Success Story

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—Ross Kirkham, IT Director, TWR

TWR and SGI® Reality Center™

Using Visualization Technology as the Catalyst for Advancements in Automotive Engineering

SGI Reality Center facilities seamlessly integrate advanced visualization hardware and software technologies to create immersive environments that envelop participants in a state of virtual reality. With over 550 deployed worldwide, they have become an indispensable tool among leaders in today's global manufacturing industries. SGI Reality Center facilities enable companies to reengineer their product development practices and bring new, better-quality products to market faster, at a lower cost, with more options for consumers.

TWR, headquartered in Leafield, England, has, for more than 25 years, provided the automotive industry with fully integrated services in vehicle design, engineering, and manufacturing. Since the installation of its first SGI Reality Center facility in 1999, the company has been able to move significantly beyond the limitations of CAD technologies when designing and engineering automobiles, automobile components, and systems for its OEM customers.

According to Ross Kirkham, IT director for TWR, "One of the key benefits of TWR having an SGI Reality Center facility is the convenience of finally having all of our design, engineering, and manufacturing data together in a single environment. Our goal is to use SGI Reality Center to exploit the latest technologies in order to reduce engineering time, encourage innovation through faster analysis and feedback, increase end-product quality, and, ultimately, build incremental business with tier-one auto manufacturers by helping them significantly reduce time to market for their products—the key selling point for OEMs."

The Power to Visualize

Providing the horsepower to TWR's Reality Center environment is an SGI® Onyx® 3400 server with InfiniteReality3™ graphics. Equipped with 12 MIPS® RI4000™ 500 MHz processors, the system is extremely robust, enough so that TWR engineers can conduct 1:1 scale vehicle design and engineering reviews. SGI® Onyx® family high-performance computers are based on the SGI® NUMAflex™ architecture. They are the only systems designed from the ground up to support immersive visualization and to simultaneously process 3D graphics, imaging, and video data in real time.

Of special interest to TWR was the SGI Onyx 3400 system's ability to provide full-scene anti-aliasing, which, through a multisampling of geometries, transforms the otherwise jagged edges of large-scale nonlinear digital images into smooth, flowing lines. This becomes critically important when conducting styling reviews.

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TWR System Configuration

- SGI Onyx 3400 system w/12 x R14000 500 MHz processors, 6GB RAM, 5 x 36GB disk storage
- Three InfiniteReality3 graphics pipes (two with two Raster Managers and one with four Raster Managers)
- Two DG5-2 (two-channel display generator) and one DG5-8 (eight-channel display generator)
- One DIVO graphics-to-video option for Onyx family systems
- Three SEOS Prodas CRT projectors with edge blending
- Trimension R2 Researcher Screen (12-ft. radius, solid/spherical)—170˚ x 46˚ field of view

SGI Professional Services works with TWR's engineering staff to upgrade and enhance system capabilities every six months. Doing so ensures that TWR and its OEM customers will maintain a competitive edge in the design and engineering of next-generation automotive products.

Using the Reality Center Facility

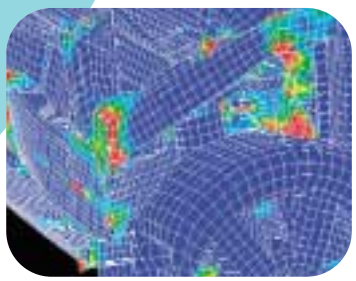
TWR's origins are in automotive racing, including Formula One now with the Orange Arrows F1 team, and while that heritage remains strong, it accounts for only 12% of the company's current business. Today, the bulk of TWR's work comes from the design, engineering, and manufacture of road and race cars, and road and race engines for OEMs worldwide. In addition TWR is a source of design and performance enhancements for current vehicles and engines.

Prior to installing the SGI Reality Center facility, TWR was using SGI® workstations to significantly reduce design times. For example, the company was able to create the Nissan® R390—a road version of the Le Mans GTI car—in just eight months using SGI equipment. It was the success of projects such as this that inspired TWR to once again turn to SGI to help it create still greater successes on an even larger scale.

The SGI Reality Center facility at TWR's Leafield location came online in May 1999. The facility had the distinction of being the U.K.'s first curved-screen, full-size immersive virtual reality environment. The Reality Center facility seats 15 to 20 comfortably and immerses viewers within the confines of its 24-foot spherical screen, which provides a 170˚ x 46˚ field of view.

Weekdays, the Reality Center facility sees a steady stream of working sessions including styling exercises, design and engineering reviews, and sales and marketing presentations to existing and potential TWR customers. Reality Center is also used to support TWR in joint presentations to OEM customers around the globe by using the power of the Internet and PTC Division dVise, a software application that turns CAD data into functioning, interactive virtual products for real-time on-screen testing across multiple machines in both local and wide-area networks.

