

# DATA ANALYSIS VISUALIZATION ENVIRONMENT

## THE CHALLENGE

CSCI was tasked in January, 2005 with modeling the Battle Management portion of a customer's Integrated Air and Missile Defense Integrated Architecture (IAMD IA). In addition, the customer was finding it increasingly difficult to effectively present the architecture and the efficiencies it offers in a format that was easily understood by their leadership and representatives of the various Services. They wanted to develop an analytical methodology and process that would improve resource management and resource tasking within the battlespace, and which could be effectively demonstrated in a concrete, observable manner.

## THE STRATEGY

The customer requested the use of Extend™, a commercial off-the-shelf (COTS) simulation tool, so CSCI assisted in producing a detailed outline of objectives for the preliminary effort to ensure that the selected tools matched the goals from the outset.

In order for Extend to simulate the decision-making processes of the Integrated Architecture, operational data needed to be obtained or created. Seeing an opportunity for increased flexibility in analysis methods and for addressing the customer's need to better illustrate the benefits of the IAMD IA, CSCI turned to a tool that it was already developing independently: a highly extensible modeling application called DaVE.

Developed in-house, the Data Analysis Visualization Environment™ is capable of modeling complex, multi-dimensional simulations. The interactive environments rendered by the tool are built on 6 Degrees of Freedom (6-DoF) navigation models and display topographical data based on government standard Digital Terrain Elevation Data (DTED). The software creates visualizations of sensors and tracks, and utilizes Kalman filters to determine the probable locations of targets. DaVE's architecture also allows one to rapidly test new ideas and visualize the data in an integrated environment, as it utilizes model "plugins" that can be developed and modified without affecting other models or a scenario's underlying framework. When CSCI used DaVE to create operational data for use in Extend, which interprets that data and provides what-if analysis based on the use of IAMD IA principles, the

combination was ideal for meeting the customer's modeling needs.

CSCI used a phased approach that steadily refined and focused the work effort based on the knowledge gained. The battlefield models took advantage of DaVE's robust design capabilities to create incoming track data and establish the parameters and locations of defensive shooters. Extend was then used to analyze the simulations based on the resource management processes established in the IAMD IA, giving the team data on how the scenario would unfold if the simulated units acted in accordance with and made decisions based on those processes.

By manually transferring the Extend data back into DaVE, the resulting scenario of battlefield units carrying out those processes could be graphically rendered. The tool applied coasting heights to prevent modeled engagers from striking terrain, and displayed color-coded markings for hits and misses, allowing the customer to visualize and evaluate the overall improvement offered when changes were made to the architecture.

## THE RESULTS

Using DaVE to leverage the capabilities of Extend and create detailed visualizations allowed CSCI to clearly show the customer the flaws and strengths of the modeled architecture. What had been merely a flowchart of decision boxes and specified activities was transformed into a series of fully rendered scenarios in which the processes and outcomes could be quantitatively observed.

Working with DaVE, determinations about changes to a scenario's design could be made quickly based on the graphical data. DaVE permits the rapid development, testing, and deployment of models, resulting in dramatically reduced time-to-market for modeling and simulation (M&S) from concept to deployment, as well as reduced cost for new M&S development. Using the product, CSCI was able to perform the analysis in a short time, completing the prototype in three months and modeling the three phases of increasingly complex engagements in under eight months. DaVE helped CSCI's customer to understand the extent to which the varying degrees of interaction between the battlefield units contributed to improved defense efficiency and to make decisions about the costs, savings, and combat benefits involved with each.

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