



Collaborative robots and machine tending: The prosperous path forward

White paper

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Cobots help machine shops free up valuable personnel, increase capacity while improving quality, and breathe new life into idle equipment.

Industry experts have said that more than half of the 4.6 million manufacturing jobs created over the next decade could go unfilled, creating a massive labor gap. These shortages aren't just limited to skilled positions such as welding but also involve line positions, including assembly, packaging, and machine tending, according to a [report](#) from Deloitte and the Manufacturing Institute.

Making a tough situation worse, COVID-19 hit the manufacturing industry hard and fast in 2020, often limiting the number of workers allowed in facilities. But even before the pandemic, more

than half of U.S. manufacturers had redesigned their workforce architecture around automation, [according to Deloitte](#).

For many manufacturers, machine tending automation is the “low-hanging fruit” in terms of ease of setup, deployment, and return on investment (ROI). Robot machine tending involves automating the process of tending machines, such as computer numerical control (CNC) and injection molding machines. Typical tasks include loading raw materials into a machine and unloading the finished parts. Applications may include CNC lathe or mill

tending, injection molding, 3D printing, welding, compression molding, grinding, deburring and deflashing.

The manufacturing labor gap is causing many machine shops to leave older CNC machines idle despite their high capital costs, resulting in productivity and profit losses. An ideal solution involves keeping all machines loaded and running as much as possible. Automated machine tending keeps human operators away from dull, dirty, and dangerous machine tending jobs while increasing worker satisfaction and value by allowing employees to manage automation equipment or execute more complex, higher-value-added tasks.



Cover: Parts at Fusion OEM are staged and ready for the UR5e collaborative robot to insert them into the CNC for machining.

Inset: ActiNav from Universal Robots picks electrical boxes at Allied Moulded from a large, unstructured bin and precisely places them in a chute for secondary operations.



By deploying UR cobots on all three shifts, RCM Industries saved a total of eight operators for three different applications.



Do-it-yourself ROI in under two months

With a proper risk assessment, collaborative robots (cobots) can operate alongside skilled workers, in a shared workspace. Cobots feature internal sensors, controls, and safety protocols to immediately and safely trigger shutdown upon unplanned contact.

Due to their mobility and ease of use, cobots are particularly well suited for machine tending. Operators can program cobots very quickly, and upon deployment, cobots deliver higher throughput, consistent product quality, and lower cost per part than manual alternatives.

Cobots perform all or parts of a typical CNC process, including loading blanks into the chuck and finished part removal. In some applications, they conduct quality inspection. Machine tending has become one of the most popular cobot applications in recent years.

Maine-based precision molds and molding company Dynamic Group had difficulty staffing a labor-intensive machine cycle that required high-consistency handling due to heat-sensitive molding material. With Dynamic's

fast cycle times, operators had difficulty keeping up, resulting in ruined parts and downtime.

Seeking a flexible and mobile solution for high-mix, low-volume production, Dynamic Group installed three Universal Robot cobots in injection molding and kitting applications.

One robot tends a complete molding cycle. It picks "book frames" that hold pieces to be molded, transports the units to a trimming fixture, and presents the parts to an operator for handling. In the second application, a platen-mounted cartesian robot unloads the press. A cobot then places the molded part into a de-gating fixture and presents the part to an operator for inspection. In the kitting application, the third robot uses a vacuum gripper to pick up a "clamshell" — the bottom of a plastic box. It then places sterile wipes and saline solution in the clamshell before pushing the box onto a conveyor.

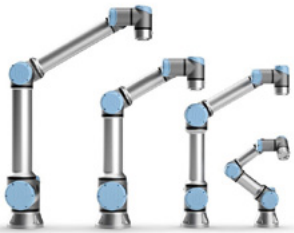
Dynamic Group previously used six to seven employees for post-mold kitting but now needs only two, providing ROI in under two months. After installation, all the

robot cells were programmed in just two days. It took Travis Oksendahl, an automation engineer at Dynamic Group, only two days to program the robots after cell setup. In multiple-application scenarios such as this, mobile floor or overhead/inverted track-mounted robots may work. In this case, Dynamic Group needed the flexibility to move the robots between presses based on the current production schedule, so mobile bases became the better choice.



