## Chavant News

*Virtual vehicle design: The search for a new paradigm continues*
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They have portentous names such as “the Cave” and “Powerwall,” and they represent the future of automotive design. They are virtual-reality imaging and other math-based design tools, and few people in the industry challenge the notion that they are imperative for any automaker that expects to be competitive in 2010.

Designers at Mercedes-Benz Passenger Car Development in Sindelfingen, Germany, use the Powerwall to project full-sized, three-dimensional renderings of their styling proposals. Their computer models can be created without touching a pencil to paper. Since April 2000, Mercedes’ passenger-car board has reviewed proposals via the Powerwall and have made key development decisions based on the electronic images.

If a traditional clay or wooden model is desired, designers can load the same math model they used on the Powerwall into a computer-guided milling machine. The mill carves the model from a chunk of the desired material without intervention from human hands. Three days to two weeks after they click their mouse buttons, designers can have a full-sized styling mock-up. And the original data model can be used to create production molds or dies.

Tools such as the Powerwall are only one element of rapidly changing design technology. There are dozens of others, and every major automaker is investing heavily in them. The advantages are obvious: faster product development cycles and lower cost. The potential pitfalls, starting with cookie-cutter style cars, are only slightly less apparent.

### Infant stage

New technology gives designers freedom and opportunity unprecedented in a century of car building. Yet, the technology goes to the core of the creative process. Automakers are somewhere between the poles of old and new, grappling to reap the benefits without ending at the worst-case scenario — ugly computer-generated cars that no one wants to buy. Design is viewed as an increasingly important element of automotive brand identity, and no one wants a computer-generated brand.

Advanced imaging technologies are at the center of what Giuseppe Delena, director of business and operations for Ford

The Cave allows Mercedes designers to work with an almost tangible model. The device is a cube, open at one end, with walls roughly 8.5-feet square. Each wall is a projection screen. The user sits in the center wearing stereovision glasses and data gloves, which transfer movement to the computer.

### Pros and cons

Imaging technologies abound in automakers' design studios these days. Some makers rely on these technologies almost exclusively. Lower costs are one reason. But with the positive can come pitfalls. Here are some advantages and disadvantages of virtual design.

**Advantages**

- Fewer prototypes
- Faster product development cycles
- Modeless crash testing
- Parallel, rather than sequential, vehicle development

**Disdvantages**

- Cookie cutter-style cars
- Data distortion, such as in

Design North America, calls “the search for a new paradigm.”

“Pockets within our corporation have totally embraced these technologies, but really we are in the infant stage,” Delena says. “In 10 years, we are going to laugh at where we are now. We’re in a hybrid state of affairs — like the turn of the century, when horses still shared the roads with cars. In some respects there are more inefficiencies than if we were entirely in the old system.”

scale, when translating from electronics
- Generational differences in designers' computer acumen

Delena’s career probably speaks to the increasing importance of math-based design technology. In the mid-1980s, he was placed in charge of Ford’s Studio 2010, a lab/studio created to develop and implement 3-D imaging, virtual reality and other infant technology for automotive design. Delena manages operations for all of Ford’s design activity in North America.

**Superhero performance**

Most manufacturers keep specifics of their advanced design technologies secret. But recently, Mercedes opened its Virtual Reality Center in Sindelfingen for a peek. The Powerwall is a prominent component.

This curved, high-resolution screen measures 8.5-by-23 feet, with several rear projectors inside a movie-theater style enclosure. It is managed by a Silicon Graphics computer with 60 processors and memory bandwidth of 22 gigabytes — about 200 times the hottest PC going. That kind of computing power is sufficient to simulate crash tests electronically — another function of the Powerwall.

Engineers learn nearly everything from these virtual crash tests that they might discover from a genuine car-into-a barrier wreck. Powerwall crash tests are limited only by time (each requires 80 hours of computer use), but engineers can crash and analyze a vehicle that may not exist, and they don’t waste a real Mercedes in the process.

For the designer, the Powerwall means freedom to explore multiple proposals without labor-intensive modeling. A full-sized car, realistic in depth to the smallest detail, can be projected driving down a highway, in a cityscape or rural environment, or side-by-side from any angle with competitive models. And if the Powerwall seems to push the technological envelope, consider the Cave.

The Cave is a cube, open at one end, with walls roughly 8.5 feet square. Each wall is a projection screen. The user sits in the center wearing stereovision glasses, which generate images for the right and left eyes at different frequencies, and data gloves that transfer movement to the computer. In other words, the operator sits behind a virtual dashboard in a virtual cabin, driving down a virtual road. The managing computer even syncs the sound of an engine, ambient noise or screeching tires as the operator drives.

Designers, fluid dynamics engineers and suppliers use the Cave to do packaging, serviceability and ergonomic analysis; no wood or Styrofoam mockup is required. System specialists can discuss problems and test, alter or optimize without building prototypes early in the development process. They’re no longer talking about an idea or line drawings; they’re working with an almost tangible model, created electronically.

