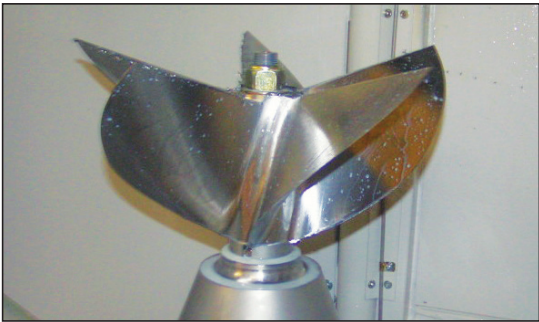


Verisurf Software Helps Five-Axis Industries Champion Quality

***Based on an interview with Erick Ellstrom,
President and CEO of Five-Axis Industries, Arlington, WA***



Ellstrom Racing is the winningest team ever in the unlimited hydroplane class, winning three season high-point honors and setting single lap speed records, yet to be broken, at every race venue on the circuit.



It was not long before Five-Axis started making specialty performance parts for other teams and today they build props for most of the unlimited hydroplanes racing.



Computer Aided Inspection (CAI) is provided by Verisurf Software. Being model-based and built on top of the Mastercam platform, Verisurf allows the team at Five-Axis Industries to open and work with any CAD file including, intelligent models with associative GD&T to support the development and execution of automated inspection plans.

Five-Axis Industries and sister company Ellstrom Racing trace their roots back to 1960 as part of the Ellstrom Manufacturing Company. Started by Sven Ellstrom, Erick's Dad, the Company established a legacy of innovation, performance, and a winning attitude that is apparent today.

Ellstrom Racing came on scene in the early '90s to dominate the highly competitive and high-risk sport of unlimited hydroplane racing. These 30-foot power boats, weighing over 7,000 pounds, are more like airplanes than boats; most of the time the propeller is the only part of the boat that is in the water. As with everything the Ellstrom's do, they came to compete and win. And win they did. Today, Ellstrom Racing is the winningest team ever in the unlimited hydroplane class, winning three season high-point honors and setting single lap speed records, yet to be broken, at every race venue on the circuit. Ellstrom Racing clocked the fastest single lap speed average ever recorded during a race in Nashville, topping 171 MPH, with straightaway speeds over 200 MPH – ON THE WATER! The success of the unlimited hydroplane campaign can be attributed to focus, drive, innovation, and a commitment to excellence. "In our minds 2nd place is the first loser; we are always out to win," said Ellstrom.

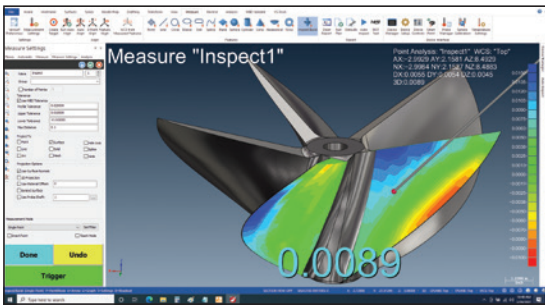
When it came to raising the bar on the status quo in unlimited hydroplanes, Ellstrom Racing knew they needed to innovate and improve the design and manufacturing of high-quality components that stand up to the demands of the sport. So, they started Five-Axis Industries, which in the beginning was essentially a hobby shop specializing in 5-axis machining to make difficult to manufacture parts from hard metals, including titanium and stainless alloys.

It was not long before Five-Axis started making specialty performance parts for other teams and today they build props for most of the unlimited hydroplanes racing. "We cut our teeth in the high-performance marine industry producing hard-to-manufacture parts and gained a reputation as the ones that can get it done with no one else can. This propelled us into producing parts for other demanding applications, like aerospace. We now produce large structure parts as well as high-performance components, including propellers, blowers, gas turbine engine parts, thrust cones for rockets, air turbine assemblies and more," said Ellstrom.

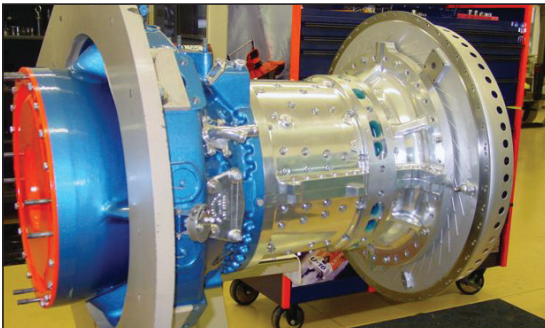
“Our roots are in racing, and we are driven to win. This breeds performance, focus, drive, and quality, which is what makes us the best in the world at what we do. We cut our teeth in the high-performance marine industry producing hard-to-manufacture parts and gained a reputation as the ones that can get it done with no one else can.”

