications include large-scale production of components for the automotive and energy industries, such as gearboxes, gears and rotor hubs, as well as forged shafts for general mechanical engineering and wheel sets for the rail industry.

Walter USA LLC | 800-945-9554
walter-tools.com/us

Trumpf Deburring Tool Provides Repeatable Accuracy

Trumpf has introduced a new TruTool TKA 1500 edge milling tool with updated features to create sheet metal edges with repeatable accuracy and without rework. The redesigned deburring tool is now available with a new cutting mount and guide fence for increased applications and safety. Additional ergonomic enhancements to the TKA 1500 contribute to the tool's low-vibration and smooth operation.

Trumpf designed the TKA 1500 for operator safety and ergonomics. The tool's handle shape, size and positioning are said to ensure safe machine guidance and support the chamfer quality. The large electric hand tool is equipped with a 2,600-W motor and adapted gearbox, meaning it is very quiet to run and operators can generate a high-quality chamfer reliably and for longer periods of time without fatigue. Design improvements have reduced vibrations and ensure that an optimum feed rate can be achieved. This reduces the amount of wear and tear, increasing durability.

The TKA 1500 comes with a standard, 45-degree multi-edge cutter mount, and depending on the application, operators can also choose optional multi-edge or radius multi-edge cutter mounts in 30-degree, 60-degree and now 37.5-degree angle positions. The new multi-edge cutter mount can chamfer 37.5-degree angles, which is particularly useful when processing tubes. The new edge-milling tool is suitable for an increased variety of applications, including deburring, rounding or chamfering end edges. The tool can also be used to prepare parts for powder and paint coatings, as well as welded seams.

The bevel length can still be adjusted without tools, although now it is easier to adjust since the new design of the TKA 1500 provides an unrestricted view of the dial ring. Operators can use the tool to create clean visible edges, break off sharp edges, add a radius or prepare a weld seam.

Another highlight of the new TKA 1500 is the unique guide fence, which is made of stainless steel and is said to be beneficial when processing long, straight sheet metal and outer contours. The guide fence makes it easier to run into the sheet metal and control the processing direction. The guide fence also provides protection against chips, directing chips downward in a controlled fashion to increase occupational safety. This standard accessory is assembled in seconds without any tools. It is also helpful that the shape, size and positioning of the handle can be adjusted ergonomically to one another, further supporting the safe and precise control of the machine.

Trumpf Inc. | 860-255-6000 | trumpf.com

Darex Adds End Mill Attachment to Drill Sharpener

Darex has added the LEX600 end mill attachment to its XT3000 drill sharpener. This new attachment enables users to sharpen the primary and secondary grind on the tips of two-, three- or four-fluted end mills up to $^{5}/_{8}$". By revitalizing these tools and reducing costs, Darex says it is committed to providing practical, simplified solutions for managing cutting tools.

The XT3000 sharpening solution, with the added end mill attachment, will enable manufacturers to continue to shape and create parts during milling, profiling, contouring and more. Darex also offers a 30-day trial for those who purchase directly from them.

Darex LLC | 800-547-0222 | darex.com

Platinum Tooling's Import Catalog Provides Improved Surface Quality

Platinum Tooling is now the North American importer of the Quick knurling and marking tools from Hommel and Keller.

Hommel and Keller manufactures the Quick line with a focus on function and innovation, with quality, precision and stability being key principals of the tools.

Benefits of cut knurling include maximum precision and surface quality, knurling of thin-walled components without deformation, as well as time savings due to faster cutting speeds and feed rates. Additional advantages are machining of most materials (including gray cast iron and plastic), with minimal (or zero) alternation of the workpiece diameter and minimal surface compaction.

In form knurling, machining of the workpiece by cold forming compresses the surface of the workpiece. Knurling is possible up to a workpiece shoulder, at any position of the workpiece of the inner and end faces, as well as conical. All knurling profiles according to DIN 82 can be produced.

Among its offering, Quick also has knurling tools with interchangeable jaws and knurling wheels available from stock. Wheels with special dimensions and pitches can be customized.

