The Vehicle Designers Review

- DESIGN STUDIO TECHNOLOGIES
- CONCEPTS & DESIGN
- INTERIOR / EXTERIOR DESIGN SOLUTIONS




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THE EVOLUTION OF RESOLUTION

Designers prepare yourselves: Large-scale, high-resolution display walls have arrived

By Ted Woerner, IGI

The transition to an all-digital design workflow could arguably be the single-most important development in the automobile design process over the past two decades. What was once a brave and expensive plunge into the unknown has gradually become the accepted and even requisite technology that is used in the design and development of new vehicles.

During this technology transition, the capabilities of computers and the new breed of computer aided industrial design (CAID) software programs preceded the technology required to adequately display a full-scale virtual vehicle. Car companies were eager to get these new images from a designer's monitor and displayed in front of a development team in actual size. It was clear that if this goal could be accomplished, the potential payoff in development time and associated cost savings could be monumental.

Time has proven that the vision of the early adopters of full-scale visualization has indeed delivered on its initial promise. But getting there hasn't always been easy.

The Early Days: The 1990s

The fundamental challenge in the early days of large-scale visualization systems, now known as "powerwalls", was to simultaneously achieve high resolution, a large screen size, and brightness. Doing simple math, it was easy to see that a single XGA (1024 x 768) or even an SXGA (1280 x 1024) CRT projector of those days could not possibly provide enough resolution to project an image onto a car-size screen with an acceptable level of sharpness.

In addition, the 4:3 aspect ratio of these projectors was not consistent with the proportions of a car and the low brightness level of CRT projectors was also a concern.

The solution that evolved was to use two or more projectors to yield not only sufficient horizontal and vertical screen resolution, but also to achieve a display proportion more suitable for automobiles. This configuration also optimized the limited brightness level of the projectors by focusing the light from each on only a portion of the overall screen area.

The remaining hurdle was how to parse out a section of the overall image to each projector while it appeared seamlessly across the screen. This became a very expensive proposition, but industry visionaries pressed on, convinced that the payoff was worth it.

Multiple projectors, multiple challenges: 1990s – mid-2000s

As there were no UXGA (1600 x 1200) or HD (1920 x 1080) resolution desktop monitors, it wasn't even a simple proposition to view a 3D CG model on the desktop in the same aspect ratio as the powerwall display. Out of necessity, multiple desktop monitors became the accepted desktop previewing solution with the image spanning across them. Key to the effectiveness of the multi-projector powerwall was blending technology, which allowed a seamless transition of the projected image between projectors, undetectable to the eye. While logical in theory, in practice the results of blending projectors on the screen could be highly variable. Careful selection of screen material, screen gain and projector lenses were critical in the design of the system to

keep the blend zone from revealing itself to the viewer. And off-axis viewing frequently exacerbated the appearance of the blend zone if the system was poorly designed.

Adjustment of slight color balance differences between the projectors and the alignment of the projectors to each other in the blend zone was critical to achieving high-quality images. A properly aligned system would help ensure that any part of the screen image that fell within the blend zone appeared in the same sharp focus as the rest of the screen.

Processing such a high-resolution screen image for a multiple-projector powerwall display – as well as its monitors – required computer power available only at a substantial cost. This was the era when a multi-processor/multi-graphics pipe SGI Onyx computer was frequently the solution of choice. With the system's computer easily costing US$250,000 or more, the cost of just a basic powerwall for full-scale automobile design visualization could easily exceed US$1 million. Nonetheless, the anticipated acceleration of the design process and its related cost savings continued to justify such investment.

