

The Problem

7-hour machining cycle
time for aerospace part

→ The Solution

Five axis machine with linear drives
to cut cycle time to 2.5 hours



Top: Close up view of the cutting tools used to machine the aerospace part. Below: The part in the machine secured by the workholding fixtures.



Half



An aerospace parts manufacturer
slashes machining time by more
than half with new five axis machine

Cyclone Manufacturing is a busy company. The Mississauga, ON, aerospace parts manufacturer has been bringing in \$10 million of new orders annually for the last four years. Since 2009, annual sales growth has averaged 20 per cent. And by the end of this year, the company expects to close in on \$65 million in sales.

Eighteen months ago, Cyclone opened its fourth manufacturing operation in Mississauga, a 60,000 sq ft plant representing a \$20 million investment in building and machinery purchases.

“We’re applying with the city to get permits and financing to expand the facility again,” says Robert Sochaj, who runs the company with his father Andrew.

One of the products being machined in the new plant is an aluminum winglet component for a major aerospace OEM. The part was being machined on a five axis multi-tasking machine.

“We knew the machining process was not as productive as it could be, but we were very busy with new orders and didn’t have the time to focus on



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improving productivity on that part.”

So when Nicholas Piccione, area sales manager for DMG MORI ELLISON, approached Cyclone last year with a turnkey solution to help improve productivity at the plant, “I thought of this part because we were machining about 100 parts per month and it was taking us about seven hours per part using the capacity of one and a half machines,” recalls Sochaj.

A challenging part to machine

The winglet component is a classic aluminum aerospace part: a complex geometry that requires a high volume of metal removal, multiple, tight tolerance holes and multiple cutting processes, such as milling, reaming and drilling.

Piccione knew DMG MORI’s DMU eVo linear machine was a good choice, but he also knew the machine alone wouldn’t improve machining cycle times. The complexity of the part would require CAM software that could handle the programming, and tooling and workholding that could handle the machining speeds and meet the tight part tolerances.

A team approach

Piccione’s turnkey solution was to bring in Delcam for its

THE EQUIPMENT



MACHINE TOOL: The DMU 80 eVo linear from DMG MORI is a five sided, five axis simultaneous machining centre equipped with linear drives in X and Y axes for higher accuracy and faster machining speeds. The machine is equipped with an Erowa robot loader. It features an NC swivel rotary table with a 600 kg load capacity, -5/+110° B axis swivel range, and 360° C axis rotation range. Rapid traverse speeds are up to 80 m/min. It runs at 18,000 rpms and features an HSK-A63 AC motor spindle. The main spindle features a high pressure (580 psi) through-spindle coolant. The compact machine has a 2,370 x 3,250 mm footprint and a large working area measuring 800, 650 and 550 mm in the X, Y and Z axes respectively.

CAM Software: PowerMILL NC CAM software from Delcam is designed for complex, high speed machining in a single set-up and for automated programming of complex milling operations. The software offers users a range of high speed machining and multi-axis toolpath strategies. For example, Vortex is a patent pending roughing technology for high speed machining with solid carbide tooling that helps reduce machining times by up to 60 per cent, according to Delcam. The software’s simultaneous five axis machining strategies give manufacturers control of the tool orientation around the workpiece, allowing for machining of complex parts in a single setup. An important consideration in CAM software is collision avoidance tools. The automatic collision avoidance function tilts the cutter away from obstacles by a specified clearance. When clear of the obstacle, the tool returns to the original cutting angle. Tool axis editing gives

manufacturers the ability to adjust tool axis settings for individual areas of the toolpath and allows the machine to run more smoothly.

Workholding: Lang workholding products include Makro Grip five axis vises and the Quick-Point zero-point clamping system (plate and sub-base for point pallets). The Makro-Grip five axis centering vises clamp at 3 mm heights. It clamps workpieces in the holding teeth contour of the jaw, requiring no endstop. The Quick-Point zero-point clamping system has a repeat accuracy of less than 0.005 mm and a low, 27 mm height O-point system. Manual actuation requires only one screw.



Tooling: Seco’s EPB toolholders are balanced to 1.5G at 20,000 rpm. They have less than three microns of run out to minimize static and dynamic run out. The Jabro end mills include the JH490, a coolant-through roughing tool with a feed rate of 1000 ipm, the JH421 Tornado Aluminum, a coolant-through end mill for finishing with a feed rate of 600 ipm, the JH410 Tornado single flute end mill for circular interpolation and true positioning on all holes, and the Aeromaster indexable aluminum roughing tools.

PowerMILL CAM software, and Seco, for its EPB toolholders, Jabro end mills and Aeromaster roughing tools. The turnkey solution also included Lang workholding fixtures supplied by Machine Tool Solutions.

"This collaboration with different suppliers is a first for us," says Sochaj. "This machine will be used 80 per cent of the time and we're not likely to machine anything else on it in the short term because the suppliers spent a lot of time in setting up the machine especially for this part and we don't want to adjust lengths, holding systems or the tooling system because it works so well now for this part."

"I called it a turnkey solution because Cyclone didn't have to do anything," adds Piccione. "We looked at every aspect of how to machine the part and implemented the process."