Quick marking tools can mark workpieces in seconds and on a wide variety of geometries independent of workpiece diameter. They are said to be ideal for machines with small installation space and can mark up to a shoulder.

Hommel+Keller Präzisionswerkzeuge GmbH
49 7424 9705 0 | hommel-keller.de

Platinum Tooling | 847-749-0633
platinumtooling.com

Systems and Software

CHRIS PASION | MANAGING EDITOR | cpasion@mmsonline.com

Flexxbotics Software Enables Robot-Driven Manufacturing

Flexxbotics' FlexxCore technology enables robots to securely connect and communicate with all types of automation equipment in the smart factory to provide more powerful, flexible and open connectivity. With Flexxbotics' FlexxCore solution, robots go beyond simply communicating with the machinery; they control and command the machines.

Flexxbotics' workcell digitalization delivers robot-driven manufacturing at scale with autonomous process control for advanced machining operations. As the critical software infrastructure for robot-machine connectivity in the Flexxbotics solution, FlexxCore delivers compatibility with over 1,000 different models of CNC machines, other factory machinery and inspection equipment options, and reportedly enables 22-times faster connector creation than conventional automation integration methods.

FlexxCore is a low-code environment for composing and running connectors that includes a highly secure, high-performance framework for data pipelines with protocols, class structures, method sets and data models for communication and interoperability between robots and all different types of factory assets. With the new FlexxCore at the center of the Flexxbotics solution for robot-driven manufacturing, companies can achieve robotic machine tending results quickly at scale or one workcell at a time, avoiding the disruption of rip and replace initiatives and risks of all-at-once automation projects.

FlexxCore empowers the robots to draw from direct numerical control interfaces and directly manipulate G code at the machine level to make closed-loop programmatic adjustments to programmable logic controller programs in real time. For example, FlexxCore can read, write and update macro variables, parameters and offsets — such as tool, fixture and work offsets — based on inspection results to adjust for tool wear and other factors so part production remains consistent to specification and tolerance for highly precise quality.

| Flexxbotics | 877-456-1576 | flexxbotics.com

ABB Software Provides No-Code Robot Programming

ABB Robotics has extended the scope of its free Wizard Easy Programming software to include its six-axis industrial robots powered by an OmniCore controller, in addition to its collaborative robots.

Wizard Easy Programming uses a graphical, no-code, drag-and-drop programming approach designed to simplify the development of robot applications. The software helps first-time and expert robot users to develop applications in minutes — a task that typically requires one week of training and another for development. Since it was first released in 2020, Wizard Easy Programming has been widely adopted in a range of applications using ABB's cobot portfolio, comprising the YuMi, Swifti and GoFa cobot families. »

The software helps operators with no prior training to develop robot applications such as arc welding or machine tending. It also increases operational flexibility, enabling users to modify existing programs and pre-programmed blocks that control various behaviors, ranging from robot movements to signal instructions and force control, through its intuitive graphical user interface.

Catering to novice and experienced users, Wizard Easy Programming comes with Skill Creator, a tool that helps system integrators and other users efficiently create customized, application-specific Wizard blocks for use with their customers. Skill Creator can simplify the creation of highly specific tasks like machine tending, welding and intricate applications, including medical inspections. Meanwhile, ecosystem partners developing accessories such as grippers, feeders and cameras will gain access to a digital tool to share product-specific functionalities, regardless of the type of robot they will be deployed on.

Wizard Easy Programming comes preinstalled on all cobots and new six-axis industrial robots powered by OmniCore, ABB's robot controller family, which reportedly delivers an average 20% energy savings and futureproofs deployments by offering built-in digital connectivity and 1,000+ scalable functions.

| ABB Inc. | 800-435-7365 | abb.com/robotics

CloudNC's Autodesk Plug-in Streamlines CNC Programming

CloudNC's CAM Assist solution is available as a plug-in for Autodesk's Fusion 360 software platform, enabling U.S. manufacturers to precision machine components more quickly and efficiently.

CAM Assist uses advanced computer science techniques to generate professional machining strategies for three-axis parts in seconds, according to the company. As a result, the amount of time it takes to program a CNC machine to make a component is reportedly reduced by up to 80%, compared to manual programming processes.

