

Innovative CNC Technology Bridges the Skills Gap

Expedited Operator Training With MAZATROL Conversational Programming

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INTRODUCTION: THE SKILLS GAP

For years, the growing gap between the number of manufacturing job opportunities and qualified candidates has alarmed manufacturers and policymakers alike. According to the 2018 Deloitte and The Manufacturing Institute Skills Gap and Future of Work Study, by 2028, this gap will have grown to 2.4 million positions, a massive number of unfilled jobs the authors estimate will cost the U.S. economy \$2.5 trillion.

Although the skills gap has many causes, the primary driver is the least amenable to change: The world's population is aging. In 1994, adults at or above 55 years of age constituted just 12 percent of the U.S. workforce; by 2024, that is expected to more than double. By the 2030s, retirees will outnumber children and teens below 18 for the first time in America, a fact that holds true across much of the developed world. And when those workers retire, they take their decades of experience with them.

The manufacturing industry has long been in the vanguard of the search for solutions to the skills gap, not least because its existing workforce is already relatively old; a 2015 SHRM study, *Preparing for an Aging Workforce: Manufacturing Industry Report*, established that roughly 27 percent of workers in the manufacturing industry are 55 or older. And one of the primary avenues for addressing the problem presented by an aging workforce is to focus on how new workers are trained and onboarded.

To this end, Mazak Corporation has spent decades perfecting its human-machine interface (HMI) paradigms, seeking at every opportunity to simplify the operation of its machines and streamline the learning process for new operators. This effort has included everything from new machine controls to the Progressive Learning program it offers at its Technology and Technical Centers across North America. Perhaps the most important element of its mission to improve user experience and fill the skills gap, however, is MAZATROL, the first conversational programming language for CNC machining.

The Mazak logo is displayed in a bold, orange, sans-serif font.

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TRADITIONAL APPROACHES TO MANUFACTURING EDUCATION

In previous years, middle and high school shop classes were part of the core curriculum, classes in which students gained the skills they needed to thrive in a manufacturing-dominated economy. As manufacturing increasingly moved offshore, however, educators changed their approach. After all, why prepare students for jobs that no longer existed?

As industry professionals know, however, manufacturing never left, but changed. Today's manufacturing professionals typically come from backgrounds in science, technology, engineering and math – the so-called w – and have the necessary training to take on industry or job-specific continuing education. For machine operators and programmers, this typically includes learning EIA/ISO programming and one of several CAD/CAM systems, along with the information one needs to apply it successfully: a thorough understanding of metalcutting physics, materials science and tooling.

Unfortunately, the competition is fierce for candidates with these qualifications. STEM graduates have numerous opportunities in today's job market, and while manufacturing has changed, the popular conception of it has been slow to catch up. Fortunately, the trends are promising – in 2017, Deloitte and The Manufacturing Institute found that 88 percent of Americans expected manufacturing to become more technically demanding, and 81 percent believe it will be a safer, cleaner and more well-compensated profession, thus drawing more individuals to careers within the sector.

Despite the fact that a majority of Americans believe that expanding the domestic manufacturing sector should be a priority for the country, the changes are likely too slow to significantly affect the skills gap. Instead, manufacturers are often forced to teach part programming and CNC machine operation on the job, a time-consuming and expensive approach given the tight production schedules under which most shops operate.

AN INTEGRATED APPROACH FOR THE NEXT INDUSTRIAL REVOLUTION

Manufacturing professionals, educators and policymakers have sought to address this issue in numerous ways, but many of these efforts are expected to span years and decades. Today's shops need a solution today. And Mazak has worked to supply that solution with a comprehensive, integrated and single-source approach to educating new operators quickly and easily – an approach made possible by a nearly 40-year-old programming language.

MAZATROL

First introduced on the MAZATROL T-1 control equipped on the QUICK TURN 10", the MAZATROL conversational programming language made its debut in 1981. The development of MAZATROL, a wizard-like programming mode that bypasses the use of G-code, made it possible for inexperienced operators to quickly and easily develop machining programs while out on the shop floor for the first time.

Operators begin the process answering conversationally displayed questions concerning the intended workpiece. These include type of material, O.D./I.D. dimensions and part lengths, among other queries. Then according to the input data, the MAZATROL control automatically calculates intersection coordinates and tool index positioning in addition to optimized cutting conditions and machining processes.

As these questions are answered, the control constructs the program, then allows the machinist/programmer to visually check the tool path and verify the program. In the event of program flaws or missing information, the control will display an alert and the programmer must remedy the problem.

Advanced program functions of MAZATROL include:

- Tool Data Integration
- Adjustable Ultra Precision
- Quick EIA
- Quick MAZATROL
- Full-Machine Simulation
- Microsoft® Windows® Integration
- Part Offset Support
- Tool Offset Support
- Spare Tool Setup
- FANUC-Compatible G-code Support
- Easy G10 Data Change
- Flexible Macro Variables

MAZATROL SMOOTH CNCs

Today, old and new Mazak machines alike are increasingly equipped with state-of-the-art MAZATROL Smooth CNCs that are part of the company's SMOOTH TECHNOLOGY platform. SMOOTH TECHNOLOGY spans the entire part-production landscape from programming and metal removal to automation and data collection. The all-encompassing technological paradigm seamlessly brings unmatched speed, accuracy, functionality and ergonomics to virtually every type of metalworking application.