The installation took place in February of this year and since then the machine has been running smoothly.

"We're on the same page when it comes to the turnkey concept," says Mark Sully, Delcam's account manager for Central Ontario. "The customer's process is only as good as its weakest link, so a high end machine with a weak tool or poor software won't perform well."

Slashing cycle times, saving costs

Cyclone's target for its aerospace component was simple: improve productivity and reduce costs. And the turnkey solution its suppliers provided did just that. The DMG MORI machine equipped with linear drives, glass scales and an Erowa robot loader, combined with the Delcam PowerMILL CAM software, Seco shrinkfit tools and Lang workholding, has resulted in significant

annual cost savings.

Not only did Cyclone reduce its machining cycle times by more than half from 7 hours down to 2.5 hours, it rationalized the number of cutting tools required from approximately 30 down to 11 simply by redesigning

quality finish and incorporate pre-process operations, such as chamfering, into the machining process on the DMG MORI machine.

One key to achieving the savings was the CAM software, Delcam's PowerMILL. The software's simulation



A team approach to improving productivity. From left: Mark Sully, Delcam; Mitch Hamilton, Seco; Nicholas Piccione, DMG MORI ELLISON; and Robert Sochaj, Cyclone Manufacturing, holding the aerospace part (also at right) machined on the new DMG MORI machine, seen in the background.

workholding fixtures and reconfiguring the cutting tool approach, so that holes could be drilled on both sides of the part instead of just one side, as the company had been doing on another machine.

Cyclone was also able to eliminate a polishing step because of the high

and collision detection/avoidance functions helped identify potential problems and how to rectify them. For example, the simulation software helped



the suppliers to reconfigure how the part was held in the machine. Originally, to hold the part securely in the machine, Cyclone extended the width at each end of the part. The suppliers redesigned it and removed 38 mm (1.5 in.) on each side and with the new Lang workholding, there were able to secure the part and hold it rigid during high speed machining.

The software also enabled faster toolpath programming, says Sochaj.

He adds that Cyclone purchased the Delcam software “because many people recommended it, including Nicholas and we took his opinion very seriously. We also liked that post processing was included in the price of the software and that we were able to deal directly with Delcam and not a middleman.”

Of course, the program is only as

good as the machine that runs it and the tooling that machines the part.

“The eVo 80 is the only machine of its kind in the shop that has linear drives and no ball screws. It reads right off the glass scale for higher accuracy and temperature control to adjust for the machining environment. There is lots of technology built into the machine that’s designed for high speed and for accuracy,” says Piccione.

Equally important to Cyclone’s success with the new machine was the tooling. Mitch Hamilton, aerospace applications engineer with Seco Tools, selected cutting tools and toolholders based on key criteria.

“Symmetrical, balanced tools are required for high performance machining of aluminum. Shrinkfit tools are also required, with as little run out

and imbalance as possible.”

For example, Seco’s EPB toolholders are balanced to 1.5G at 20,000 rpm and have less than three microns of run out. “This minimizes static and dynamic run out,” says Hamilton.

For his part, Sochaj says he and his father are happy with the outcome of the turnkey operation.

“We saved a lot of money and we’ve freed up capacity on other machines we were using for this winglet part and can now machine other parts.” SMT

www.cyclonemfg.com

www.delcam.ca

www.dmgmori.com

www.machinetoolsolutions.ca

www.seco.com



INVESTING BACK INTO THE BUSINESS

Cyclone Manufacturing is one of the largest privately owned aerospace parts manufacturing companies in Canada.

The company was formed in 1965. In 1989, Andrew Sochaj, an engineer and the company’s CNC programmer, purchased the business. At the time, Cyclone consisted of a 24,000 sq ft operation and employed 30 people.

Today, Cyclone is comprised of four facilities, spans some 280,000 sq ft and employs 450 people. Next year, it’s looking at expanding its newest manufacturing facility and purchasing more machines to meet new orders.

Robert Sochaj, Andrew’s son and vice president of the company, attributes Cyclone’s success to two things: his father’s astute business acumen and a philosophy of investing back into the business, estimating that approximately 95 per cent of earnings are invested back into the company.

“We’re always willing to help customers with whatever it is they need. That’s how we made our big inroad with Bombardier. Years ago, during a visit to Bombardier, they mentioned they wanted to offload five

axis machining work. The key procurement team was going to lunch so they passed on lunch with my dad. My dad decided to go to the same restaurant and noticed there were some 15 people there. He thought if this is the procurement group, there must be a lot of work to offload.”

He decided to purchase his first five axis machine. “Within six months, he had purchased three five axis machines and Bombardier kept offloading work to him.

That work alone jumped our sales by \$5 million. We’re still making some of those parts today for the Dash 8,” says Sochaj.

Cyclone continues to invest in machining technologies. It’s already expecting delivery of its second DMG MORI machine, the duoBlock 125 simultaneous five axis machine, valued at \$1.2 million.

“We’ve put in \$15 million worth of new equipment this year at the new plant and we’re holding back on buying more right now. But we’re putting in an expansion so we’ll be looking to purchase more equipment next year.”