According to CloudNC, that gain enables manufacturers using CAM Assist to raise productivity and shorten lead times. In addition, the software frees up time for experienced programmers, while also allowing junior employees to program more complex parts and be productive faster, helping fill the manufacturing sector's widening skills gap.

Theo Saville, founder of CloudNC, says, "By making CAM programmers faster, CAM Assist enables manufacturers to increase machine uptime, slash lead times, improve process stability and upskill staff to become expert machinists more quickly. These advances will re-energise precision manufacturing companies struggling with rising costs and aging workforces."

CAM Assist uses advanced computational optimization and artificial intelligence (AI) inference techniques to rapidly determine a professional strategy and toolset needed to manufacture a part, along with the most appropriate cutting speeds and feeds from the user's library.

As a result, a Fusion 360 user can upload a 3D model of a three-axis component and the software determines the best milling tools needed from those available, and how they will be used. In seconds, CAM Assist drafts the code required to instruct a CNC machine how to make it within the user's existing CAM platform.

| Autodesk | 800-536-6540 | autodesk.com

| CloudNC | 020 3966 8379 | cloudnc.com

Modern Equipment Review

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SPOTLIGHT | Machining Centers

Mazak VMC Provides Versatile Machining of Complex Parts

Mazak's VC-Ez 20X vertical machining center (VMC) provides accurate, cost-effective processing of complex parts via 3+2 or full five-axis machining. It features a rotary/tilt trunnion table with roller gear cam technology. For part-size flexibility, axis travels on the VC-Ez 20X measure 31.5" in X, 20.08" in Y and 20.08" in Z (1050 mm × 510 mm × 635 mm), with a rapid traverse rate of 1,260 ipm (42,011.6 mm/m) on all three axes. The machine accommodates maximum workpiece dimensions of 27.55" in diameter, 23" tall and weighing up to 881 lbs. The ergonomically designed machine requires only 99.72 ft.^{2} of floor space.

The VC-Ez 20X features a 25-hp, 12,000-rpm CAT-40 spindle with a 30-tool-magazine automatic tool changer. Options include a 15,000-rpm, 29.5-hp (22 kWh) spindle with 81.13 ft-lb (11.22 Nm) of torque and a 50-tool-capacity tool changer.

According to Mazak, VC-Ez 20X machine programming can shorten the learning curve for new operators, and Mazak's Mazatrol SmoothEz5 CNC features a 15" touchscreen with full keyboard. Within the control, EIA/G-code and Mazatrol conversational programming languages provide a full range of programming options directly on the machine.

Mazak North America | 800-231-1456
mazakusa.com

Okuma America Double-Column VMC Features Compact Footprint

Okuma America Corporation's Genos M560V-5AX is built with a double-column machine design, affording it maximum structural integrity. The machine offers a working envelope with a 500-mm table and wide axis travels (X: 1,050 mm, Y: 560 mm, Z: 460 mm), while still maintaining a compact footprint of 2,515 mm × 3,750 mm.

The Genos M560V-5AX features a trunnion table positioned parallel to the front of the machine, which enables easier access to the table and good visibility during machining. This, and other user-friendly features on the machine, reduce physical burden on the operator. Additionally, the machine comes standard with a 60-tool automatic tool changer magazine and can also accommodate tools measuring up to 400 mm in length.

The Genos M560V-5AX comes standard with Okuma's Thermo-Friendly concept, an on-board thermal and energy management technology to support both stable, high-accuracy machining and reduce energy consumption. »

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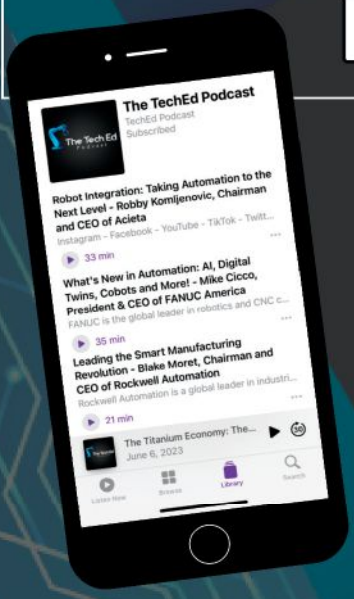

