Modern Machine Shop

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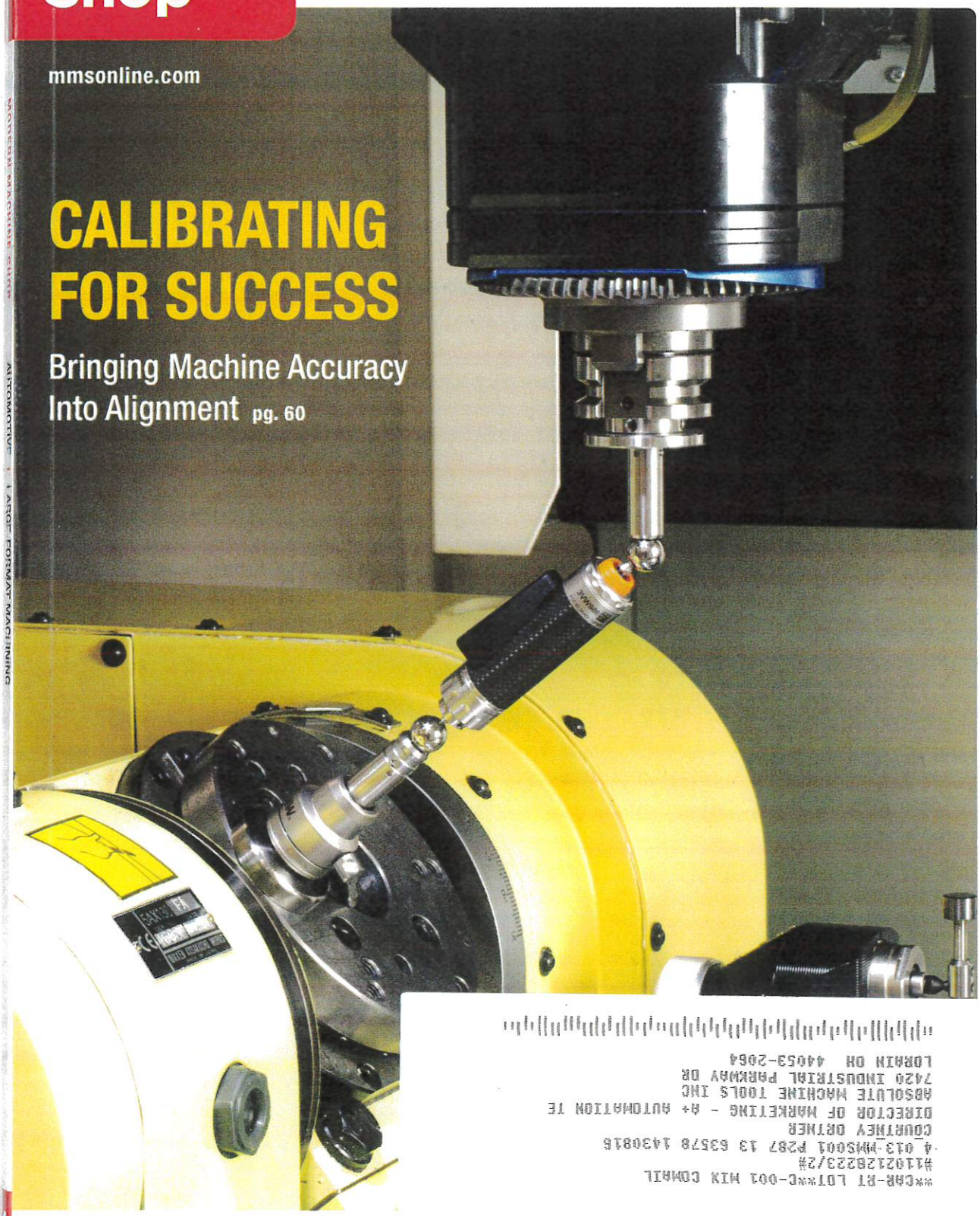


Barbco's Johnford DMC-4100PH is not the largest machine in Johnford's catalog — but it was the largest that could fit in Barbco's facility. The table can hold extremely heavy parts, supporting a total weight just over 11 tons.

All photos: Evan Doran, *MMS*

Rigidity Reigns Supreme for Utilities Drilling OEM

Different industries often require different machining priorities, a truism Barbco recently demonstrated with its success in pivoting toward rigid, less complex machining centers.

