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Rolls-Royce

propels business growth with 3D investment

By Rob Colman

When a client has a tight delivery timeline, the best companies deliver no matter what the obstacles. Obstacles are exactly what Rolls-Royce Canada's Marine division in Vancouver (Vancouver Facility) faced when it needed to machine, assemble and deliver two controllable pitch propeller hubs for a ferry that was to be in drydock for only two weeks. To make the deadline, the team invested in 3D programming software that allowed them to reduce machining and assembly time by several weeks.

The Vancouver facility manufactures the UML steerable azimuth thrusters, which replace a conventional propeller, rudder and reduction gearbox with an integrated unit that performs both steering and propulsion functions. At the company's facility in Coquitlam, the team also services a wide variety of Rolls-Royce Portfolio equipment – fixed pitch propellers, controllable pitch propellers, deck machinery, steering systems, control systems, engines and other marine equipment.

However, although the 30-employee

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The hub being lifted off the Doosan DB130 cx.

On the cover: The Rolls-Royce team assembles a pitch propeller hub in its Coquitlam facility.

facility has a strong group of service engineers, its machine shop is relatively small, with just a few machinists on hand. The project they had undertaken involved the building of two brand-new, but original design hubs for a ferry built in the 1960s, and they were depending on supplies from the Rolls-Royce Product Centre in Sweden to make their deadlines.

"Due to the age of the design our factories in Sweden had to outsource this work," explains Dij Sahota, Service Manager at the Vancouver Facility. "This time, we couldn't wait for that." It was Mark Wilk and Johan Brandelid, Senior and Specialist service engineers from the Vancouver Facility, who discovered the problem when they went to Sweden to take part in the assembly of a hub being produced by a sub-contractor to the Rolls-Royce factory.

"When I arrived they hadn't yet started the machining, so I asked how long it would take," Wilk recalls. "There are four pockets on the hub, and they said it would take two weeks per pocket to complete – that's two months, and the boat was dry-docking in four weeks. So we air freighted the parts as fast as we could to Vancouver because we didn't have a choice. The docking had to be met."

Each hub is made of a 5,800 kg duplex stainless casting, two metres high with a 1,300 mm diameter.

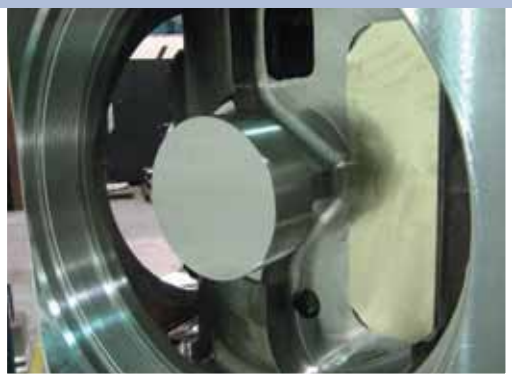
"Usually what is required after machining a part like this is about two weeks of grinding and fitting for all of the internal components, clearances etc.," Wilk continues. "We didn't have that luxury of time, so we had to be spot-on in our machining and assemble everything and it had to be right first time."

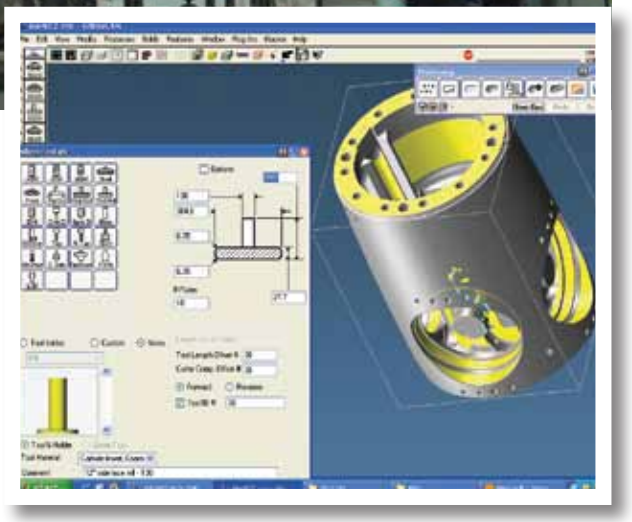
"It is quite a complex casting to begin with," notes Sahota. "But with the amount of clearance that had to be machined out of it, it was even more so."