TWR currently uses this technology to conduct joint design reviews between the U.K. and Detroit, U.S. and between the U.K. and Melbourne, Australia, as well as three-way collaborations involving all three countries.



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After hours and on weekends the Reality Center facility's SGI Onyx 3400 system takes on an even more computational function, performing CFD analyses, to assess the aerodynamics both outside and inside the vehicle, and crash-test simulations to evaluate vehicle safety.

CFD analyses performed on the Onyx 3400 system and visualized in the SGI Reality Center facility allow any number of vehicle design iterations to be tested simply by making computational changes in the design or engineering specifications. This, in turn, helps minimize the number of physical prototypes manufactured for actual wind tunnel testing. Consequently, the physical prototypes that are created bear the most desirable attributes of the simulated designs.

Crash test simulation, in particular, is of high interest to OEMs as physical crash testing is a significant cost factor in overall vehicle development. Because physical crash test models must be fully developed and assembled prototypes, costs can run upwards of $1 million per prototype per crash test. Being able to perform the same simulations using virtual reality can cut the number of necessary physical crash test models nearly in half, a tremendous savings in both cost and development time.

Collaborative Visualization

Within the confines of an SGI Reality Center facility, collaborative visualization serves as the common language for multidisciplinary teams. As a result, long-standing engineering disciplines—CAD, CAM, CAE, and modeling—integrate seamlessly to create a whole that is greater than the sum of its parts.

Ross Kirkham looks at it this way, "Collaborative real-time visualization promotes innovative thinking by serving as a catalyst between TWR engineers, the software they use to create their design, and the hardware that delivers it to the team. It keeps them focused on taking advantage of everything Reality Center has to offer, and using it to keep TWR a leading-edge company."

Most significant among the collaborative benefits afforded by the SGI Reality Center facility is a greater cognitive awareness of how the knowledge set of one discipline can further that of the other. And the more efficiently multidisciplinary teams work together, the more effective their efforts become.

A Multidisciplinary Advantage

At TWR, real-time visualization technology is an effective tool in creating a collaborative environment in which multidisciplinary teams can design, engineer, and manufacture automobiles that set the industry standards for superior quality.

Kirkham cites design reviews as an example. "During design reviews the SGI Reality Center facility's collaborative environment allows the design and engineering teams to show and validate their work in progress, and to demonstrate that the 'integrity' of the design is not being compromised."

Overall, because multidisciplinary teams are able to use the Reality Center environment to visualize and analyze large CAD data collaboratively, TWR has been able to gain product insights faster, thereby enhancing the company's ability to ensure the fit and functionality of vehicle components before the first prototype is built.

Real-time visualization has done much to impact time to market for TWR customers. For example, by using real-time visualization of high fidelity, 1:1 scale (and larger) 3D vehicle renderings in its Reality Center environment, TWR was able to eliminate the need for a significant number of full-size clay vehicle prototypes in the creation of the Renault Sport Clio V6 for itsclient Renault. Reality Center made it possible for participating teams from TWR and Renault to interact with every part of a vehicle's design and achieve consensus early in the process.

Typically, automotive manufacturers will require that 10 to 15 prototypes be built to assess the integrity of the design before moving forward with a project. The reduction in prototypes translated to a savings to Renault of £250,000 ($375,000) per prototype not built, and helped to reduce what would normally be a three- to four year-time to market to just 16 months.

Return on Investment

TWR does not measure its return on investment (ROI) based solely on financial profit. Time also is a critical factor, as are the resources required to generate ROI. Among the most quantifiable benefits that TWR has realized in using SGI Reality Center are the reduction in physical prototypes and the significant costs associated with their creation.

But by far the biggest benefit for TWR has been time to market, a cumulative effect of fewer physical prototypes and shorter development cycles. For TWR customers, this brings to the fore one of the most coveted of all business positions—competitive advantage.

TWR's OEM customers such as Renault know that getting a product to market before the competition increases market share and establishes leadership status, two powerful weapons for sales and marketing. It also means unchallenged sales from similar competing products and, therefore, unchallenged profitability. Not to be underestimated is the added financial bonus of being able to earn the highest possible profit margins early in a product's lifecycle, before competition drives prices down.

Finally, there is the ROI realized through the collaborative efforts that take place between multidisciplinary engineering teams within the SGI Reality Center facility. While the overall effects may be subjective in nature, Reality Center has enabled TWR to eliminate design, development, and production problems in the early stages of product development. The end result is higher-quality, better-engineered products.

Continued Innovation

SGI will continue to innovate, developing next-generation technologies and working with leading software companies to provide TWR and others in the automotive industry with advanced visualization solutions that deliver the highest-available performance and unsurpassed return on SGI Reality Center investments.

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