EVAN DORAN | ASSOCIATE EDITOR

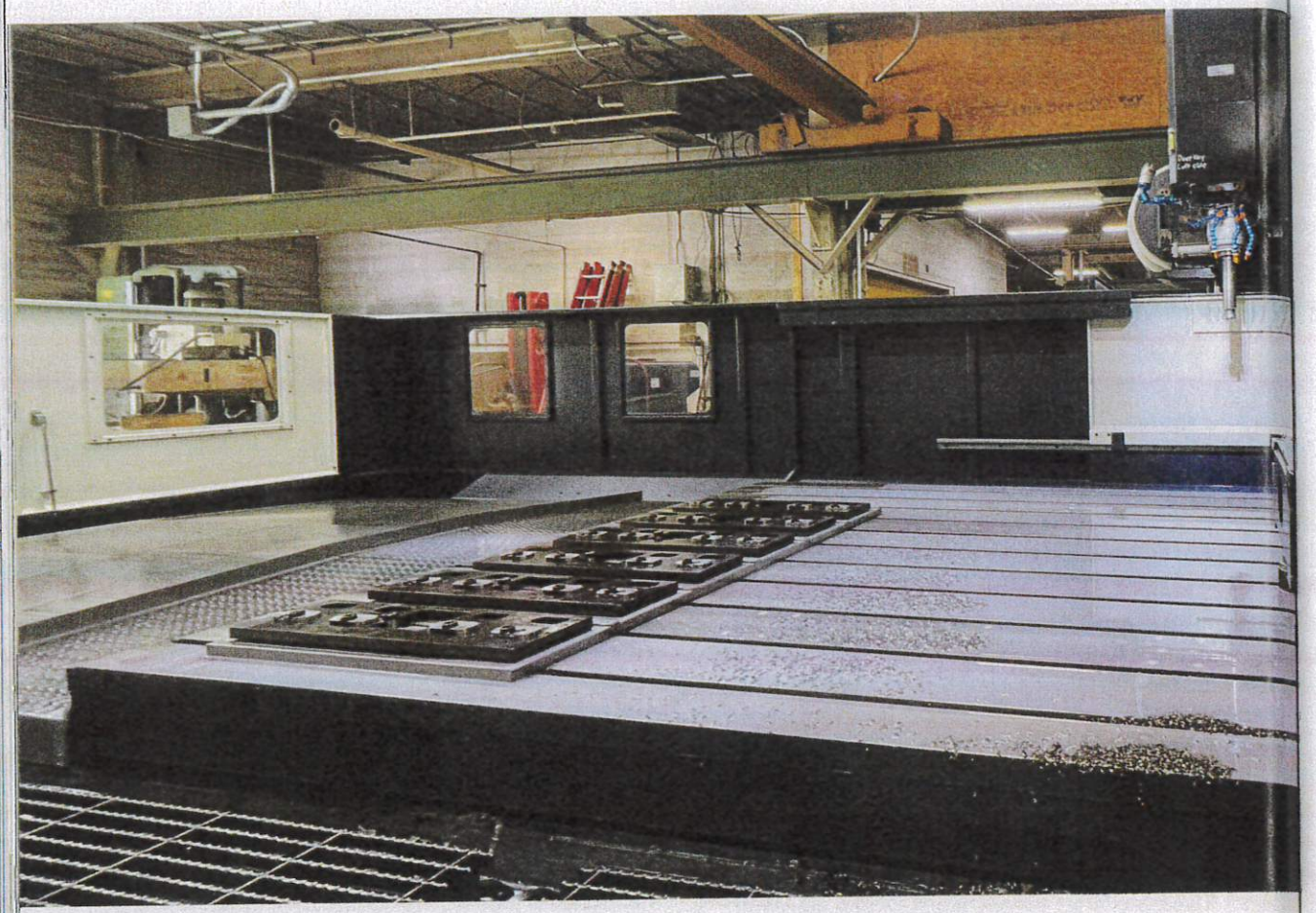
Two years after Barbco bought a five-axis mill to machine its monolithic parts from a single block, its machine shop has changed directions. The company, founded in 1989 and located in Canton, Ohio, is well-known in the underground construction industry as a producer of trenchless boring equipment meant to drill through earth and rock without disturbing the ground above. This equipment encompasses drill heads (which can have diameters anywhere from 24 inches to 72 inches) and other components for heavy-duty underground drilling machines, as well as track rails for these machines. After experimenting with five-axis milling in hopes of reducing setup times, the company's star machine is now a double-column Johnford DMC-4100PH three-axis mill — a move that returned many of its one-piece constructions to weldments and prompted operators to learn G code after a lifetime of using conversational programming.

