

# Applied Modeling and Visualization

CENTER FOR ADVANCED ENERGY STUDIES

*An Idaho National Laboratory researcher views data points turned into three-dimensional representations inside the Cave Automatic Virtual Environment in the Center for Advanced Energy Studies.*

## Augmented & Virtual Reality for Better Data Visualization

When it comes to presenting and understanding data, virtual and augmented reality are poised to revolutionize industry and academia. Instead of spreadsheets, pie charts and line graphs, it is now possible to view data sets in multidimensional, immersive ways, offering research scientists and engineers revelatory new insights.

Virtual reality exploration systems offer the ability to create visualizations of large data sets that can be projected and run in real-time simulations. Using six-degrees-of-freedom input devices – which allow a body to move

forward and backward, up and down, left to right – and stereoscopic output, they offer the benefits of more realistic interaction.

The Center for Advanced Energy Studies (CAES) opened its first Cave Automatic Virtual Environment (CAVE) in 2010. With a new CAVE installed in 2017, CAES's Applied Visualization Laboratory is even better equipped to provide researchers from universities, industry and government agencies with a user facility where they can visualize and address scientific and technical challenges.



### EXPLORE

Energy and Environmental Research



### EDUCATE

Energy and Environmental Education



### ENGAGE

Apply Knowledge to Industry



### ENABLE

Energy Transitions and Economic Development

## The CAVE

This four-panel system – 12'x12'x7.5' – uses rear digital projection to display computer graphics on three walls and the floor. Large data sets can be loaded quickly into the system. Wearing stereoscopic glasses to create depth perception and using a wand to manipulate and control data, researchers can study such things as contaminant flows through water systems, plot construction of new power transmission lines over topographically accurate terrain or examine graphite billets from a nuclear reactor.



*The updated CAVE uses rear digital projection projectors to display computer graphics on three walls and the floor, which can be viewed through stereoscopic glasses and manipulated with a wand.*



*Augmented reality solutions can be viewed using virtual reality headsets such as Samsung Gear VR and HTC Vive, or even the low-cost option of Google Cardboard.*

## Augmented and Virtual Reality

As virtual and augmented reality technology evolves, the opportunities for portable, in-depth analysis of complex data sets increases. Augmented reality solutions are envisioned to allow researchers to have CAVE-like experiences anywhere. These include virtual reality headsets such as Samsung Gear VR and HTC Vive, or even the low-cost option of Google Cardboard. Web-based 3-D geographic information systems, mobile applications (for both phone and tablet) and serious games (games built for training or educational purposes) allow users to conduct research at their desks or in the field, enabling discovery outside the lab.

Scientific research projects at CAES and INL use a suite of open-source data science software tools called the Scientific &

Intelligence Exascale Visualization Analysis System (SIEVAS). Tools such as Paraview, Matlab, Visit and Google Earth can be easily connected to SIEVAS to allow for tight integration into the users' existing workflows.

Although its chief purpose is data analysis and collaborative research, CAES's Applied Visualization Laboratory also can be used to communicate research results to key stakeholders, offering unique perspectives that enable people to make scientific connections that might otherwise be difficult. New technologies can help everyone make better sense of the physical world, identifying irregularities and patterns that allow for the advancement of scholarship and improved quality of life.

## About CAES

*The Center for Advanced Energy Studies (CAES), a consortium of Idaho National Laboratory, Boise State University, Idaho State University, University of Idaho, and University of Wyoming, is a public/private research center that provides research capabilities, energy-related educational opportunities, and industry assistance to fuel economic growth.*

## FOR MORE INFO

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