

BAE Systems Submarine Solutions Brings Virtual Reality to the Manufacturing Floor with Integrated PTC®-Virtalis VR Solution

Saves Time & Money by Eliminating Physical Prototypes in Product Development

BAE SYSTEMS Submarine Solutions, Cumbria, UK

BAE Systems Submarine Solutions is the prime contractor to build the Astute Class nuclear submarines, considered the most sophisticated and complex ever built in the United Kingdom, for the UK's Ministry of Defence. A user of PTC solutions for product development, BAE Systems Submarine Solutions has turned to Gold PTC Partner Advantage Program member, Virtalis (Manchester, UK) to create, install and integrate powerful Virtual Reality (VR) solution systems for product development and manufacturing.

The Challenge: Build Submarines without Physical Prototypes

BAE Systems Submarines is currently tasked with building three Astute Class nuclear submarines, with the first scheduled for launch on June 8, 2007. The company determined that a factor in accelerating the process would be using a VR system in product development instead of creating physical prototypes. The VR system had to be easily accessible both to the CAD/IT professionals, as well as to welders and pipe fitters who would physically build the submarine.

The Solution: Packaged Virtual Reality Solution from PTC & Virtalis

For design, BAE Systems Submarine Solutions is using the PTC CADD5 shipbuilding solution, a familiar tool that enables groups of engineers to work simultaneously on design, validation, and machining of the same assemblies. For the VR system, BAE Systems Submarine Solutions commissioned PTC's partner, Virtalis, to integrate the PTC DIVISION MockUp solution with Virtalis' VR tools. In the larger 3D stereoscopic theater, this solution exposes potential clashes between submarine components and assemblies, so that a redesign can be performed prior to the build. The use of advanced visualization enables all those working on the vessel to view the 3D virtual models in accessible 'cabins' locally positioned on gantries surrounding the boat. This provided a direct replacement for expensive physical models.



With the VR component of its product development system in place—created with the assistance of PTC Partner, Virtalis—BAE Systems Submarine Solutions is on schedule to build three Astute Class nuclear submarines for the UK's Ministry of Defence.

The Results: Tremendous Savings in Time, Effort and Cost

The PTC-Virtalis VR solution is not only bringing VR to the Barrow-in-Furness shop floor for the first time, but it is also delivering significant time-to-market benefits to BAE Systems Submarine Solutions, including: the elimination of time, effort and money spent on physical prototypes; an increase in design/build productivity; real-time access to virtual models and related engineering data; significantly faster upload time of 3D models for BAE engineers; elimination of time spent by users visiting design departments; full access to the VR solution by non-CAD/IT users; and a coveted BAE Systems Submarines Chairman's Bronze award for a job well done.

“The VR models give you a very real sense of the boat from the inside. People can literally drop in and walk through the exact area they are building.”

– Dean Brown, Dimensional Control Inspector
BAE Systems Submarine Solutions

Charting a New Course in Product Development

Like every manufacturer, BAE Systems Submarine Solutions is always looking for ways to accelerate time-to-market, reduce costs, and improve customer satisfaction. Recently, the company decided to make significant changes to their product development process, after the company was contracted by the UK's Royal Navy to build three Astute Class submarines, the first of which was to be launched in the summer of 2007.

To deliver the submarines on time, BAE determined it would need a different approach to product development, by using a 3D model in conjunction with a VR system for design and verification versus the traditional method of creating a physical prototype. The BAE team also realized that to ensure maximum productivity, they needed a VR solution that could easily be used by the assemblers and pipe fitters whose main role was to physically build the submarine. Knowing that the Astute Class was more complex than any attack submarine previously built in the UK, BAE believed that building it without a physical prototype would significantly reduce design and build time, and provide great competitive advantage.

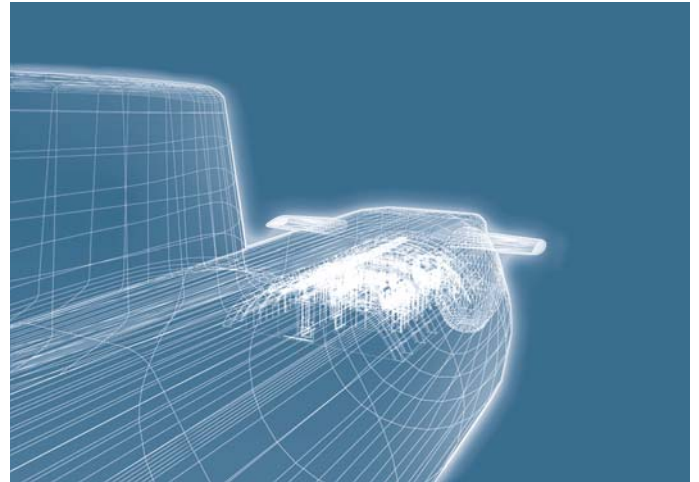
Fortunately, BAE also realized quickly that searching for new design and development solutions wasn't necessary, as the company already had in place PTC product development tools including the PTC CADD5 shipbuilding software. What was needed was a better and more efficient Manufacturing Floor Design, and this solution had to emphasize "who" would use the tools and solutions being provided.

