CAVE Sets the Stage for Real-Time Collaboration

by **Beverly A. Beckert**

An **immersive virtual environment** speeds the creation of prototypes to **cut time** in military **product development** programs.

The government, industry and academia have been working hand in hand over the years to transfer technology from defense research initiatives to industry and consumers. Just ask Dennis Wend, executive vice president for Technology Transfer at the Tank Automotive Research and Development Center (TARDEC) and its Business Group, the National Automotive Center (NAC).

Wend will remind you that the first computer was developed by IBM for the Army, the Internet was funded by DARPA to bring together industry and academic researchers and the microwave oven evolved from patent work done at Raytheon in microwave communications. What's more, the majority of satellites for Global Positioning Systems, used in daily life as well as war, are owned by the Department of Defense (DoD).

So, it is no surprise to learn that the NAC and its Advanced Collaborative Environments (ACE) group are hard at work on a myriad of next-generation projects. In fact, the NAC and its partners are applying leading-edge CAVE Automatic Virtual Environment (CAVE) technology to carry out their objective of compressing the military product development process and transferring that know-how to industry.

NAC's CAVE Exploration

The NAC was established in 1987 and chartered by the Secretary of the Army to serve as the Army's agent for fostering the development of dual-use automotive technologies by industry, academia and the military services. Essentially, the NAC and its partners share the cost of applying and developing new, dual-use technologies to improve automotive performance.

The reduction in the availability of research dollars, coupled with the more expensive cost of new technologies and weapon systems, has led the NAC to create partnerships with industry. Out of these partnerships has come enabling research and development technology, including the CAVE.

A CAVE is a room-sized visualization system that combines high-resolution, stereoscopic projection

and 3D computer graphics to create the illusion of a complete sense of "presence" in a virtual environment. Pioneered by Fakespace Systems, CAVEs are designed for any application that requires users to be "inside" or immersed in data. Typical CAVE systems consist of four projected surfaces (three walls and a floor); five- and six-surface configurations for complete virtual immersion are also available.

Wend explains that the NAC became interested in CAVE technology a few years ago, after it started investigating how to implement an open-architecture, Web-centric system for collaborative design work. Initially, the NAC collaborated with Parametric Technology Corp. (PTC), buying the first federal license of WindChill, a product data management tool, to serve as cornerstone technology for building a virtual product development extranet. Later, the NAC teamed up with Fakespace Systems, SGI and other companies to add the visualization component (CAVE).

"Our objective was to create an advanced collaborative environment that would enable us to take CAD models, put them into a visualization environment, gather data, make changes and continue on with cutting time out of programs to build prototypes," says Wend. He notes that the team created the ACE to better explain and demonstrate this open-architecture, Web-centric, visualization solution.

The ACE group's first CAVE project involved the design of a new gun that would replace the M-16. The ACE team partnered with engineers at the Picatinny Arsenal in New Jersey to help them refine the weapon by reducing weight and cost. Not only was the project a success, but it also drummed up interest in the CAVE and virtual engineering.

According to Wend, the ACE team then went to work on designing elements of the Interim Armored Vehicle, now called the Stryker. Lighter and more mobile than its predecessors, the Stryker is said to bring speed to the battlefield that no enemy can hope to match.

The National Automotive Center and its Advanced Collaborative Environments group use CAVE technology as a key component in their open-architecture, Web-centric system for collaborative design work.

In the development cycle, the Stryker design team found itself in a bind: it was up against a deadline to get the vehicle into testing and the field. However, a major component, the gun system, was being made remotely. Because there was no time to ship a physical prototype of the gun system to the U.S., the Stryker team evaluated it in a virtual world.

Soldiers, who were responsible for assessing the Stryker and loading it into a C-130 airplane, were brought into the CAVE to simulate the gun's operation. In doing so, the design team was able to identify a better way to stow the gun. The team also discovered a line-of-sight issue in mounting the gun that was addressed in training.

"If we had to address these issues after the vehicle was in production," says Wend, "it would have cost millions of dollars." Instead, the design team was able to catch them earlier in the development cycle, where it was cost-effective to make changes.

The ACE team is now involved in the design of hybrid electric trucks for the Army. These vehicles will have on-board power-generation capabilities of up to 400 kW,

President George W. Bush previews a Future Tatical Vehicle in the virtual world during a recent visit to the U.S. Army's National Automotive Center's CAVE.

which will help to eliminate some generators needed on the battlefield and their repair. In the next two years, the Army wants to put up to 100 of these trucks into soldiers' hands. Instead of testing the vehicles at a track, soldiers will test them in the CAVE.