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Key specs of the Genos M560V-5AX vertical machining center include:

- Table size: 500 mm
- Maximum workpiece dimensions: 700 × 500 mm
- Spindle maximum speed: 15,000 rpm
- Spindle motor power: 22/18.5 kW
- Weight: 10,000 kg

With its versatility and five-axis cutting capabilities, Okuma says the Genos M560V-5AX provides shops with the ability to expand their operational possibilities.

Okuma America Corporation | 704-588-7000
okuma.com

Nidec Double-Column Machining Center Reduces Non-Cutting Time

Nidec Machine Tool Co.'s double-column machining center, MV12BxII, is designed to reduce non-cutting time while achieving high productivity in a range of applications. MV12BxII uses grease to lubricate all of its spindle and feed axes to improve energy efficiency and running cost. Featuring an electric power unit, the machine is designed for a diverse range of production environments, from high-precision surface machining to general parts machining, including light cutting and heavy cutting.

With the high-speed rapid traverse (X-axis: 48 m/min.; Y- and Z-axes: 32 m/min.), MV12BxII provides shorter non-cutting time, while its spindle's maximum rotating speed has been improved to 7,000 min^{-1}, and its motor output has been increased to 26 kW. It features a compact footprint of 3.4 × 5.8 m and a maximized range of operation (X-axis stroke: 1.6 m; Y-axis stroke: 1.3 m).

With the use of an energy-efficient and low-noise electric power unit to operate its pump only when necessary, MV12BxII consumes less power than conventional hydraulic units that are always running. In addition, the adoption of Nidec's tribology technology enables the use of grease to lubricate MV12BxII's spindle and feeding axes, helping the machine to use less air and lubricant agent, reducing running cost and operator workload.

Additionally, MV12BxII has available a variety of options that were jointly developed with Nidec OKK Corporation, including an automatic operator door, a coolant shower and a selectable chip conveyor.

Nidec Machine Tool Co. | +81-75-922-1111
nidec.com/en/nidec-machinetool/

DN Solutions' VMC Provides Diverse Five-Axis Machining

DN Solutions' DVF Series comprises compact five-axis CNC machines that are designed for diverse five-sided or simultaneous five-axis applications.

The DVF 4000 comes standard with a 15,000-rpm, direct-coupled spindle, powered by a 24.8-hp (18.5-kW) motor that generates 87.1 ft-lbs (118 Nm) of torque. A FANUC 31i-B5 Plus control makes full five-axis simultaneous control possible, giving complete contouring capabilities. It features a 400-mm-diameter, built-in rotary table with a zero-backlash roller gear cam design for optimal rigidity and speed. The rotary table is designed for ease of use and consummate work effi-

ciency, minimizing interference as the part is machined. An eight- or 12-pallet auto work changer provides additional productivity via unattended machining.

Each DVF Series machine comes equipped with a 40-tool, servo-driven automatic tool changer, giving more tooling to tackle complex parts that have varying profiles. For more versatility, 60- and 120-tool magazines are also available. The oil-cooled spindle controls heat to minimize thermal issues. A Z-axis thermal compensation feature collects real-time data from six sensors throughout the machine to automatically calculate compensation.

The DVF Series also incorporates roller LM guideways for speed and added rigidity. The machines are equipped with linear scales on the X, Y and Z axes and rotary scales on the B and C axes for the most accurate positioning and repeatability.

DN Solutions | 973-618-2500 | dn-solutions.com

Mitsui Seiki's Compact VMC Offers High-Precision Milling

Mitsui Seiki's VL30 Series of high-speed vertical machining centers were developed for high-speed, high-precision hard milling of mold components, as well as graphite and copper tungsten electrodes. The VL30 Series features high-thrust, high-efficiency linear motor drives for the X-, Y- and Z-axes for machining hardened tool-steel alloy components. The five-axis versions use direct-drive rotary axes for smooth and controlled complex contouring. Delivering up to 1,574 ipm cutting feed rate with 1G acceleration/deceleration, it provides superior speed and motion control in high-speed point milling in multiaxis contouring applications. For accuracy, the precision glass-scale feedback system detects 0.1-µm increments.

