# Automation: Today and Beyond

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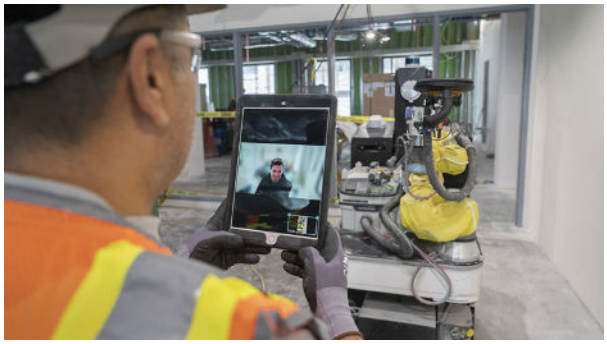
***It's time to rethink manufacturing and the role our workforce (or lack thereof) plays in its success***



As with many robotic solutions, Canvas provides remote support to its users through a mobile device interface. (Image provided by Universal Robots USA)

Decades of offshoring coupled with a societal "trades-are-dirty" mindset have left the United States manufacturing industry wedged firmly between a rock and the proverbial hard place. Machine shops, moldmaking houses, sheet metal fabricators, and plastic injection molders all share the same sad story: We can't find workers, and when we do, they A) want big bucks, B) are unskilled, C) don't stick around long, or D) all of the above.

It's not going to get any better. According to a 2021 study conducted by Deloitte and the National Association of Manufacturers (NAM), the manufacturing skills gap in the U.S. could result in 2.1 million unfilled jobs by the end of the decade, potentially costing the economy $1 trillion in 2030 alone.

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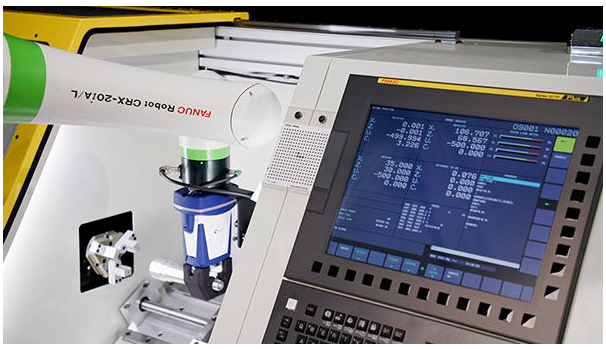
stated in a Forbes article what many in the industry have already learned: “Automation can help manufacturers augment human workers and free them up to focus on more valuable tasks, enabling a new level of productivity.”

To say that success in manufacturing is now an automate-or-die proposition might be hyperbolic—but only slightly.

## Quick and Simple

FANUC America Corp. of Rochester Hills, Mich., has plenty to say on the subject, and as Executive Director of Global Accounts John Tuohy is quick to explain, there’s plenty of low-hanging fruit. “Of the millions of CNC machine tools in North America, less than 5% have a robot sitting in front,” he said.




With more than 5 million CNCs installed around the world, FANUC is making robot integration simpler by eliminating the need for a PLC. (Image provided by FANUC America)

FANUC aims to change this unfortunate statistic by making robot implementation faster and easier, at least for those who own one of the company’s machine controls. About a year ago, the well-known CNC and factory automation provider introduced Quick & Simple Startup of Robotization (QSSR), which takes the installation process from one day or more to a few hours, according to Greg Buell, a cobot expert and staff engineer for FANUC’s Material Handling Segment.

Buell added two caveats to his statement. Both the robot and machine control must have a FANUC logo, and an Ethernet connection is required. But, considering that every FANUC control for the last 20 years either has Ethernet or the option to install it, meeting these requirements is a slam dunk for much of the machining universe.

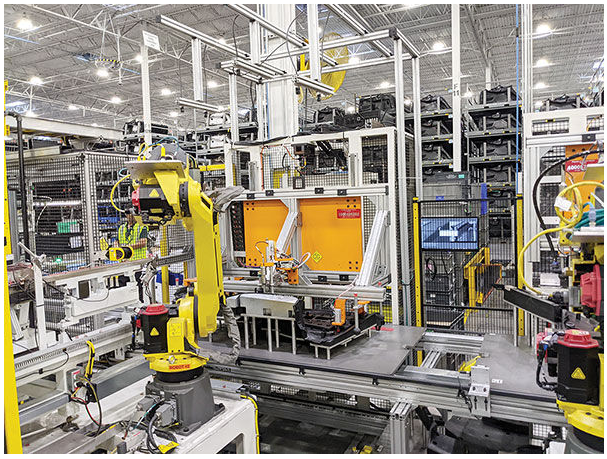
“Given the ongoing labor shortage, it’s increasingly difficult to find people for even basic tasks like machine tending,” Buell explained. “That’s why shops need the ability to quickly automate their machines, so they can

forms of machine interface. Instead, the robot can use an Ethernet connection and FANUC's FOCAS2 protocol to read and write macro variables within the CNC."