BAE Submarine Solutions commissioned PTC Partner Advantage Program member, Virtualis, headquartered in Manchester, UK, to customize, integrate and install its own VR system with PTC's VR software system, DIVISION MockUp, a tool that creates animations of major events in a boat's build before they are shown to all those involved with a particular part of the build.

Eliminating Physical Prototypes

The use of advanced visualization tools in the customized PTC-Virtualis VR solution enables all those working on the vessel to view the 3D virtual models in accessible cabins locally positioned on gantries surrounding the structure. Both the first in class Astute, whose hull is complete and is now being fitted out, and the second in class Ambush, which is at the vertical outfitting stage, each have a dedicated VR cabin, though each is capable of running the other's models should one cabin be booked or unavailable for some reason.

John Martin, a consulting engineer at BAE Systems Submarine Solutions, notes, "This was the vision for the use of virtual reality when it was decided not to rely on physical prototypes in 1997. Being able to view the 3D virtual models in accessible cabins locally positioned on gantries surrounding the boat provides a direct replacement for expensive physical models."



BAE uses a 3D model in conjunction with a virtual reality system for design and verification versus the traditional method of creating physical prototypes—thus saving significant time, effort and money.

Unlike other VR software packages, the PTC DIVISION MockUp package enables viewing of large areas of the boat. The VR models highlight potential clashes and, if need be, a redesign can be performed prior to the build. To ensure the VR cabins and suites are almost always available, and to maximize the company's return-on-investment, 30 personnel have been trained on how to run the PTC DIVISION MockUp software and operate the Virtualis VR equipment.

The value of incorporating the PTC DIVISION MockUp with Virtualis enables BAE Systems Submarine Solutions to eliminate the physical prototype they have worked with for many years. Virtualis' Managing Director, David Cockburn-Price states, "We support and resell the PTC DIVISION MockUp technology because we believe our packaged solutions deliver a value that customers can see immediately; it's not hard to walk onto the shop floor and notice there is no longer a scale prototype. Being a member of the PTC Partner Advantage Program, we have access to APIs that enable us to develop tools and utilities for a seamless integration between hardware and varied software technologies. People effortlessly use our integrated tools and it saves time and energy in both training our customers and for them to begin generating benefits. Looking forward, we are already marketing a MockUp Cluster solution for Engineering and Academic users, and further utilities are in development."

Accessible to Assemblers and Pipe Fitters

The old process of building a submarine using prototypes would have taken pipe fitters and welders significantly more time than the environment BAE is working in today. Historically, the assembler had his materials on the shop floor, and referenced CAD drawings and a physical prototype scale model of the real sub in a completely different area.

When the assemblers had a question on the design and needed to reference files, they would travel off the shop floor and over to the CAD drawings, models and the physical prototype. Assemblers would have to envision the area of the sub they were working on, which was very difficult for a number of reasons: the subs are cylinder-shaped, but the physical prototype detail was not easily accessible, and the CAD data and drawings are “flat”. After consulting both these sources, the assembler would return to the project and perform the task. The challenges speak for themselves. The assembler would spend quite a bit of time both studying the model and drawings, and walking back and forth from actual design to prototype in order to replicate exactly what was required. Adding even more difficulty to the situation, the assembler was not a trained CAD/IT expert and had little working knowledge of the solutions.

In today’s VR environment, the assemblers at BAE can use the virtual prototype running in 3D stereo where they can “virtually” review ‘before-and-after’ builds of the design area they are working on. Now, they can upload the system with virtual prototypes in the area of the sub where they are working, and then manipulate files, which has greatly increased confidence in the designs and the tasks. Using 3D glasses, a wireless keyboard and a mouse, the assemblers can orient themselves in this 3D world and essentially fit themselves into the project. The results are far less time traveling from the shop floor to design center, a quicker build of the project, and a much lower risk of error.

“Drop in anytime...”

The unique combination of the PTC DIVISION MockUp with a “shop floor VR” system has a solid endorsement from BAE pipe fitters, such as Chris Foote, who regularly operates one of the cabin systems. Foote is one member of a team that keeps this facility open during the day shift and back shift, Monday to Friday, and as required on weekends. “People just drop in and look at the compartment they are working on. Sometimes they stay ten minutes, sometimes they stay an hour. If there is a particular problem they are wrestling with, they might pre-book a cabin. I drive the system for them, but, because I have manufacturing and boat building experience rather than an IT background, I can bring my practical experience to bear.”



BAE Systems Submarine Solutions has been using PTC’s shipbuilding solution—CADD5 5—that enables groups of engineers to work simultaneously on design, verification and machining of the same assemblies.

A Revolution in Shipbuilding and Design

The PTC-Virtalis VR solution has greatly accelerated time-to-market for BAE Systems Submarine, increasing design/build productivity, making design data available in real-time to all users, increasing the efficiency of welders and fitters who don’t need CAD/IT training to use the system, and eliminating workers’ time wasted traveling back and forth from the shop floor to the design department.

No doubt, the PTC-Virtalis VR solution will continue to help BAE Systems throughout the Astute project, helping designers, engineers and all product stakeholders work more efficiently and productively in their new virtual world.

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