The VL30 line is designed to machine high-precision mold inserts for medical, packaging, industrial and aerospace applications. The machine's upgraded offerings include advanced features for process automation, workpiece and tool handling, and the latest FANUC 31i-B with i-HMI operator interface provides improved output. The latest graphite package option enables customers to machine completely dry with no risk of electrode contamination or premature machine wear. All versions enable simple integration with robotics and in-process part inspection.

Available in three models — the VL 30-5X five-axis machining center, as well as the VL 30 and larger VL 50 three-axis versions — this series features a 15-hp, 50,000-rpm spindle accepting HSK E25 tooling for precise roughing and ultra-fine finishing. An integrated tool changer holds up to 90 tools.

Specifications include 7.9" × 11.8" × 7.9" X-, Y- and Z-axis travels, an 11.8" × 15.8" table size and a compact 53" × 128" footprint.

Enhanced production features include a four-point leveling bed, specialized main components, hand-scraped castings for excellent machine geometry and superior chip and dust evacuation.

Mitsui Seiki USA Inc. | 201-337-1300
mitsuiseiki.com

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Starrett's Wireless Electronic Depth Gage Provides Ease of Use

The L.S. Starrett Company, a leading global manufacturer of precision measuring tools and gages, metrology systems and more, has introduced three wireless electronic depth gages, including the W640JZ, W643JZ and W644JZ. The gages, which are made in the United States, are part of a line of over 40 new electronic precision gages that Starrett recently introduced to the market. The new depth gages feature a digital readout, which can be viewed on a large LCD display, and offer automated wireless measurement data collection when integrated with data acquisition applications such as Starrett DataSure 4.0 software.

Tim Cucchi, continuous improvement manager for assembly at the company, says, "The new wireless depth gages are convenient and fast, with no wires to contend with. Together with DataSure 4.0, measurement data can automatically be collected by the touch of a button. An embedded radio in the wireless depth gage allows data to be transmitted up to 30 feet, or up to hundreds of yards by adding a backpack."

The new W643JZ depth gage features a knife-edge base and a needle-point contact that has been hardened and ground. The conical point, which is ½" long with a 40-degree angle, can be precisely positioned for close work due to a cutout on the knife base. All three of the new Starrett wireless electronic depth gages are accurate to ±0.001"/0.03 mm, and have a 0.0005"/0.01-mm resolution. Measurement ranges for each of the gages are as follows: the W640JZ offers a range of 0-0.500" (0-13 mm), the W643JZ offers a range of 0-0.125" (0-3 mm) and the W644JZ offers a range of 0-3" (0-75 mm).

All gages feature a positive, tactile-feel button activation, a long rechargeable battery life, origin set and zero set, as well as automatic shutoff after 20 minutes of inactivity.

| The L.S. Starrett Co. | 888-674-7443 | starrett.com

Kuka Automated Mobile Platforms Streamline Operations

Kuka Robotics' KMP 1500P autonomous mobile platform is designed to automate intralogistic optimization, while the Kuka KMP 600-S DiffDrive mobile platform automated guided vehicle (AGV) advances industrial logistics with laser scanners and 3D-object detection to meet the highest safety requirements.

The KMP 1500P autonomous mobile robot (AMR) features a 60-mm stroke and precision positioning, enabling it to transport up to 1.5 tons of materials and workpieces, pick goods, supply lines and cells with materials and transport production parts in process linking. The robot uses built-in technology and QR-code readers to identify loads. It lifts all types of load carriers for easy implementation into existing industrial projects to optimize warehouse processes, streamline assembly lines and enhance complex material handling.