Despite these seemingly counterintuitive changes, Barbco Production Manager Matthew Wolf and Lead Programmer and Foreman Andrew Liston say that production is not only back on track, but running smoother than ever. "There is life after five axis," Wolf says with a grin. By focusing on the industry it serves and being adaptable to change, rigidity and dependability now rule the day on Barbco's shop floor.

Toward an Unshakable Construction

The key selling point for the bridge mill was its rigidity and stability. Barbco needed a machine that could perform both heavy-duty roughing and fine-tolerance work down to 0.0005 inch in A36 steel. When the shop's aggressive cuts damaged the five-axis machine's pivoting spindle head, repairs caused a delay that Barbco could not afford to repeat. With this lesson in mind, Liston and Wolf began weighing the tradeoffs between reduced setup times offered by five-axis machining versus the stability of a more rigid but less complex machine tool.

Nearby distributor Absolute Machine Tools soon introduced them to the Johnford bridge mill. While it lacks the positional five-axis capabilities of Barbco's previous machine, its table is larger and its work travels longer, with 161 inches of X-axis travel and 90 inches of Y-axis travel. It can also hold heavier parts, and the



The table on the Johnford is large enough for Barbco to set up different projects on different portions of the table, using G stops to indicate which section of the table the machine should work on at a particular time. This lets the company keep parts set up if it needs to change focus for a rush order, or if one project runs into problems that can't immediately be resolved.

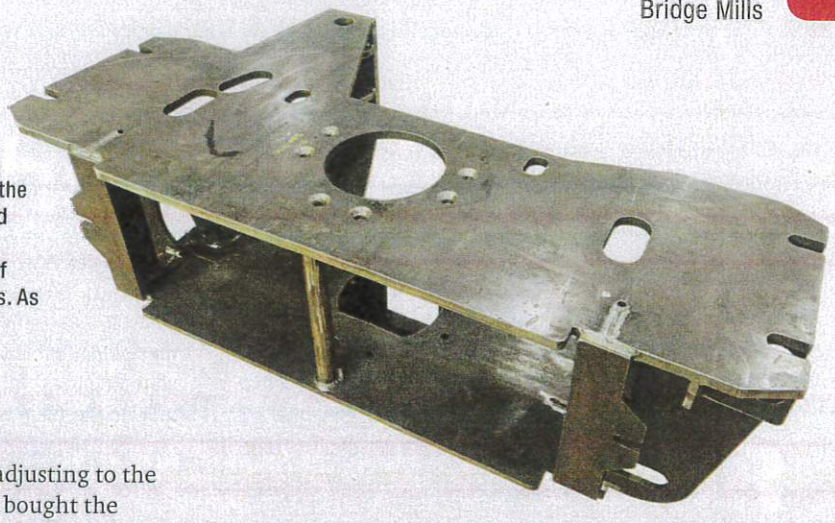
machine's construction is more rigid to sustain the shop's aggressive machining strategy. The five-axis machine's advantages in setup time and operational consolidation were greatly appreciated, and Wolf says the five-axis machine would be well suited for aerospace work, but the Johnsford bridge mill's strengths "fit our industry better."

For a non-rigidity example, because Barbco is an OEM for a high-wear industry and often performs field maintenance, it must deliver repair parts on tight schedules. Yet with half-day setup times for larger metal weldments used in drills and track rails, unloading parts to meet a rush order is not an option. This is when the larger size of the Johnford table comes in handy, as Barbco can set up the repair parts on a different segment of the table and add G stops to the part program to ensure the machine only works in that area.

Strong Support

Meeting these rush orders also requires swift support. When Liston and Wolf talked to Absolute Machine Tools, the representative from the distributor promised prompt service that would respond to any issues in two days or less. So far, Absolute has remained true to its estimates and has worked to get ahead of any issues by creating a maintenance log with service dates to ensure Barbco knows the necessary service intervals for individual systems on the machine.

While the service plans are useful to Barbco, the Johnford has only required regular maintenance such as topping off coolant and way lube oil since the machine's installation in April 2023. Even filter changes are simple on the machine, as the DMC-4100PH is so large that some can even be changed while the machine is running on a different part of the table.