**Faster and faster**

The overall benefit still is difficult to quantify, but some specific advantages are not. Dr. Hans-Joachim Schopf, chief engineer for Mercedes passenger cars, says the Cave alone has already cut the number of models 20 percent.

Delena expects that, when imaging and virtual reality technologies are more fully implemented, they will reduce required design and engineering models by two-thirds.

“The point isn’t to eliminate models entirely,” Delena says. “It’s something like writing on a word processor as opposed to a typewriter. At some point, you want to see how the words look on a page. But we’ll tremendously shorten the time it takes to do an iteration and increase the number of highly developed options.”

Time — that’s the most important advantage of math-based design tools, measured by shorter development and quicker response to market trends. Designers can rule out non-viable options sooner, or study more variants in less time at lower cost. They can delay final decisions until later in the development process, allowing more flexibility.

There are management and administrative advantages, too. The original proposal — say the computer model projected on the Powerwall — becomes a master file that incorporates changes as development proceeds. All appropriate parties have immediate access from their desktop computers. Yet the greatest efficiency with advanced imaging will be concurrent or parallel vehicle development, rather than the traditional sequential approach.

Under the conventional regime, engineers might establish a vehicle’s hard points. Then the designers create an attractive, functional package around those, and then it’s back to the engineers to fit the mechanical components inside, review by service or assembly, and so on. Advanced designed technologies increasingly allow those operations to occur concurrently. That means true integration of development teams and fewer misunderstandings between specialists in various disciplines.

“It’s the designer’s job to make people downstream see the vision — how the machinery is supposed to look and feel,” says Chris Bangle, head of design at BMW. “I like to think of it as corn. The vision is the ears — not the seeds or the stalk. But when you start with the seeds, it’s hard to see the vision. If everyone can buy into that vision — the ears — then they can understand the steps to get there. Anything that makes that easier is valuable.”

**The dark side**

Simply put, new design technologies can grow the corn faster, and allow more hybrids at less cost. Yet the process of mastering and applying the technology will take time. There’s no consensus on the best approach to using it.

“This should not be viewed as a great enhancer for the design process as much as an engineering enhancer,” says Ford’s Delena. “We have done programs entirely with 3-D, with a tenth of the resources and a third of the budget, but only under duress. We haven’t institutionalized the process because it’s not the preferred method.”

Why are designers wary? Because computer-assisted design tools can create problems. Sometimes what you see in 3-D imaging is not what you get when you build a car.

“There can be problems judging scale,” says Allan Flowers, senior designer at Nissan Design America.

"Certain cars lose proportion in the translation from electronics. They get bloated, or sometimes it's boarding (a flattening). It's hard to explain exactly why, but I can tell you that it happens. I was shocked the first few times I saw it."

Further, according to Flowers, computer-design programs tend to work better with certain shapes and proportions. Designers can be inclined to avoid other shapes, no matter how attractive, because they aren't rendered well by the computer. It's not an issue of cars not turning out as expected; it's how the tools influence the creative process.

"Sometimes the technology makes us forget that the time axis is not hardware or software related, but people-ware related," Bangle says. "So I'm a big advocate of understanding things in people terms and then using whatever technology is necessary. Why? Because how you do something has a direct relationship on what it is that comes out."

**Old vs. new**

Delena expects another eight to 10 years before the auto industry at large adapts a new design paradigm. Part of the process is overcoming reluctance to change. Current managers haven't grown up with computers as a standard tool, while fresh design-school grads feel comfortable with the new technologies.

"One of the challenges, and I think we'll see it in a lot of companies, is kind of a battle between the older generation that doesn't use computers and the younger one that does," says Jon Hull, a 28-year-old designer at Mitsubishi who broke in the business by making computer technologies his specialty. "The older group knows that the computer is the way to go, but it doesn't understand how to optimize it. There's a learning curve for the older people with computers almost as much as for the younger people learning the business."

Either way, it's hard to find a design manager who doesn't want all the advanced technology available. BMW's Bangle, advocate of the human side, can't neglect the high-tech side either.

"We can do everything completely on computers, or we can do cars by hand with 0.2 mm accuracy from end to end," he says. "People ask, 'Chris, what do you want?' I want the full kitchen.

"There are times when you know so well what you are doing that you can just skip all the screwing around and get it done. There are times you don't know what you're doing, so you use tools that aren't labor intensive because that costs money, and you've got a hunch that this thing ain't gonna last longer than two weeks anyway, but let's give it a shot."

At the bottom line, automakers will increasingly rely on virtual reality and advance 3-D imaging. Survival demands it.

"We must not forget that these are tools, and creativity does not come from the tools," Delena says. "The real object will always be the ultimate. But if we are going to have the turnaround time our customers expect, the turnaround time we need to stay of the front edge of the market, we can't do it without these technologies.

"We can't get more efficient the way we've been doing it the last 40 or 50 years, because that process is already highly refined. We have to find a new paradigm."

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