Differential drive, flexible mobility and the ability to adapt travel paths with autonomous efficiency enable this mobile platform to handle any dynamic, complex environment. To protect the KMP 1500P, its loads and the workplace, safety provisions include 3D cameras, laser scanners and IP class 54. The KMP 1500P charges both at a charging station and during work processes, with inductive, intelligent 24/7 charging management. Kuka's KMReS fleet manager simplifies integration for what the company says is the ideal combination of cost efficiency and safety. Maintenance is quick and easy, with replaceable control »and switching electronics.

To transport demanding loads, the Kuka KMP 600-S Diff-Drive mobile platform automated guided vehicle (AGV) moves at speeds up to 2 m/sec in all directions of travel and offers up to 600 kg of payload capacity. An integrated lifting device lifts up to 60 mm in under three seconds. The vehicle requires no safety fencing, which provides maximum freedom of movement for employees.

When cycle times require high-speed travel, front- and rear-mounted laser scanners ensure safe operation in all travel directions. Camera-based 3D-object detection enables the KMP 600-S DiffDrive to integrate seamlessly into existing production environments and detect obstacles autonomously from 50 mm up to 2.1 m above the ground. Equipped for tough industrial environments, the KMP 600-S DiffDrive features an IP54 design that works reliably even in adverse conditions, such as in water spray and dust.

| Kuka Robotics Corporation | 800-459-6691 | kuka.com

Kennametal Chip Fan Automates Chip Clearance

Kennametal Inc. has announced its newest metal cutting accessory: the Chip Fan. Its latest accessory to launch features a specialized fan blade design activated by centrifugal force to support automated chip clearance, especially effective while operating unattended or lights-out machining.

The Chip Fan is manufactured with a high-quality 4140 steel cylindrical shank and durable, glass-fiber reinforced nylon fan blades that can easily be replaced if they become worn or damaged. The accessory features through coolant in combination with fan blades to support complete chip evacuation.

"We're proud to now offer an ideal tooling accessory that can support machinists across industries to minimize downtime," says Scott Etling, Kennametal's VP of marketing, global product management. "With the Chip Fan's powerful chip clearance capabilities and high-quality engineering, users can count on less disruptive machining stops for long-term use."

| Kennametal Inc. | 800-446-7738 | kennametal.com

Renishaw AM System Features Detailed Build Insight

Renishaw has expanded its RenAM 500 series of laser powder bed fusion (LPBF) systems with the launch of the RenAM 500 Ultra AM system, which can reportedly cut build times by up to 50% without compromising on quality, and give metal additive manufacturing (AM) users the tools to produce parts faster.

The RenAM 500 Ultra system includes all the existing benefits of the RenAM 500 series, including optical, chamber and gas-flow design, and new productivity-boosting Tempus technology and advanced process monitoring software.

Tempus technology incorporates new scanning algorithms that enable the laser to fire while the recoater »

is moving, saving up to nine seconds per build layer. The RenAM 500 Ultra's advanced process monitoring software also delivers detailed insights into the build, equipping users with data and providing in-process visibility.

The RenAM 500 Ultra metal AM system is the latest model in the RenAM 500 family, which also includes the Flex system, optimized for R&D work, and the powder recirculation model for series production. The entire RenAM 500 family is available with one (500S) or four (500Q) high-powered lasers, each able to access the whole powder bed simultaneously.

Renishaw Inc. | 847-286-9953 | renishaw.com

Edge Technology Sliding-Headstock Lathe Boosts RPM

Edge Technologies' FMB Turbo 3-38 bar feeder for sliding-headstock CNC lathes features the company's Revolutionary Sliding (RS) technology. This design is said to be the first in the industry to fully support the bar pusher and stock from inside the bar feeder all the way into the lathe spindle.

According to the company, the FMB Turbo 3-38 RS is well suited for Swiss lathes with longer Z-axis strokes, as well as demanding applications such as challenging materials, profiled stock and non-guide brushing mode. The integrated and oiled sliding guide module and moving steady rest provide superior bar pusher and stock support in the transition zone between the bar feeder and lathe spindle. FMB's RS technology eliminates the need for telescopic noses, extended pushers and Z-axis axial track, all of which were accessories designed to minimize the gap between the bar feeder and lathe. The design reduces vibration and boosts maximum rpm.