One of Barbco's standout new parts is the rotary gearbox for its Pathfinder guided boring machine. The rotary gearbox includes four pinions with 26,000 lbs of torque and can push nearly 500,000 lbs. As such, the gearbox must meet exacting tolerances to remain durable.

Conversing About G Code

Less simple for the shop has been adjusting to the Johnford's FANUC control. Until it bought the DMC-4100PH, Barbco ran its machine shop on manual machines and CNCs with conversational controls. Moving to a more traditional control — one that lacked a touchscreen and presented lines of G code rather than graphics — created a tall order for the shop. While the shop had already invested in Mastercam in 2019 to simplify coding for the five-axis machine, its use cases were rare enough that it could rely on Liston as the sole expert in the software. In contrast, the team estimates that 90% of the work on the Johnford requires Mastercam, doubling the shop's use of the software.

The two operators for the Johnford have both started learning how to use the FANUC control, but Liston still performs most of the programming, utilizing many of the lessons he learned while programming for the five-axis machine.

In addition to the Johnford mill, Barbco bought a Hurco VM20i three-axis mill earlier this year from Reynolds Machinery in Dayton, Ohio. With chip hopper and through-spindle coolant add-ons, the machine is fast and strong enough to match the output of the company's larger VMX 60. Now, the shop uses the Johnford for its larger parts while tasking the Hurco with smaller parts.

SELLING POINTS

The collapsible drill head has interested job applicants in Barbco's machine shop. Liston and Wolf credit this to the company's appearance at a Utility Expo where Barbco showed off the drill head. "If you see the final product, it drives a different aspect than even just seeing the machine you get to work on," Wolf says. "Sometimes it's not about the work environment, so to speak. It's about what you get to build and what you get to be a part of."

That's not to say work environment doesn't play a role in employee retention, as Wolf and Liston say some employees have joined Barbco for the more open environment, even if it pays less than their previous job. As managers of the shop floor, Wolf and Liston say they keep their doors open for operators to suggest new ways of tackling problems and test out these theories. They say this autonomy helps boost staff members' self-worth, attitude and ambition, making the team work better alongside one another.

Also helping retention is the part variety moving through the shop. Even as an OEM, "We're not just making the same 10 parts," Liston says. "Engineering is constantly changing things. I see multiple parts hit the floor each week that I've never seen in my life." These can be revisions or wholly new designs, pushing the limits of the Johnford and the other machines in Barbco's machine shop. But so far, all have come out successful.

This includes high-efficiency machining strategies that use the full flute length of tools, which he says have enabled high-end tooling performance with less-expensive tools.

The team has also found that altering programs from the control is more difficult than altering them from Mastercam and posting them to the machine. Liston handles most of these changes, accessing Mastercam from his office or from home through a VPN and posting the program to the Johnford via a data server attached to the machine. However, this reliance on Mastercam has required the shopfloor team to trust Liston more about the programs he sends them, and they must properly communicate any issues with the part program to him.

When this all comes together, it works wonders for the machine shop. One example Liston points to is the rail tubes for the company's Pathfinder rotary gearbox. These rail tubes can be 164 inches long and must remain straight. Through manual means, operators would need to use an indicator and take measurements all the way down the machine to ensure the tube is properly set up. Errors would require infinitesimal adjustments and another round of measuring. With Mastercam, operators only need to probe each end to find the part's angle in comparison to the table. From there, Mastercam can skew the entire part program to match the part's orientation.

Designing to Limits

The rigidity of the machine has enabled Barbco's engineering department to design increasingly complex parts that push the Johnford's capabilities, most notably a collapsible drill head for utility drills.

Unlike previous challenging parts designed to be monolithic single-piece parts, this drill was designed to be assembled via welding. The part material arrives as six-inch-thick steel, with dimensions that would not have fit in the five-axis machine's enclosure. This material gets machined down to 5.5.-inches thick, then undergoes a two-day profiling process. The machine shop then mills the wipers and cutting heads from separate stock — potentially on another mill, but Wolf says the process is more effective on the Johnford — then welds them onto the frame.

This part is Barbco's answer to a long-running challenge in the industry: When a cutter breaks or dulls, how can a company withdraw the drill head without losing the hole? Liston and Wolf say demand for the drill head has been high, and as such the shop needs to make the parts as quickly as possible — the shop even plans to start building an inventory of the machined parts during lulls of orders so it can quickly weld the pieces together and maintain a swift turnaround time for fulfilling orders.