That should come as welcome news for many CNC owners, but machine tending is only one of the tasks that robots—FANUC or otherwise—will be called on to perform over the coming years. On the manufacturing floor, these activities include part washing and deburring, assembly and inspection, and painting and packaging. But as machine tool integration program a society can expect to see robots as part of our everyday lives—and sooner than any of us expect.

For instance, many fast food companies are looking hard at robots from Miso Robotics Inc. to automate kitchens. The Pasadena, Calif.-based robotics company is currently taking reservations for its Flippy2 frying system, and at $3,000/month, it presents an ROI model that competes favorably with paying an employee $15 an hour. When we have automated sales clerks, warehouse workers, mechanics, and body shop technicians, as well as self-driving trucks and delivery vehicles—never mind the possibility of A.I.-powered doctors, lawyers, and hopefully politicians—it raises a troubling question: What jobs will be left for us humans?

## Exhausting Tasks



A chip assembly workcell at a Tier 1 automotive supplier that uses an Apera AI vision system to guide an industrial robot to place chips in an injection-molded subassembly. (Provided by Apera AI)

Joe Campbell can't speak to the future of humanity, but he offers two examples from the construction industry where robots are making their mark. The senior manager for strategic marketing and applications development at Universal Robots (UR) USA Inc. in Ann Arbor, Mich., Campbell points to San Francisco-based Canvas SF, a partner company that has developed a UR-equipped "digital drywall solution" named Basil. "They took our collaborative robot

(premium) finish."

Then there's Hilti North America, a manufacturer of construction equipment that has tasked UR machines with a miserable chore—holding a hammer drill over your head all day. "The Hilti Jaibot downloads instructions from the cloud, uses a laser scanner to orient itself to the room, and gets to work punching the mounting holes for water pipes and wire channels," Campbell said.

Automation's continued growth can be attributed to the decrease in available labor rather than increasing labor costs, according to Campbell. "Construction site managers and plant owners aren't looking to save a buck. They need to meet customer orders, or they have half-million-dollar machine tools sitting idle," he said. "Automation is the only solution. And as I preach on all the time, the situation isn't going away. The Boomers are all retiring and the younger generation simply isn't interested in the trades."

For the Millennials, Generation Z, and the upcoming Gen Alpha workforce (collectively born from the early 1980s to mid 2020s) who decide to pursue a vocational-technical career, automation promises to make their days more interesting and enjoyable. Robot manufacturers have been telling us for decades that their products are designed to tackle the dull, dirty, and dangerous jobs—and as these little droids grow more capable, the list of suitable tasks grows ever longer.

A skilled welder can now spend her shift on the challenging "onesie-twosie" jobs while the robot does the "high-volume bracket work," Campbell said, adding that CNC machinists are assuming the role of robot herdmaster rather than loading and unloading parts all day. If Hilti and Canvas have their way, construction workers will soon have similar responsibilities, as will those in the fast food business where Flippy will make fryer burns—a painful and all-too-frequent experience for human workers—a thing of the past. "Companies of all kinds will also find it much easier to keep employees if they're offered interesting, fulfilling work," Campbell said.

## A Room With a Vue

While even a blind robot can find a nut, it will find nuts (and bolts) faster and more accurately if it can "see" them. Eric Petz might not laugh at this

software equips robots with “human-like” speed, sight, and perception.

“We make software that gives robots the ability to autonomously plan the best path in, through, and out of a work environment, and avoid collisions while doing so,” Petz said. “Further, we provide the robot with grasp intelligence, so that it knows when it’s picked up an item, and can then orient it properly based on the given task.

“This could be something as simple as pulling an item out of an unstructured bin and placing it on a conveyor or into a CNC machine, or it might be a more complex activity, like aligning a series of slots during an assembly operation,” he continued. “What’s more, the part can be translucent, reflective, or untextured, and there’s no need for special lighting as with many machine vision systems. It’s very forgiving.”

Such advanced capabilities have long been the Holy Grail of many robotic applications, but they were unattainable until fairly recently. As with facial recognition software, large language model chatbots and digital voice assistants, Apera AI uses artificial intelligence (A.I.) and machine learning to achieve its goals. It also uses off-the-shelf, commercially available cameras that “function like a pair of human eyes” and can cover larger areas in pairs.