Providing a rigid extruded base and advanced performance characteristics, the Turbo 3-38 RS is designed to help manufacturers achieve faster cycle times, better surface finish and tighter tolerances.

Kevin Meehan, president of Edge Technologies, says, "The patented sliding guide module represents a significant advancement in providing superior bar stability and rpm performance."

Edge Technologies | 314-692-8388
edgetechnologies.com

Universal Robots' Cobot Offers Precise Placement of Large Payloads

Universal Robots has expanded its portfolio with a new 30-kg-payload cobot. UR30 is the second in Universal Robot's new series of cobots, and it is built on the same architecture as the UR20. Despite its compact size, UR30 is said to offer extraordinary lift, and its motion control ensures the ideal placement of large payloads, enabling it to work at higher speeds and lift heavier loads.

According to Universal Robots, UR30 is ideal for several applications, including machine tending, material handling and high-torque screw driving. For machine tending, the high payload brings new possibilities, as it enables the cobot to use multiple grippers at the same time. This means it can remove finished parts and load more material in one single pass, shortening changeover times and maximizing productivity. »

UR30 will also effectively support high-torque screw driving, as it can handle larger and higher-output torque tools, and due to a Steady Mode feature, UR30 delivers straight and consistent screw driving. This will be beneficial in the automotive industry, for example.

In addition to this, the 30-kg payload makes UR30 a great match for material handling and palletizing of heavy products across all industries, with the small footprint enabling it to fit into almost all workspaces, relieving humans of the heavy lifting. Weighing 63.5 kg, it can also be easily moved between work cells.

Universal Robots USA Inc. | 844-462-6268
universal-robots.com

Nikon Metrology Systems Provide Non-Destructive Inspection

Nikon Metrology has launched three new models in its VOXLS range of X-ray computed tomography (CT) systems for non-destructive inspection. The 30 Series is designed for users looking for an automation-ready system with the versatility to meet a wide range of industrial applications.

The VOXLS 30 C 225, 30 C 320 and 30 C 450 models have maximum source energies of 225 kV, 320 kV and 450 kV, respectively, for examining parts of various densities and sizes. They also have a more compact footprint than Nikon's 40 series, while maintaining advanced features traditionally exclusive to larger, more expensive solutions.

The systems are designed for automated operations across the production sector, especially for quality control in factories producing lithium-ion batteries or additively manufactured components. The automotive, aerospace, medical and pharmaceutical industries are additional target markets, and many applications can be found in materials science, natural sciences and academia.

At the core of this series is a metrology-grade, granite-based manipulator coupled with rigid steel towers, which provides a thermally stable and solid construction. High-precision motors, ballscrew drives and encoders provide precise positioning and accurate movement of all axes, including the synchronous vertical motion of the X-ray sources and detectors.

The 30 series systems feature extensive CT acquisition technologies and reconstruction algorithms, including X.Tend Helical CT, Offset.CT, Panel Shift, Pixel Split CT, Half.Turn CT and Tilted CT.

According to Nikon, the 30 series' 225-kV model offers an industry-leading scan volume within its size class, while all models offer maximum scanning volumes of more than 600-mm diameter by more than 1,000-mm high. The systems are powered by Nikon's X-ray source technology, including its specialized 225 kV Rotating.Target 2.0 and 450 kV reflection target.

The 30 series cabinets utilize a manipulator-interlocked, glass outer door to give the operator visibility into the enclosure when the inner radiation safety doors are open. This design enables confident positioning of the scan object, minimizing the risk of collision with the X-ray source and detector while also providing a physical safety barrier between the operator and the moving manipulator. Multiple internal, high-resolution video cameras provide a view even with the inner radiation safety doors shut and X-rays on. The systems also feature motorized bi-parting radiation doors that open and close in less than five seconds, behind which the cabinet interior can accommodate items up to 1,000 mm in diameter by 1,370 mm tall.

Nikon Metrology | 810-220-4360
industry.nikon.com/en-us

Marketplace

Review CNC machining innovations and products targeted to metalworking professionals and industrial manufacturers.