Erick Ellstrom

President and CEO, Five-Axis Industries



Verisurf software is built on a CAD platform and maintains digital continuity between design, manufacturing, and quality inspection.



Five-Axis Industries specializes in making difficult to manufacture parts from hard metals, including titanium and stainless alloys.



Excellence in the performance marine industry propelled Five-Axis Industries into producing parts for other demanding applications, like aerospace and spacecraft in particular.

Five-Axis Industries has grown from its albeit humble but high-performance beginnings to a full-size manufacturing facility. “We are not always the first choice, but we are the best choice. Difficult parts can be expensive to manufacture, and our high-performance mindset does not allow for cost-cutting shortcuts,” said Ellstrom.

CAD/CAM/CAI

The design, build, and quality verification processes at Five-Axis Industries are strategically linked to provide a consistent digital thread throughout. This allows the company to effectively comply with preferences, and in many instances requirements, of prime contractors they work with. But more importantly, it supports the company’s mantra of delivering high-performance, high-quality components.

Designers, manufacturing engineers and machinists at Five-Axis Industries have been using Mastercam exclusively to program parts for machining since 1982, well before Five-Axis emerged from Ellstrom Manufacturing. Most of their design work, especially high-performance engine components, is also done using Mastercam and its integration with SOLIDWORKS. They are also capable of working with other CAD formats such as CATIA, Siemens NX, PTC Creo and others.

Computer Aided Inspection (CAI) is provided by Verisurf Software. Being model-based and built on top of the Mastercam platform, Verisurf allows the team at Five-Axis Industries to open and work with any CAD file including, intelligent models with associative GD&T to support the development of automated inspection plans. The net result is efficient quality verification, regardless of CMM type, capable of producing first article inspections within minutes. The Verisurf Device Interface (VDI) lets operators choose from any of their portable arms or CNC CMMs (3-, 4-, or 5-axis) to conduct quality inspections, reverse engineering, tool-building, or assembly guidance using the Verisurf software.

HIGH QA

As part of the overall Quality Management System (QMS), Five-Axis Industries uses a management and connectivity platform called High QA. The solution automates the entire quality process creating a seamless partnership and collaboration with supply chains. Verisurf software is integrated within the High QA platform through Inspection Manager. The integrated solution automates the measurement, inspection and reporting process providing real-time comparisons of finished parts based on submitted design authorities, whether received as 3D CAD models, annotated PDFs or 2D drawings. Inspection Manager allows for the automatic ballooning of drawings and creation of bill of characteristics in minutes, while CAD-based Verisurf 3D measurement and inspection software, provides measurement data collection and analysis.

“We realize up to 50% reduction in overall cycle time plus added flexibility using 5-axis machining; the time savings are comparable when it comes to inspection using our 5-axis CMM, powered by Verisurf.”

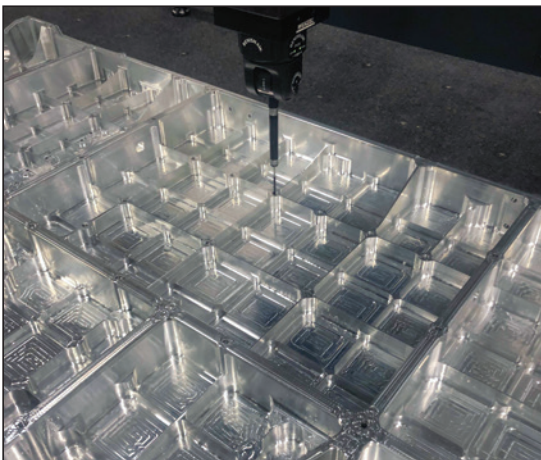
Erick Ellstrom,
President and CEO, Five-Axis Industries



Standard Renishaw REVO 5-Axis scan patterns.



Additional exclusive REVO 5-Axis scan patterns available with Verisurf Software.



The exclusive Verisurf 5-axis pocket scan type is particularly useful when it comes to inspecting orthogrids and other weight reduction techniques used in aerospace manufacturing.