Teaching the system starts with a CAD model or 3D scan of the workpiece. But, Petz explained, intelligence is augmented by “synthetic data”—artificially generated images that are fed into a neural network. “It’s not unusual for us to run a million simulations before we achieve the desired reliability,” Petz said.

“That said, all the training can be done offline, and once completed, the robotic program can be installed on a cell’s computer and operating in about half an hour.”

## Ready to D:PLOY

Even when gifted with vision and intelligence, however, robots can do little more than wave hello without end-of-arm tooling. Unfortunately, deciding among the many options can be a confusing exercise, especially as robots gain additional capabilities.

“For grippers, certainly, there’s no one-size-fits-all system,” noted Kristian Hulgard, general manager of Denmark-based OnRobot Americas’ U.S.


Fastems MMS for Part Handling offers batch production and setup scheduling for CNC lathes and machining centers. (Provided by Fastems)

When choosing a gripper, he added, the first step is to identify what type of workpiece you're trying to hang on to, whether it's a cylinder, cube, or more random shape such as a casting. There should be enough fingers to grip the parts securely and safely but without damaging it, and the system should be easy to set up to minimize downtime.

"Is it a heavy steel block or a delicate, precision-machined aluminum workpiece? Obviously, each has different needs in terms of gripping force, and the decision must be made as to electric, hydraulic, or pneumatic actuation," Hulgard continued. "But for payloads of 50 pounds (22.7 kg) or less, electric is often the best option, mainly because it's software controlled and you don't have to worry about valves and tubes. You simply plug it into the robot and go ... if a new part comes along, you just change the software setting."

This equation changes dramatically as the robot moves into sanding, welding, assembly, and, yes, hamburger flipping. It's for this reason that OnRobot developed D:PLOY, a software platform that provides a unified interface for robots, sensors, end-of-arm-tools, and even CNC machines, with all peripherals controlled via the D:PLOY interface. "Everything gets plugged into our software, and we then create the motion logic, gripping parameters, and whatever else is needed to control and operate the entire robot application cell," Hulgard said.

## Entering the Intelligent Automation House

Simplified programming and ease of use are crucial to automation's widespread future acceptance, but it's essential to recognize that not all automation is robotic. Bob Baldizzi is the regional sales manager for the East Coast region at Fastems LLC USA in West Chester, Ohio, a company known for its large-scale, container-style pallet handling

Fastems has moved into part-handling and cutting-tool automation systems, Baldizzi explained, as well as robot-based manufacturing cells that take instructions from a centralized manufacturing management software (MMS) platform. “Demand has increased exponentially, especially since COVID,” he said. “Every show, every customer visit, or phone call, the questions are always the same: We can’t find people, what can you do to help us, and how soon can we get it?”

As a result, the Fastems team’s job responsibilities have evolved, taking on advisory roles more so than sales as they “help folks understand how to automate,” Baldizzi said. But as he and anyone who’s attempted to do so will explain, there’s much more to it than hardware and software. “You can’t just slap a yellow robot in front of a machine and call it good,” he quipped. “There’s a lot that needs to change in a typical manufacturing environment and a lot you should be aware of when you begin an automation project, whatever its form.”

Sitting at the top of this list are stable, predictable processes, followed by more mundane but often overlooked considerations—hydraulic or pneumatic workholding, chip and coolant control, tool life management, inline probing systems, and downstream deburring and parts washing operations. Without robust solutions in each of these areas, automation will not produce the desired results.

In some way, humans will be more relevant than ever as automation use increases, albeit in fewer numbers. So will software, including the programming tools and aforementioned MMS. In these and countless other examples, human workers must not only learn new technologies, but develop a new mentality: How can I get a robot or other automated system to take over this task so I can go do something more important?”

## Everyone Is a Success Story

Courtney Ortner, chief marketing officer for Absolute Machine Tools Inc., Lorain, Ohio, agrees. Her company offers a range of automation systems —from Productive Robotics’ “truly teachable” cobots to the LoadMate Plus machine tending cells from Mitsubishi Electric. Absolute has also created the A+ Automation Team, a group of application engineers and integration specialists focused on this rapidly growing business.

aboard the robotic train. “Especially with the smaller companies, they’re enthusiastic until they see the price tag. Even when you show them the ROI, they’re simply not comfortable spending what they perceive as a big wad of cash on a piece of equipment that A) their people are unfamiliar with, and B) will provide uncertain results.”