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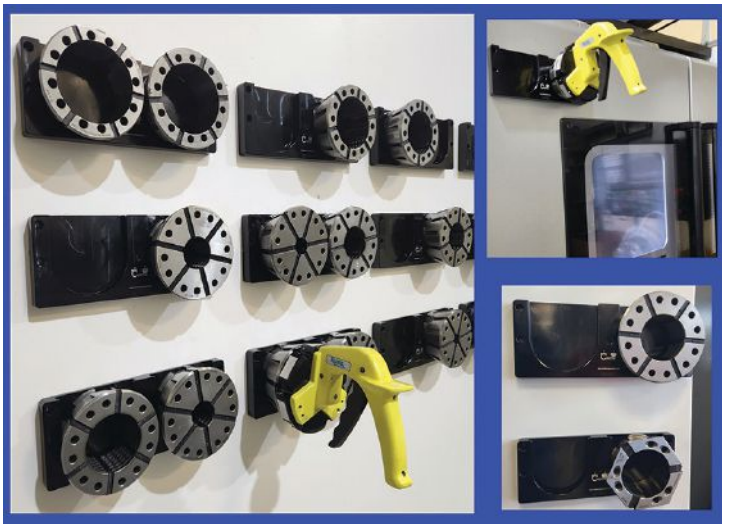

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HOW I MADE IT

Doug Schulte

SENIOR PRODUCT MANAGER,
Select Machining Technologies

INTERVIEWED BY | **BRENT DONALDSON**

To some of his friends, Doug Schulte is known as "machine tool Google." His encyclopedic knowledge of the specs and mechanics of machine tools comes from a lifetime spent in the industry. It all started with his dad, John, who joined machine tool manufacturer LeBlond in the early 1950s.

I GUESS YOU COULD SAY I was born into this business. My dad started working for LeBlond around 1953, and after 32 years he went to work for a small company who was the LeBlond Makino distributor at the time, the R.O. Deaderick Company [now part of The Morris Group].

I REMEMBER GOING TO THE FACTORY with him where they had several different lathes on the floor. If I had a science project at school where I needed to make something, we would go to LeBlond and make it. The idea that you could cut metal was astounding to me.

I QUICKLY REALIZED after one year of a four-year college program that I wasn't the manufacturing engineering type of guy. So I went to Cincinnati Technical College (now Cincinnati State), which had a program called Industrial Sales and Marketing.

SINCE '88 I'VE BEEN WITH THE MORRIS GROUP. But I didn't differentiate it. It always felt like I was working for Dad. And I continued to work for Dad until he retired in 2001.

IF I SELL SOMEONE SOMETHING AS SIMPLE AS A SAW, and that saw was a good saw, when that person did get around to buying a lathe or a machining center, I was probably going to get the phone call. That was my thinking. I never want to turn a customer over to a competitor and say, "Go buy from them."

I WAS EMBARRASSED EARLY ON IN MY SALES CAREER with a customer in Tennessee. An engineer asked me a question and my answer was incorrect. He called me on it. After I left, I said to myself that I'm never going to let that happen again. Ever since, if I was promoting a machine to a customer, I would know every aspect of that machine forward and backward. I would know the specs better than the manufacturer.

MY DAD WOULD ALWAYS BE ASTOUNDED because I hate to read. I've got books on my bookshelf but there are very few of those books that I've read. But I'll sit down with a machine tool manual and read it cover to cover.

EARLY IN MY CAREER, Dad pointed out that I asked a lot of questions in the sales meetings. But I noticed the older sales guys would never do that. So I asked Dad why no else asked questions. He said, "Well, they don't want to admit that they don't know the answer."

IT'S A FANTASTIC INDUSTRY. If the country's not manufacturing something, the country's not surviving. And it's a fun industry — the kind of things we do, the kind of things we make, the kind of parts you see, the people you deal with. I've developed friendships all over the world. There are (machine tool) builders that I don't represent anymore that still wish me happy birthday every year. You're tied to a very small industry that has so much impact on everybody's lives. And most people don't know it.

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