New perspective in the CAVE with 3-D computer-assisted virtual environment

October 19 2010, By Brett Stone

The new computer-assisted virtual environment (CAVE) at INL's Center for Advanced Energy Studies lets researchers get more information from data represented in an interactive 3-D form.

Hollywood movie studios aren't the only ones embracing 3-D technology. Researchers at Idaho National Laboratory and the Center for Advanced Energy Studies are using a new 3-D computer-assisted virtual environment -- or CAVE -- to literally walk into their data and examine it from various angles.

With the CAVE's Mechdyne FlexTM technology, users can see how a protein catalyst is organized or look over the nuts and bolts inside INL's Advanced Test Reactor facility.

"This is an advanced tool for our scientists," said Patrick O'Leary,

director of INL's Center for Advanced Modeling and Simulation. "This allows them to enter their data and look at it in ways they can't on traditional computers."

The Advanced Visualization Laboratory, located on the second floor of the CAES facility, resembles a cave -- black walls, ceiling and carpet and dim lights reduce glare. In the middle of the room stand three white walls, each 10 feet wide, and a slightly raised white floor.

Projectors mounted behind the walls and on the ceiling create 3-D images. With the help of specialized 3-D goggles and handheld controller, a user is able to step into the CAVE and manipulate data. The system is designed to track the movement of a user's head and the controller so the images can react accordingly.

Researchers can walk around the corner, crouch on top of ATR's heat exchangers or twist an enzyme to view its molecular structure from a different angle.

"These are very powerful tools," said Keith Wilson, who helps operate the Advanced Visualization Laboratory. "And they're pretty cool, too."

CAES is the only facility in Montana, Idaho, Utah and Wyoming with a CAVE of this kind, which one team is using to map geographic information.

Since it came online in June, the scientists and engineers have already used the CAVE for a variety of projects. It is even being used to help with maintenance of the ATR.

Engineering teams have toured a virtual model of the ATR in the CAVE to train staff, orient subcontractors and consider new designs.

By using the CAVE, the ATR engineering teams can spend as much time as needed to plan, measure and try different options. The image is so detailed they are able to see if a valve placement will scrape their knuckles, or if pipes will have to be re-routed, saving costly time, materials and labor.

"The immersive environment operates under a paradigm that places the users' data at their fingertips," O'Leary said.

Engineering teams can use the CAVE to tour a virtual nuclear reactor, train staff, orient subcontractors and consider new designs.

LIDAR mapping of the entire Malad Gorge in full color with details that

allow someone to virtually rappel down the cliffs and identify features as small as a human hand took one day. Creating a similarly detailed map with other processes would likely take a full year.

Travis McLing, the technical lead for the carbon sequestration project at INL and CAES, agrees. He and others on his team have used the CAVE to determine whether a location could be suitable for long-term storage of carbon dioxide.

McLing's team used LiDAR or "laser radar" to scan Idaho's Malad Gorge and create a 3-D model. The gorge's exposed rock faces towering over the river allow researchers a meticulous cross-sectional view from any height or angle of what the earth looks like beneath the surface — a labyrinth of flows, tablatures, sediment deposits and chambers, all important clues as to how successful any attempt to store carbon in this area would be.

"If we're going to do carbon storage, we've got to provide the public with accurate and up-to-date information," said McLing.

Projects like McLing's are examples of why INL invested in the CAVE, O'Leary said.

"A lot of the research going on today involves modeling and simulation and the CAVE is one of the best ways to view that data," he said.

Provided by Idaho National Laboratory