That’s a crying shame, she lamented. Those who’ve taken the leap enjoy immediate productivity benefits. And once past the initial trepidation, employees begin dreaming up ways to give robots the donkey work, so they can do something more interesting. What’s more, shops that master automation open the door to the grand prize of manufacturing: lights-out operation, which promises to double or even triple output without additional machine tools, floor space, or the skilled employees that no one can find anyway.

Still, Ortner understands the reluctance, which is why she offers this simple piece of advice to anyone on the fence about automation: start small. “Take the first step and invest in a cobot,” she said. “They’re inexpensive, take less than a day to implement, and can be used for multiple tasks around the shop. ... We have quite a few customers now who’ve picked up a shift of unattended operation without a whole lot of effort,” Ortner said.

“I can also tell you that no one has ever come back to us asking for a refund, and most come back for a second or third cobot, or begin looking for other ways to automate. This is one case where everyone who takes that leap of faith is a success story.”

AUTOMATION ROBOTICS

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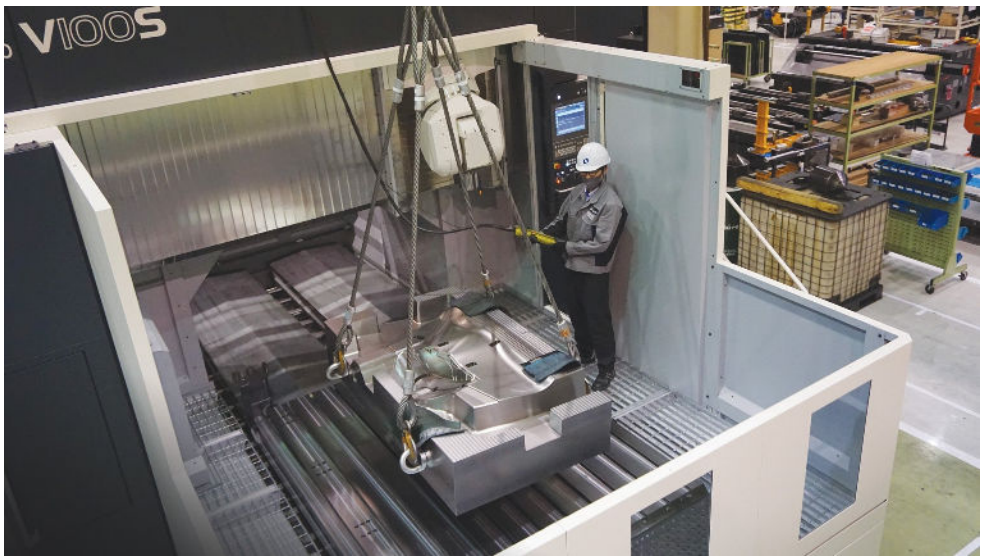
By **Kip Hanson**

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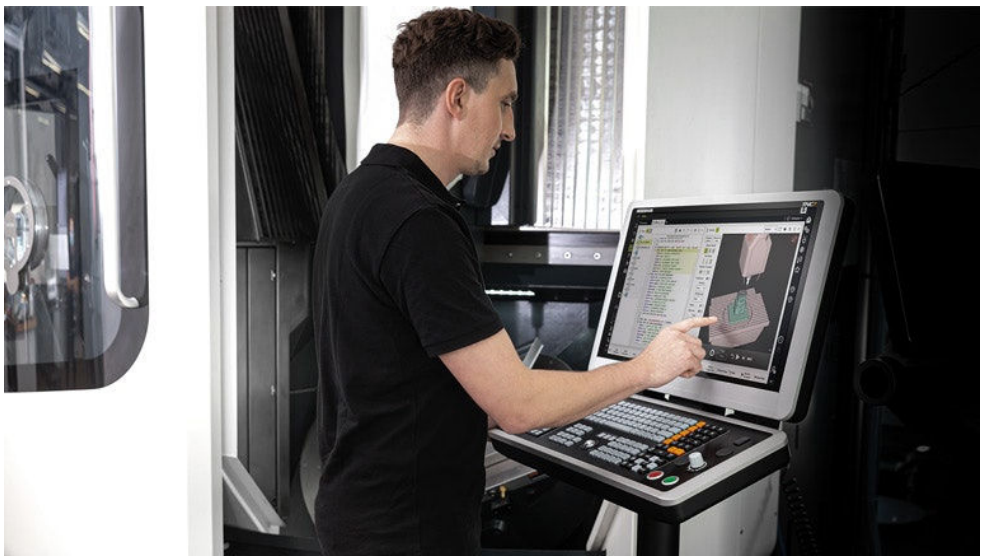

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AUTOMATION

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By **Kip Hanson**

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