

Market: *Manufacturing*

Sub-Atlantic submerges costs, maintains quality with SolidWorks® 3D CAD and analysis software

Sub-Atlantic Ltd.'s remote-controlled submersible robots endure cold and tons of pressure in the world's oceans. The submersibles explore for minerals and oil, maintain drilling rigs the size of the Eiffel Tower, lay undersea cable, and gather data for fisheries and university marine research. Customers pay up to \$400,000 for Sub-Atlantic systems, which are manufactured to the customers' individual requirements.

Above the surface, the company has to hold down overhead costs to maintain price advantages over its competitors. Although Sub-Atlantic occupies a fairly specific niche in the manufacturing world, competition within the space is intense. It has three competitors who specialize in developing North Sea submersibles, and more who specialize in its other markets. Since its founding in 1997, the 20-person Aberdeen, Scotland-based company has used SolidWorks three dimensional computer-aided design (3D CAD) software and analysis tools to develop and test new designs rapidly, with fewer expensive physical prototypes and without compromising design safety.

"In 1997, we were the first company in Scotland to install SolidWorks 3D CAD and COSMOSWorks™ finite element analyses systems," said Colin Millum, Sub-Atlantic's co-founder and director of mechanical engineering and design. "These tools reduce design time and increase the integrity of our designs."

SolidWorks solution

SolidWorks 3D CAD software and COSMOSWorks analytical software let Sub-Atlantic produce and test designs during production, revealing flaws that are faster and cheaper to fix during the earlier phases of the design cycle. SolidWorks ease-of-use also saves Sub-Atlantic's time in the design process by reducing dependence on draftsmen to produce final drawings.

"Our engineers can do the work for themselves, right up to producing 3D photo-realistic models for inclusion in marketing brochures or for animated customer presentations," said Millum. Once engineers produce designs in SolidWorks, COSMOSWorks tells them how they will behave in real-world conditions.

"The subs are designed to be weight-neutral in water so they can descend or rise according to the surface operators' instructions," Millum said. "Thanks to COSMOSWorks, we accurately

Sub-Atlantic Ltd.

www.sub-atlantic.co.uk

Challenge: Hold down overhead costs to maintain price advantage over competitors without sacrificing safety and quality.

Strategy: Sub-Atlantic uses SolidWorks three dimensional computer-aided design software to cut steps from the design process.

Results: Sub-Atlantic engineers complete designs without using draftsmen to produce final drawings, cutting a time-consuming step from the process.

anticipate where high stresses occur and optimize the design by adding or removing buoyancy elements so that, above water, the vessels are as light as possible.”

Other SolidWorks features help Sub-Atlantic anticipate a submersible’s buoyancy and maneuverability. SolidWorks’ built-in mass calculation tool keeps track of an assembly’s real-world weight. Other tools identify points of inertia and critical centers of mass, which determine how well a sub will handle once it’s built. “Without SolidWorks we would need to make these calculations manually, continually iterating figures in spreadsheets,” Millum said.

The company has used SolidWorks on every major project since its founding, including its biggest ever: a 57-ton hyperbaric chamber for the French oil company ELF to use in the North Sea. The chamber protects welders working on drilling rigs hundreds of feet under the surface. Its design was a delicate balancing act between weight restrictions and strength that tested Sub-Atlantic’s ingenuity.

“The project was a real challenge for us,” said Rob Wraith, director of electronic and electrical engineering, who founded Sub-Atlantic with Millum. “It meant using a wide range of in-house skills to cover all the elements of mechanical, electrical, hydraulic, and life support systems. SolidWorks proved invaluable for producing detailed drawings fast while giving us full control of clashes, weight, buoyancy, and stability.”

More recently, Sub-Atlantic designed a completely new plastic manned submersible in SolidWorks and tested it with COSMOSWorks before prototyping. The new submersible, the Navajo, is a low-cost, lightweight vessel meant to supplement Sub-Atlantic’s line of heavier-duty submersibles and attract new customers. It had to be small enough to be taken out on a regular boat and launched by hand, unlike Sub-Atlantic’s other submersibles, which need launch platforms because of their weight. The Navajo weighs about 70 pounds, where the typical Sub-Atlantic submersible weighs 280 pounds.

To keep the Navajo light and simple, yet able to dive 1,000 feet under the ocean, Sub-Atlantic designed it in plastic instead of the traditional aluminum, and consolidated all of the cabling and electronics in a single “bottle.” The company also needed to design new thrusters that produce 50 pounds of thrust, versus the 20 pounds of thrust standard on competing submersibles.

“SolidWorks allowed us to design the complete vehicle from scratch, every single component,” Millum said. “We did all our weight, buoyancy, and center-mass checks in SolidWorks. Then we loaded the components with forces and pressures in COSMOSWorks to simulate working conditions. COSMOSWorks lets us optimize the design by looking closely at specific areas under stress to see whether we can save some weight by making something thinner or moving materials around.”

When Millum co-founded Sub-Atlantic, he evaluated PTC’s Pro/ENGINEER and AutoDesk’s Mechanical Desktop. Pro/ENGINEER was too complex and expensive, and Mechanical Desktop was poorly integrated with third-party design tools. “For simplicity and power at an affordable price, SolidWorks cannot be beaten,” he said. “It’s an absolutely superb package.”

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