Evco Plastics had trouble staffing a third shift so they implemented cobots to harvest plates in its 3D printing farm.

↓ Universal Robots offers four models of cobots ranging from 3kg to 16kg.



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Jiří Koláček
CEO
2K Trend

No programming knowledge, no problem

While Dynamic Group went the do-it-yourself route for setup, many other machine shops have had great success with robot integrators for quick and efficient cobot implementation.

In the Czech Republic, for example, companies such as 2K Trend have seen a shrinking labor pool. They knew automation would help, but given a heavy project load, 2K Trend didn't have the engineering bandwidth to develop a reliable solution in a short time. To increase productivity and allow

employees to add value elsewhere, the company selected a Universal Robots Certified Systems Integrator (CSI) for the complete project.

Their cobot was mounted on a pedestal next to the molding machine, allowing it to place plastic pellets into the mold to begin the cycle. In a scenario with no floor or overhead space, or if machine size restricts floor-mounting options, the cobot can attach directly to a machine or be invert-mounted on a vertical or overhead structure. At the end of the

molding cycle, the cobot removes finished parts onto a conveyor belt. While a monotonous activity, the task requires great precision in handling the finished plastic molding. The cobot now handles the entire process for [2K Trend](#), with no human interaction beyond regular visual inspection of the molded products and the robot's mechanical components. “The acquisition of a collaborative robot has proven to be a step in the right direction, and its operation in the company has met all expectations,” says Jiří Koláček, CEO of 2K Trend.

Leveraging lean integrators

Cobots have even spawned a new class of integrators specially adapted to the needs of small and medium-size enterprises (SME) looking to automate. Unlike traditional integrators, “lean integrators” are built for speed and managing overhead costs, typically specializing in highly targeted applications.

After installing a robot in 2018 for CNC machine tending, machine shop [Fusion OEM](#) continued adding robots to the point where its expertise could be leveraged beyond its own facilities. Today, Fusion Cobotics is a Certified Systems Integrator for Universal Robots that helps small to medium-size job shops focused on high-mix, low-volume applications automate CNC mill and lathe tending, as well as press brakes for sheet metal.

Partnering exclusively with Universal Robots (UR), Fusion Cobotics often formulates total project costs within hours after a first meeting and provides an electronic quote within days. The company can have a robot in full production a few days after its arrival. Fusion’s customers often see a 25%–30% efficiency improvement, routinely translating into an ROI

in 10–11 months. Even more, with Fusion’s systems, customers achieve a more predictable output than with manual machine tending – assuming they can even find and retain machine tenders.

After reading [Robotiq’s Lean Robotics book](#), CEO Craig Zoberis knew that cobots would not only

improve production processes but also empower his people. “It taught me many things – but the most important is that robots help fulfill human potential,” he said. “So instead of having our staff loading and unloading machines every 10 minutes, they can focus on machine programming and any other value-added tasks.”

Machine Loading for Metrology

Automating repetitive batch production, including quality assurance measurements, offers great ROI. Hexagon Manufacturing Intelligence’s TEMPO delivers automated part loading, queuing, and unloading for interruption-free inspection.

Hexagon’s system comprises a UR cobot and three to six drawers – each with 0.3 square meters of storage and capable of holding up to 100 kilograms of parts. TEMPO also accommodates mixed parts in one measurement cycle.

Operators remotely monitor machine status and process via mobile phone or tablet, and the software provides

notifications for completed measurements and out of tolerance work pieces.

With minimal operator training, TEMPO can be running within two days. Operators can also easily reconfigure it for new parts, as necessary.