The NAC is also collaborating with Daimler-Chrysler and General Motors to put commercial-based tactical trucks with plug-in power into the field. Wend notes, "Our ACE initiative, based on the CAVE and an open-architecture, Web-centric engineering system, will let us put these trucks out in the field fast and get data back from the troops quickly. Having this information in hand will enable us to determine if we should put this new technology into our legacy fleet to save fuel and money."

The NAC Role Grows

Prior to creating the ACE group, the NAC was not exchanging engineering data over the Web interactively. Instead, it was simply making and moving hard tapes and data files. Since the launch of its ACE, not only has the NAC changed but prime contractors as well as defense and commercial partners now have a Web-enabled environment to post, share and visualize information. What's more, users can evaluate design trade-offs, space claims, form, fit, function, safety and maintenance issues.

According to Wend, the ACE group has evolved to a point where it is linking multiple CAVEs around the country. Now, 50 people can collaborate at once: several can be in two or three CAVEs and using PowerWalls (flat, large-scale stereoscopic displays) while others can be participating from their laptops or desktop machines.

"We can bring young soldiers, on-line, who have driven tanks into battle and have them provide input on the design of future tanks that our veteran engineers are developing," says Wend.

With regard to technology transfer, the NAC reports it has had much success in recent years. Wend points out that the NAC has been instrumental in making a business case for industry to develop a severe, off-road vehicle. And, thanks to the government's interest in hybrid trucks, consumers will see them in the not-too-distant future. The NAC has also collaborated with the trucking industry in developing a J1939 data bus.

Wend remarks that the NAC is always looking for ways to broaden its partnerships. "For example," he says, "we are working with the Society of Automotive Engineers because if we can bring in our military needs along with commercial needs at the standards level, we can save more money for taxpayers."

The NAC also will leverage the automotive industry's expertise, through its partnership with Automation Alley (see sidebar), to cross-train engineers in automotive design and CAVE technology. Through the agreement, industry will benefit by utilizing CAVE interactive, immersive visualization technology while designing and testing products for the U.S. automotive and aerospace industries. According to Wend, working with Automation Alley will provide regional and national high-tech companies a great opportunity to do business with the NAC. C2R

Beverly A. Beckert is Editorial Director of *Concept to Reality* Magazine.

To learn more about how CAVE technology can improve your product design and development process, visit *www.altair.com/c2r* or check 02 on the reply card.

A Consortium with Clout

The Automation Alley Consortium, based in Oakland County, MI, is an alliance of private and public businesses dedicated to strengthening the economic base of southeast Michigan. The Consortium was created to promote its technology and to attract high-tech workers.

Members include companies in such industries as computer software and hardware, telecommunications, automotive, consumer products and design and engineering. The Consortium provides its 1,800 members with a range of services including networking and marketing opportunities, trade missions designed to promote global business and access to special services, such as research.

According to the Consortium, it has established a master Cooperative Research and Development Agreement (CRADA) with the National Automotive Center (NAC), part of the U.S. Army Tank-automotive and Armaments Command. CRADAs are established between Federal Government Laboratories and one or more commercial companies to easily facilitate technology transfer between the parties for their mutual benefit. A CRADA provides leveraging of resources including funding, facilities, equipment and knowledge.

Automation Alley foundation member Altair Engineering recently signed a Statement of Work under the CRADA with the NAC. It calls for cooperative use of CAVE technology for work on projects related to product design development and manufacturing of vehicles.

unbelievable CAE performance

the fastest CAE on the planet just got faster!

world's fastest workstation performance*
low-cost, big-memory solution
finally pre/post processing and power solver all in one
value partners to assist with your migration

Don't think it's all down the road. It's here today in the HP Workstation zx6000, with a SPECfp of 2106 it's almost twice as fast as the next closest competitor.

The HP zx6000 features one or two Intel® Itanium® 2 processors, HP Chipset zx1, up to 24GB of memory and other advanced features—such as built-in Gigabit Ethernet and support for three 64-bit operating systems—Linux, HP-UX and Windows®.

If you're looking for unparalleled CAE power, the HP Workstation zx6000 and the single-processor HP Workstation zx2000 are ready to work with you. They break through today's computing barriers—at affordable price points.

To get more information about the products and pricing or to find a value partner, visit **www.hp.com/workstations/itanium**.

Circle 07 on the reply card or visit www.altair.com/c2r for more information.

hp® invent