

Plug and Play Profitability



THE PROBLEM

Lack of skilled machinists hinders company growth

THE SOLUTION

Implement an intelligent robotic part handling solution

Quebec job shop meets with success on its first foray into robotics

Robotics are an accepted and necessary part of several manufacturing industries. Automakers use them to assemble, weld, and paint more than 60 million vehicles each year. Electronics producers use them to pick and place components, perform in-process inspection, and package finished goods. Without robots, production of cars and many consumer goods would stall, and their costs skyrocket. Why then are these important tools so underutilized in machine shops?

An outdated paradigm

Part of the reason is that robots are often perceived as inflexible, high volume solutions, suitable only for dedicated production. Even for those who understand the benefits robotics bring to a job shop environment,



there's the installation of the robot itself to consider, followed by protective guarding, machine modification, and interfacing auxiliary equipment such as conveyors and grippers, and once all that is done there's a new programming language to learn. Is it really worth the hassle and loss of expensive floor space?

Mathieu DeBlois thinks so. The president of Précinov Inc. in Lévis, QC, he and his team of 22 employees work two shifts to produce a wide array of low to medium volume aluminum, plastic, and stainless steel components for the medical, electronics, and other high-tech industries. The company's 743 sq m (8,000 sq ft) shop floor is home to nine CNC machine tools, including a handful of Matsuura three to five axis machining centres, a pair of Doosan two axis lathes, and a Nakamura Tome NTMX multi-tasking machine. Despite Précinov's experience with complex equipment, this 11-year old company faced some new challenges with its most recent piece of equipment: a robot.

"Every year it gets harder to find qualified machinists that can help grow the company," DeBlois says. "I don't see that situation changing in the future, and with demand going up, we had to do something to increase our capacity. Bringing in a robot to load and unload parts seemed to be the best option for us."

DeBlois investigated his options and decided on a turnkey solution from Automation Éclair, an industrial equipment provider based in Saint-Jérôme, QC, near Montreal, which installed the system and provided employee training. The PartNR is a self-contained "machine tool tending



Précinov houses nine CNC machines tools, including the automated machine tool tending cell.

cell" complete with a KUKA robot, part conveyors, operator guarding, grippers, and operator interface. The cell was delivered in May, 2016, and married to another recent addition to Précinov's equipment list, a 20,000

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rpm MX-520 Matsuura five axis machining centre purchased from distributor Elliott Matsuura Canada.

The PartNR was loading and unloading parts that same day of the installation.

Rules to follow

This came as no surprise to Elliott Matsuura vice president Vince D'Alessio. "There is a certain stigma around automation with many smaller job shops," he says. "Many feel they don't have the application,

the expertise, or that robots are too expensive and the payback too long. But as Précinov and others have discovered, there are systems on the market that are easy to integrate, and often offer payback of one to two years."

D'Alessio offers a few caveats:

- There should be some consistency of repeating part numbers month to month.
- An investment in quick change workholding is necessary.
- Five axis machines and multi-task turning centres are best suited for these types of automation
- To facilitate quick changeover, the machine tool should be equipped with large tool change capacity, and have the ability for automatic fixture activation.

"In today's manufacturing environment, it's simply too expensive not to automate," he says. "Even for those shops performing high mix, low volume production, these systems are quickly and easily changed over, and can accommodate a wide variety of work. That said, it's important to speak with a knowledgeable machine tool supplier before making any

investment, to help identify the correct level of automation.”

This last point is an important one. With all the hoopla over collaborative robots these days, some might be tempted to drop a \$25,000 cobot in front of the machine and start showing it the ropes. Yarek Niedbala, regional sales manager for KUKA Robotics Canada Ltd., Mississauga, ON, says there are many good applications for cobots, but this isn't one of them.



No teacher necessary

“Anytime you're feeding a high value machine in a production situation, you want the robot to move at peak speed,” he says. “That's not the case with collaborative robots, which because they are generally used without guarding, max out at around 250 mm/s (9.8 in./s), far slower than the Agilus robot used in the PartNR cell. Also, to avoid machine downtime during setup, you want to have a robot that requires minimal teaching.”

Smart robots such as this are able to extract information on part size, shape, and position directly from an NC file, using that data to “fill in the blanks” of a parametric program. This greatly reduces the need for a Teach Pendant or manual manipulation of the robotic arm, as is typical with cobots. It also increases part handling accuracy, an asset in any precision machining environment.

Says Niedbala, “we use a PC-based front end, so there's no PLC (programmable logic controller) as with other industrial robots. It is in charge of its own operation, but can also keep track of other activities, such as when the conveyor starts and stops. The PC is also very easy to connect to other systems—shop floor management software, for example, or directly to the Cloud. When made part of



1. The automated system incorporates a KUKA robot and Robotiq grippers.
2. The PartNR machine tool tending cell offers front or side loading options, making machine access easy in any shop environment.
3. The Robotiq gripper adjusts automatically from 0 to 140 mm (0 to 6 in.). It's equipped with a built in part detection system, and if there's a problem, it activates an alarm and shuts down the machine.