[View more information on TEMPO here.](#)



Address labor shortages, enable worker upskill

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↑ Dynamic Group implemented a UR10 which now tends the entire injection molding machine cycle.

The company experienced just a 2 month ROI on the robot.

wipes and saline solution in the clamshell before pushing the box onto a conveyor.

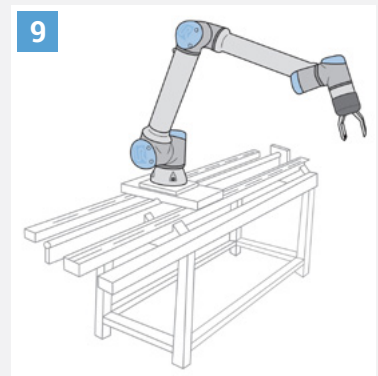
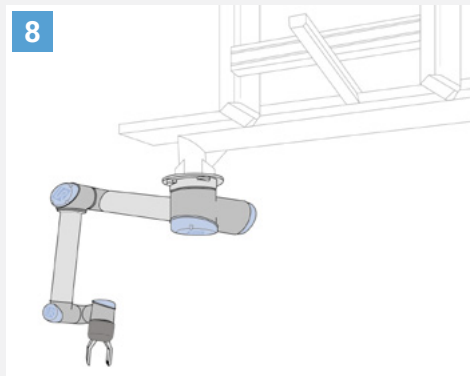
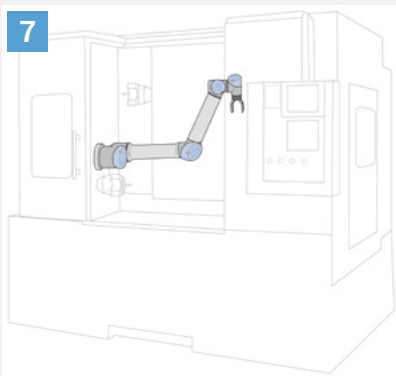
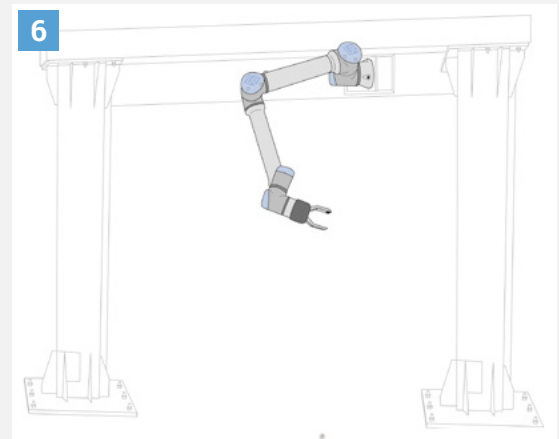
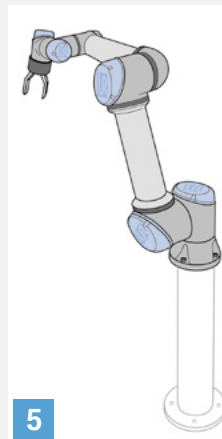
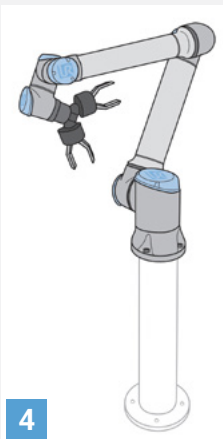
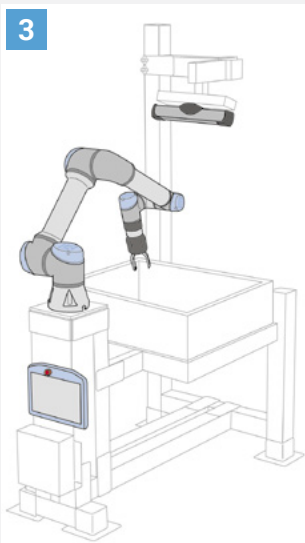
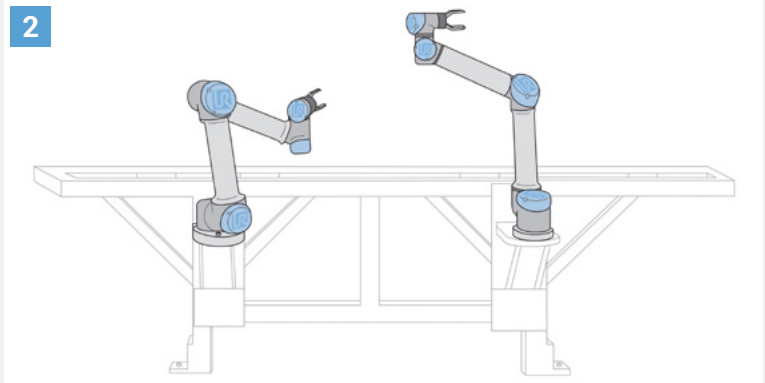
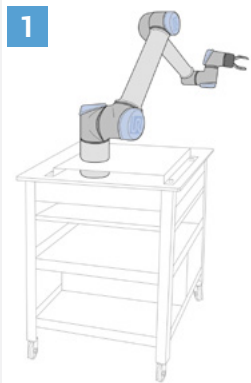
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Cobot mounting configurations