Every feature of Mazak's MAZATROL Smooth CNCs is a direct response to real-world issues and customer input. Mazak's MAZATROL SmoothC optimizes programming and makes it easy to generate programs for processing complex parts through off-centerline machining as well as angled drilling, milling and tapping. The MAZATROL SmoothG CNC offers the same capabilities with an advanced Windows-based platform, and for highly advanced programming, the MAZATROL SmoothX CNC, the most progressive control available, significantly reduces part cycle times, especially in fine increment programs for full simultaneous 5-axis machining on applicable Mazak machines.



MAZATROL COURSE SYLLABUS SAMPLE

Course Title

“MAZATROL SmoothG/SmoothX Conversational Programming for Machining Centers”

Overview

The purpose of this class is to provide part programming information using the MAZATROL programming language on Mazak Machining Centers.

Day 1

Machine and programming coordinate systems, program file screen, common unit, WPC, face milling, tool file, basic shapes, shape and tool path graphics

Day 2

Edit features, same tool, multi-mode, line machining, tool data and tool file, WPC, virtual machining, machine simulation, arbitrary shapes

Day 3

Units explained: end, M Code, subprogram, pallet change, index, step, pocket mountain and pocket valley; process control and program layout screens; unknowns calculating; shape rotate and shape shift

Day 4

MMS; tornado milling; planet tapping; parameters, TPC, VFC and TPS explained; Factory tour

PROGRESSIVE LEARNING

Mazak's Progressive Learning program represents a unique, phased approach to education and training. It combines hands-on learning, web-based instruction and real-world examples to empower customers with the skills needed to capitalize on their investments in advanced technology.

The program encompasses tiers of offerings, ranging from self-paced coursework to highly advanced Multi-Tasking User Groups. This ensures an appropriate entry point for any individual, regardless of their current level of skill and expertise, while three years of free training included with every new machine makes it possible for any shop to make the most of their Mazak technology.

In addition to online classes, students may attend courses at a variety of locations. Classes are routinely offered at the Mazak Learning Center and Center for Multi-Tasking and Manufacturing Excellence in the company's Florence, Kentucky-based headquarters, where more than 3,000 customers receive training annually. Furthermore, each of the Regional Technology Centers and Technical Centers also utilizes the Progressive Learning approach, offering a host of training alternatives, including on-site programs held at customer facilities.

MAZATROL BRIDGES THE GAP

As educators and policymakers begin reorienting the American education system toward better preparing students for the modern job market, manufacturers will likely see more applicants with the programming, robotics and supply-chain expertise needed for success in the industry. In the meantime, however, companies like Mazak have worked to fill in the gap between aging experts and youthful students.

The core advantage of MAZATROL – its conversational approach to part programming – makes it possible for students to quickly garner the skills they need to become fully capable operators. A single five-day class is all that's required for competency, and further coursework is available to help competent operators become master craftspeople – coursework that is free of charge for years after the initial purchase of a Mazak machine.

Now, manufacturers have a simple, effective way to avoid falling prey to the worst effects of the skills gap. An aging workforce only presents a problem when bringing new operators up to speed is cost-prohibitive, and employer-subsidized training can be a significant motivator for young job applicants, many of whom feel unable to gain applicable skills without taking on student loan debt. Today, Mazak offers an alternative by providing access to technological solutions that expedite training and arm young people with the skills they need for the jobs of tomorrow.

Mazak customers have access to the industry's first programming system designed to work with our natural language – MAZATROL – and an exceptional, comprehensive training program.



SUMMARY

With millions of unfilled manufacturing positions expected to result in trillions of lost economic potential expected over the next decade, manufacturers have turned to their OEMs and suppliers to overcome the skills gap and continue expanding their productivity. Mazak customers have access to the industry's first programming system designed to work with our natural language – MAZATROL – and an exceptional, comprehensive training program. Thanks to this innovative approach, every Mazak machine serves as a bridge across the skills gap, a way to bring new professionals into the industry and keep manufacturing alive and well in North America.

About Mazak

Mazak Corporation is a leader in the design and manufacture of productive machine tool solutions. Committed to being a partner to customers with innovative technology, its world-class facility in Florence, Kentucky, produces over 100 models of turning centers, Multi-Tasking machines and vertical machining centers, including 5-axis models. Continuously investing in manufacturing technology allows the Mazak iSMART™ Factory in Kentucky to be the most advanced and efficient in the industry, providing high-quality and reliable products. Mazak maintains eight Technology Centers across North America to provide local hands-on applications, service and sales support to customers.