Wilk also notes that tool extensions were a challenge.

"We had almost 600 mm on some tools, when you pull the spindle out, and the biggest thing was that on almost every corner there was a 20 mm radius, and it was profile dimensions, not straight lines," Wilk explains. "So unless you are using a 20 mm radius insert, you are never going to get it right. That's where the 3D programming really came in handy – when we were trying to do a blend of multi-step pockets and similar cuts."

Rolls-Royce already had a GibbsCAM suite that they used, but it was a 2D program. When Wilk saw what they were up against, he knew that 3D pro-





The hub on the Doosan DB130 cx with Rolls-Royce's Steve Poole, and a screen capture of a tool path on the GibbsCAM system.

gramming was going to be essential to reduce machine time. That's when Sahota called in Chuck Van Volkingburgh from WestCAM Solutions to discuss setting the team up with the programming ability they needed.

"We already had a 3D model of the part we wanted to machine, so we knew the best way forward was to have a 3D CAM machining program for the part," says Sahota. "Mark had some experience in 3D programming, but it was new to (machinist) Steve Poole, who was also working on the project. It was a steep learning curve for all of us."

It was WestCAM's technician Stephen Cunningham who was brought in to work with Rolls-Royce on the project.

"Cunningham was in our facility for almost two full days, about 20 hours," notes Poole. "He did an excellent job. He didn't have a casting model, so it was difficult for him to determine or predict where the bulk of the material was coming off, so he really stuck it out and redid his 3D programming for us until we got it just the way we wanted it."

"We also got a lot of value out of the VoluMill option in the GibbsCAM program, which is supposed to maximize material removal rates by building toolpaths that control tool cutting factors," says Wilk. "The process takes into account the best option for milling pockets. With the long extensions on the tools we tried regular programming for removing material in the pockets, but we just couldn't get rid of the chatter. The VoluMill made a huge difference, and it also increased tool life."

The 3D also helped in the machining of parts that go into the completed hub, which are machined on a 5-axis mill turn. "We've used GibbsCAM in the past but we've never taken it to this level," notes Wilk.

Within two days, the team was up and running on the 3D, and in just over a week two hubs were completed.

"Another advantage we had was that when we did the static balancing on the completely assembled hubs, one was only out by seven pounds, and the other was out by just nine pounds," says Poole. "In the old days, when you had to grind the clearances on these cast hubs, you would never get that kind of balance because there is no consistency in the grinding."

In the marketplace, the successful completion of these hubs has created a distinct advantage for the company.

"We can now do everything internally on these parts, which allows us to better control lead times, delivery and quality," says Sahota. "This also allowed us to create a very repeatable finish. Although we can probably hone our process very slightly we know that if we need to machine another of these hubs it will be just as good as the two we've just completed. We've already got more orders based on this successful completion – six more hubs of the same type to overhaul."

This also creates an opportunity for the Vancouver facility to take on more component manufacturing orders. "In the past, we've had to order components completely finished," Sahota explains. "We have to plan months in advance for that. Now, we may be able to cut back on lead times and maybe even cost. At the end of the day, when these parts are in operation, they are under water – you can't get to them, you can't send a service engineer out and fix it. This is a vessel operating seven days a week. In our field, you can't cut corners, vessel availability is the name of the game. The successful completion of this project has shown our customers that we are capable of doing tough jobs with very short lead times. We can give them the support that they need."

In early December, the sea trial of the ferry with the two new hubs was successfully completed to the delight of Rolls-Royce and their customer. MPP

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