Collaborative robots are known for being flexible in many different ways, even how they're mounted. Here are some examples of various mounting configurations that allow cobots to get close to their tasks - in many cases tasks that humans could not safely reach.

Mounting Configurations

1. Cart-Mounted
2. Dual Floor-Mounted
3. ActiNav Machine Loading Kit
4. Dual Gripper
5. Pedestal-Mounted
6. Inverted-Mounted
7. Machine-Mounted
8. Track-Mounted, Overhead
9. Track-Mounted



Address Labor Shortages, Enable Worker Upskill

By introducing an automated machine loading solution called ActiNav, UR further enhanced its cobots' capabilities in machine loading and unloading applications.

Deploying ActiNav for repetitive, mundane tasks allows human operators to add value in new and more fulfilling ways. For example, full-service molding company Allied Moulded recently faced labor shortages and needed to keep processes running while protecting employees during the COVID-19 pandemic. Instead of using people to pick bins, the company decided to explore automation.

Initial explorations into bin picking automation proved unsuccessful. The guarding was intrusive and prevented operators from working in the area, and space at Allied was limited already, said Manufacturing Engineer Technician Nate Gilbert.

“Floor space here at Allied is pretty limited already, and the thought of having to put up more guarding to accommodate a robot was one of the things that held us back initially. But with collaborative robots being safe around

employees, we felt that was a great way to go,” he said.

Allied Moulded chose UR’s ActiNav solution, which combines intelligent vision with autonomous motion control software and UR’s world-leading cobots to deliver machine loading that’s precise, consistent, intuitive, and agile. ActiNav, explained Gilbert, was the first system that fit within the available space without creating extra obstacles.



Just the simplicity of it picking parts out of the bin and onto the conveyor is what we were really looking for, and ActiNav seemed to meet that demand,

Nate Gilbert
Manufacturing Engineer
Technician
Allied Moulded

PrecisionForm was challenged to automate the task of picking parts in deep bins and inserting them into a CNC machine. The company deployed Universal Robots’ ActiNav system for flexible machine loading, enabling them to boost competitiveness, overcome labor challenges, empower their workforce and extend the lifespan of older equipment.



“ We just touch the robot to each part of the bin. You do a few spots of that, and ActiNav learns the bin itself.

Nathan Wells
Maintenance Group Lead
Allied Moulded

“Just the simplicity of it picking parts out of the bin and onto the conveyor is what we were really looking for, and ActiNav seemed to meet that demand,” said Gilbert, noting that ActiNav constitutes a major improvement to the vibratory feeders that are often used for part positioning.