Visualization goes to the movies: The new world of 4K

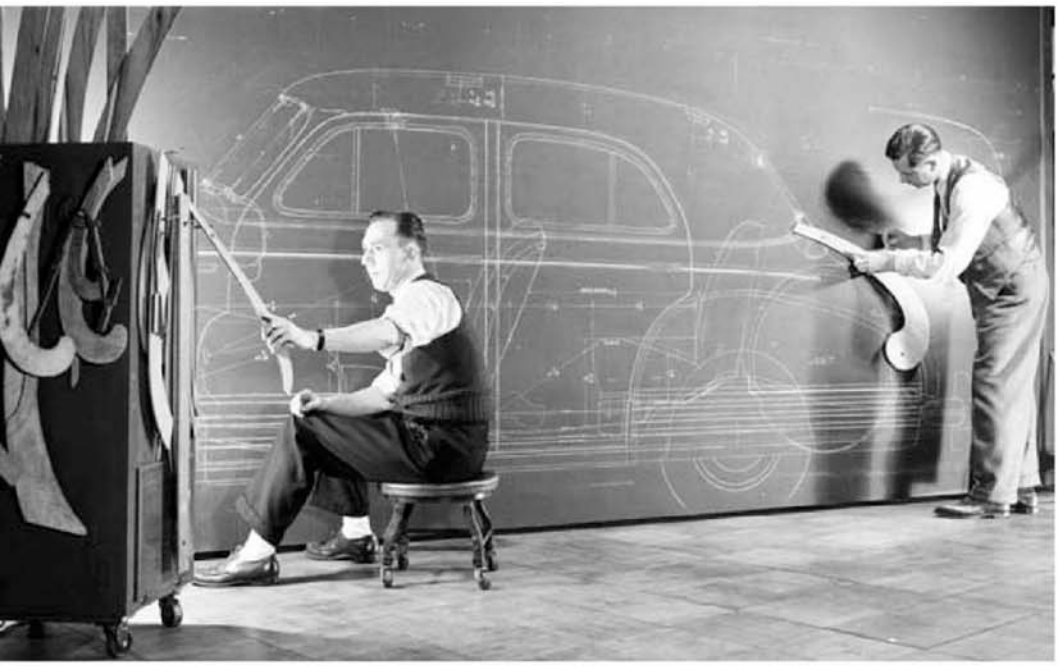
Multiple-projector powerwalls are still in use throughout the industry, but projector technology has also undergone a digital transformation.

Digital DLP, LCD and LCOS projectors are brighter and more stable than ever before, allowing them to be used on a daily basis.

But the display resolution can still be a potential problem given that individual pixels now make up the display raster.

In the past couple of years, however, a number of design studios have embraced a new projection technology that elevates the powerwall to an unprecedented level of image quality and performance. Originally developed for theater exhibition of extremely high

resolution, digital motion pictures, a single Sony SXRD® 4K projector can provide sufficient powerwall resolution all by itself. Its impressive native resolution of 4096 x 2160 pixels (referred to as "4K") represents a fourfold increase over the industry's previous projector resolution maximum of 2048 x 1080 (2K).



Pat Hernandez, founder and president of IGI, a Detroit, Michigan-based visualization system integrator, has a unique perspective on this latest industry development. "The Sony SXRD 4K projector has allowed us to design systems for our customers that were unthinkable even just a couple of years ago. Just this one projector delivers four times the resolution of HD at a substantial brightness level of 11,000 Lumens. You cannot even detect individual pixels on the screen at arm's length viewing distance." Hernandez says that robust processing is still required to project full-scale, 4K resolution images on a powerwall screen. "We use NVIDIA's Quadro® Plex technology to drive the 8.8 million pixels," he says, "However, the cost of this graphics processing is a fraction of what was once needed to drive far fewer pixels not that long ago."

IGI is in discussions with several major Hollywood post production studios about the use of its 4K displays in the production of 4K digital motion pictures. Hernandez sees exciting potential for 4K design visualization providing the foundation for digital cinema marketing opportunities for manufacturers.

"The future digital format of motion pictures will clearly be 4K," predicts Hernandez. "I can see the opportunity for car companies to produce 4K digital cinema preshow ads that will leverage the modeling and visualization work they've already done during the design process. This is already happening for television broadcast ads, but rendering that same digital ad content at 4K for cinema exhibition will be the next step in leveraging the digital design workflow to help generate product excitement. At 4K resolution that content will be absolutely stunning to the cinema audience."

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IGI has over ten years of experience in the design and installation of large-scale, high resolution display walls. We have provided visualization systems to nearly every automobile manufacturer with a design studio in North America. From simple, single-projector HD systems to sophisticated, multiple 4K projector systems, IGI has the expertise to bring your vision to life. **Visit IGI at www.werigi.com**

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