

Projecting Success

The Problem

Increased demand for complex parts

The Solution

A high speed, five axis machining centre

Ontario rapid prototyping shop expands its machining capability

Christie began making mechanical film projectors in 1929. If you paid a nickel to see the original *Frankenstein* movie, or sat in awe during the release of *Gone with the Wind*, chances are you watched it on a Christie. More recently, you may have cheered when Ricky Obeda took first place on “*So You Think You Can Dance*,” or wept over yet another Cinderella remake at the neighborhood Landmark Cinema, all thanks to Christie projectors.

Flight simulators at the Canadian Maritime Helicopter Program, a three-story video wall in the atrium of the

The Okuma five axis VMC has improved machining efficiencies in Hyphen's shop.

University of Waterloo, light shows in the Bund and nightclubs in Dubai, Christie Digital Systems Inc. brings its digital display and projection technology to every corner of the globe. Much of that technology came from Canada. Shortly before Y2K, recognizing that mechanical projectors were going the way of silent movies, California-based Christie acquired the digital visual displays division of Ontario electronics

manufacturer Electrohome. They've been lighting up cinemas, sports arenas, and concert halls ever since.

It's a big company. With 1500 employees and annual sales of around \$800 million, Christie Digital designs and develops hundreds of new products each year. To meet the needs of its designers and engineers, Christie opened its own prototype and testing centre around 12 years ago, and has since filled it with an impressive array of additive manufacturing equipment—Viper and iPro 8000 stereolithography (SLA) machines and a Sinterstation HiQ selective laser sintering station (SLS) from 3D Systems. From Stratasys, there are Titan, Dimension, and Fortus fused deposition modeling (FDM) printers, and a Connex 500 Objet polyjet that combines multiple materials in a single part build.

Some prototypes must be machined, however, so over the years Christie purchased several three axis vertical machining centres (VMC) and a CNC lathe from Haas Automation. And since testing is a big part of product development, Christie acquired a wide range of mechanical and electrical test equipment such as thermal and anechoic chambers, shock and drop



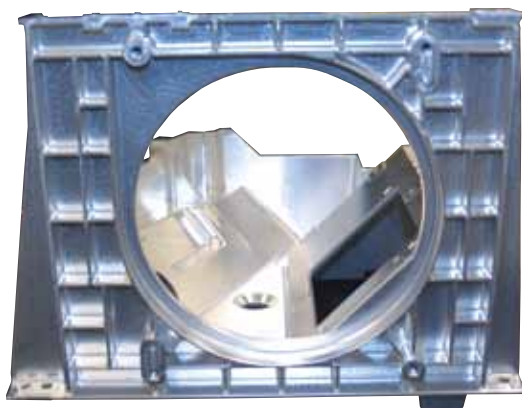
capability, vibration tables, electrostatic discharge and emissions testing...the list goes on. All told, the lab measures 1,394 sq m (15,000 sq ft) and keeps 16 technicians busy making and validating prototype parts.

With capabilities like this, word was bound to get out. Christie was soon taking orders from other shops doing product development, and two years ago, management decided to commercialize the lab. Hyphen Services was born.

Mark Barfoot, managing director of Hyphen, says Christie is still the lion's share of the new company's work, but that's beginning to change. "We have a lot of people asking about our capabilities, and there are times when our machines have excess capacity due to internal product development cycles. Taking on outside work helps us level load our equipment, and provides additional revenue for Christie. It only makes sense."

Hyphen serves a wide range of markets. Much of this comes from consumer and commercial customers, as well as startup companies wanting prototypes for show and tell with potential investors. The increase in job shop work, together with Christie's continued growth, prompted management to expand its five axis machining capability.

"A few years ago we mounted a tilt-rotary trunnion on one of our VMCs," says Barfoot. "Because it allowed us to hit five sides of the workpiece in a single setup, we saw a huge improvement in start to finish processing time. And since many of our prototypes are for cast aluminum parts, five axis allows us



Top: A prototype part machined on the Okuma.
Bottom: example of prototypes at Hyphen's facility.



to tilt the part a few degrees to machine the draft angles representative of the casting process."

Reduced setup time is critical to efficient prototype machining. Hyphen wanted a five axis VMC with large toolholder capacity, so that every drill, tap, reamer, and end mill could be kept in the carousel, ready to go. And since most of the company's work is aluminum, high spindle speeds were a must-have on the shopping list. After a good deal of test cutting and tire kicking, Hyphen ordered an Okuma

MU400-VA five axis vertical machining centre with 15,000 rpm and 78 tool magazine from EMEC Machine Tools Inc., the eastern Canada distributor for Okuma America Corp.

Matthew Yates, senior machinist, says the learning curve for the new machine was manageable. "The Okuma control was different than what we were used to, but most of the G-codes are the same. The OSP P300M control uses a touch screen and is easy to navigate. Probably the biggest change for us was learning a new CAD/CAM system."

The machinists at Hyphen quickly discovered the shop's existing programming software wasn't going to cut the mustard, and purchased a seat of Delcam's PowerMill to generate toolpaths for the new Okuma. "We never expected that our old CAD/CAM would be unable to program some of the complex parts we wanted to run on the Okuma," Yates says. "PowerMill also simulates the machine movement, and checks the cutter, toolholder, and fixture to make sure there won't be any collisions or over travel.

MACHINING | Five Axis

The Connex 500 Objet polyjet additive manufacturing equipment.
Image: Haas

“You don't realize the capabilities of a high end five axis machine until you have one.”



This is important on a five axis machine, where the crash potential is fairly high.”

It was a box office hit. A good example of the new work running on the Okuma is the Light Engine Enclosure, a projector housing that starts out as a 300 mm (12 in.) cube of 6061-T6 aluminum weighing 63 kg (140 lb), but finishes 95 per cent lighter at a svelte 2 kg (5 lb). Barfoot stresses the Light Engine Enclosure is a new product design and was never actually machined prior to the Okuma, but says a program generated in the old software indicates a 20-hour cycle time. The MU400-VA using PowerMill finished it in 10 hours.

Reduced cycle times are only part of the equation for success at Hyphen. Every new job is clamped in a Raptor five axis workholding fixture and mounted to a Jergens quick-change ball lock system. With the Okuma's extended tool magazine, setups are a matter of minutes. In fact, Barfoot's only regret is that they didn't purchase the 156-tool magazine, but since this can be retrofitted in the field, he's not too worried about it.

“You don't realize the capabilities of a high end five axis machine until you have one,” he says. “We figure the larger tool magazine alone adds about three months each year of production time. Together with the heavy cutting capability and the fast rotational speeds of the Okuma's five axis, it's been a real benefit. In fact, we're already looking at another machine.” SMT

*Kip Hanson is a contributing editor.
editor@shopmetaltech.com*



Hyphen invested in a Haas CNC lathe several years ago to help with machining of prototypes.

www.delcam.ca
www.emecmt.com
www.hyphenservices.com
www.okuma.com

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