Providing ActiNav part data and teaching the robot to pick from the bin were straightforward processes, according to Allied Moulded. “We just touch the robot to each part of the bin,” said Maintenance Group Lead Nathan Wells. “You do a few spots of that, and ActiNav learns the bin itself. I would say after the first day of setup, it took maybe a shift to learn how to actually do the programming, and after that we were good on our own.”

Deploying ActiNav has allowed Allied Moulded operators to take on more meaningful work, becoming trainers and mentors on the system and contributing design ideas for future automation projects.



ActiNav from Universal Robots picks electrical boxes at Allied Moulded from a large, unstructured bin and precisely places them in a chute for secondary operations.



Approachable automation ecosystem

Whatever route a machine shop takes for automation, an ecosystem of certified work cells and accessories can help customers feel confident in choosing cobot-based automation. For example, the UR+ ecosystem of third-party kits and components allows customers to quickly implement cobot technology without the challenges of developing their own custom solutions. UR+ certification ensures that ecosystem products are easy to set up and program and will provide a reliable user experience.

For example, a cobot might need to handle high-mix production or glass or other specialized materials. Parallel grippers such as the [Hand-E from Robotiq](#) suit precision assembly tasks, while vacuum grippers like the [Robotiq AirPick](#) can pick up uneven work pieces made of disparate materials such as glass, dry sheet metal, plastic, and cardboard. For more complex tasks, customers may require a gripper capable of metrology, such as the [NSR-PG gripper/caliper from New Scale Robotics](#), which automates small part measurements with a UR cobot. For applications requiring

vision, UR+ offers a range of solutions – from [ActiNav](#) to [ifm's O3D](#) 3D time-of-flight sensor for measuring an object's position, orientation, and dimensions.

UR+ ecosystem solutions are chosen for their ease of use and reliability. For example, training ActiNav on a bin requires the operator to move the cobot into position to touch the top, bottom, and sides of the bin with its end effector. Training the software on a pick involves operators attaching the part at the pick point and scanning it. Training a location for the robot to navigate in the environment requires physically moving the part to the location where it is to be placed. ActiNav remembers part location and orientation, allowing it to make picks from different places, such as autonomous mobile robot carts, bowl feeders, and boxes/bins.

An ecosystem of certified work cells and accessories can help customers feel confident in choosing cobot-based automation.



All Axis Manufacturing struggled to automate the operation of old machinery. By implementing UR cobots, the company was able to quickly automate six different operations: CNC machine-tending, sanding, deburring, part inspection, laser marking and wire EDM.



Hire Your Cobot Co-worker Today

Whether a customer requires help tending a CNC, brake press, injection molding, or 3D printing machine, cobots can help increase productivity, improve quality and capacity, address the labor shortage issue, and improve employee satisfaction by allowing workers to handle more complex tasks.

Let Universal Robots demonstrate how cobots can multiply workforce productivity, increase customer value, and offer a fast ROI. Contact ur.na@universal-robots.com to identify projects where cobots can deliver value in under 12 months. In most cases, our technology can be implemented and fully operational within 30 days of purchase order submission.

About Universal Robots

Universal Robots (UR) was founded in 2005 to make robot technology accessible to all by developing small, user-friendly, reasonably priced, flexible collaborative robots (cobots) that are safe to work side by side with people.

Since the first cobot was launched in 2008, the company has experienced considerable growth with the user-friendly cobot now sold worldwide.

The company, which is a part of Teradyne Inc., is headquartered in Odense, Denmark, and has regional offices in the United States, Germany, France, Spain, Italy, UK, Czech Republic, Poland, Hungary, Romania, Russia, Turkey, China, India, Singapore, Japan, South Korea, Taiwan and Mexico.

For more information, please visit universal-robots.com



Find out more
Click here to learn even more about using cobots during COVID with Universal Robots.



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