THE EQUIPMENT

MX-520 5 Axis Vertical Machining Centre

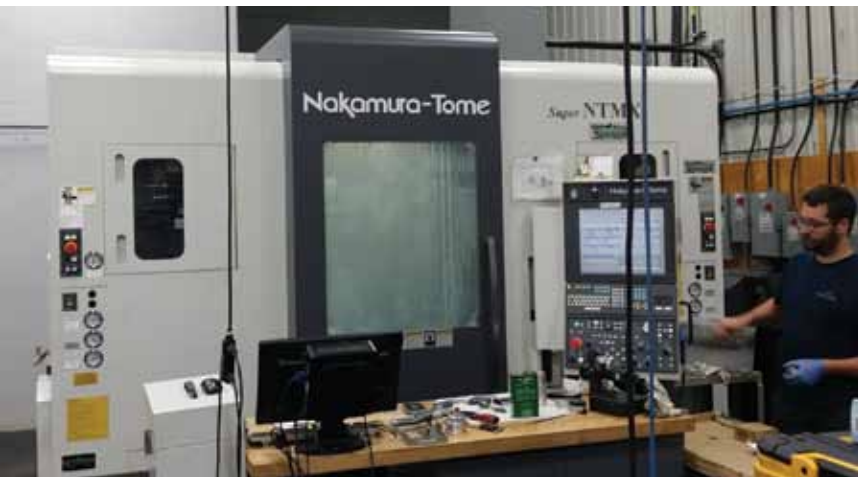
Max. Work Size:	520 mm dia. x 350 mm high (20.47 x 13.77 in.)
Table Capacity:	200 kg (440 lb.)
XYZ Travel:	630 x 0560 x 510 mm (24.80 x 22.04 x 20.07 in.)
Spindle Speed:	12,000 rpm (20,000 opt.)
Rapid Traverse:	40 m/min (1,574 in./min)
Tool Capacity:	60 standard, 90 optional

PartNR Machine Tool Tending Cell

Robot:	KUKA KR 6 R900 sixx C
Maximum reach:	900 mm (35.4 in.)
Number of grippers:	2
Maximum part weight:	4 kg (8.82 lb)
Positional repeatability:	<+/- 0.03 mm (0.0012 in.)
Conveyor width/length:	1.22 x 4.27 m (48 x 168 in.)



Précinov president Mathieu DeBlois says it gets harder every year to find skilled machinists to run his machines, and he doesn't think this will change. Automation and robotics is one way that Précinov is addressing the lack of skilled machinists.



Précinov was familiar with multi-tasking machining because of its Nakamura-Tome machine, but the new robotic system with the Matsuura machine was the company's first foray into five axis robotic machining.

a pre-engineered robotic cell such as the PartNR, they reduce cost, eliminate risk, and are very easy to install.”

Grippers making grippers

One important part of this solution is the gripper, parts of which are actually made by Précinov for a longtime customer, automation provider Robotiq Inc., headquartered just 14 km away. KUKA has developed an interface for the gripper used in the PartNR cell, one that controls its speed, aperture, and gripping force, and can do so based on information extracted from a file or by operator input. The result is an intelligent gripping solution that DeBlois says can “hold anything, at any time.”

“The gripper adjusts automatically from 0 to 140 mm (0 to 6 in.),” he says. “It’s actually a more flexible workholding tool than our five axis, air-operated vise, which only opens 3 mm (0.125 in.). The Robotiq gripper also has built in part detection, so if there’s an alignment problem, or it has dropped a part for whatever reason, it kicks up an alarm and stops the machine.”

The current cell configuration accommodates four different raw material sizes, allowing Précinov to machine batch sizes of a few parts to five hundred or more. DeBlois says the PartNR investment was a good choice for his company, but adds that the Matsuura MX-520 was another big piece of the lights out puzzle. The five axis machining centre is equipped with a Renishaw probe to measure critical part dimensions, and a laser that detects broken tools and signals the machine to pick up an alternate tool in the event of a problem. Because of this, Précinov machines a wide range of parts unattended up to twenty hours per day, and sometimes over the weekend.

“We were familiar with multi-axis machining on our Nakamura NTMX multi-tasking machine, but this was our first five axis mill as well as our first robot. We’ve learned there are pros and cons to both technologies. The main advantage is that you can work on five sides of the part and do very complex, accurate work, but since you are going all the way around the part, you’re generally limited to a single workpiece per operation—it’s difficult to have a second vise on the table without running into interference problems. But that’s another nice thing about the PartNR, as we can often use the robot to flip the part so the backside can be machined in the same operation. That’s the perfect case, and is something we’re able to achieve fairly consistently. It’s a good solution for us.” SMT

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