MODEL-BASED DEFINITION (MBD)

Verisurf is the only measurement and inspection software dedicated to MBD and built on a CAD/CAM platform. This enables greater compatibility, workflow integration, and more complete end-to-end solutions customers require.

Verisurf software serves as a common measurement and inspection platform across 5-Axis Industries’ manufacturing enterprise. Whether for inspection, reverse engineering, tool-building, or assembly guidance, the entire design/build team is trained to use Verisurf. This increases productivity, reduces bottlenecks, standardizes reporting, and lowers overall software and training costs – regardless of measurement hardware device, everyone uses the same software. “Verisurf is so easy to use; we all picked it up quickly and now the software is indispensable to us. I consider myself CMM stupid and even I can use it,” said Ellstrom.

5-AXIS MACHINING, 5-AXIS METROLOGY—PERFECT MATCH FOR EFFICIENCY AND PRODUCTIVITY

Five-axis is in their name so it should not be a surprise to know the company has been using 5-axis machining capabilities for more than 20-years. Machining complex shapes and features such as propellers and other helical shaped parts are easier and more accurately machined using 5-axis technology. This is due to continuous 5-axis movement which produces better results on contoured or curved shapes. 5-axis machines are also easier to set up with fewer clamp changes, and you can typically access five sides of a part with a single set up. These and other benefits of 5-axis machining have pushed adoption of the technology among shops at a rate of 7% compounded annual growth in recent years.

“For us, 5-axis capabilities are all about moving the part less and articulating the machine to move around the part. We were an early adopter of 5-axis machining, finally, CMMs have caught up and can offer the same productivity gains in measurement and inspection. 5-axis workflow from machining through quality verification just makes common sense. We realize up to 50% reduction in cycle time plus added flexibility using 5-axis machining, and the savings are comparable when it comes to inspection using our 5-axis CNC,” said Ellstrom.

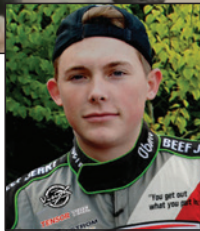
Verisurf software increases overall measurement and inspection productivity, from CMM plan creation through execution. With Verisurf, users have the unique ability to create a single inspection plan that can be executed on any measurement device across their manufacturing enterprise, including 5-axis CMMs. The team at Five-Axis Industries currently use the Renishaw PH20 5-axis touch-trigger probe and are considering upgrading their primary CMM to the Renishaw REVO 5-axis scanning probe, which will enable them to perform continuous scanning of complex surfaces for enhanced inspection and reverse engineering purposes. Verisurf software seamlessly supports the



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Ellstrom Racing continues to out-think and out-build the competition as it adds harsh and competitive world of modified pro turbo UTV racing to its achievements.



entire line of Renishaw probe heads and is currently one of only a few companies that can program and run the REVO 5-axis head, including two exclusive scan patterns developed by Verisurf.

MAINTAINING DIGITAL CONTINUITY WITH THE FLEXIBILITY TO CHOOSE

Change is the only constant in manufacturing, and this applies directly to Five-Axis Industries. In recent years the company's commercial customer base has grown to include more high-stress applications associated with aerospace and spaceflight in particular. And while still a dominant supplier in high-performance marine applications, the company continues to support the Ellstrom racing team, which has shifted from the water to the desert, building and racing modified pro turbo UTVs in one of nature's harshest environments. As you might have guessed, Ellstrom Racing is consistently a top-5 finisher in a field that averages more than 100 starters.

Though the business has expanded and shifted a bit, the design build process has remained constant. The company is dedicated to a model-based environment that maintains digital continuity from beginning to end, with the CAD model serving as the design, manufacturing, and quality inspection authority. "While Mastercam is our preferred CAD/CAM platform, Verisurf software verifies every part we build and is our final say on quality," added Ellstrom.

ABOUT VERISURF

Verisurf Software, Inc. is a measurement solutions company committed to delivering advanced surface analysis, quality inspection, assembly guidance, and reverse engineering. Verisurf products and processes are vital to maintaining a digital thread between design, engineering, manufacturing, and finished part validation. Based on a powerful CAD platform, Verisurf is committed to digital Model-Based Definition (MBD), open standards, and interoperability with all coordinate measuring machines and CAD software. Verisurf solutions help manufacturers produce higher quality products in less time. For more information about Verisurf, visit www.verisurf.com

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