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Feature Article

Simulation Software Solution Does the Math

'Object-oriented' models let engineers manipulate military vehicle designs

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One significant challenge in developing an effective simulation is being able to predict the behavior of the objects being duplicated. Animated objects are particularly difficult because their behavior is unpredictable. However, the behavior of inanimate objects or machines can be determined through a series of mathematical equations.



A case in point is the simulation used to train military pilots. There is a push from the Defense Department to make all helicopter cockpits standard, said Don Johnson, vice president of marketing for Global Majic Software, manufacturer of 3DLinx, a simulation software product.

"3DLinx takes advantage of [established industry standards] to bring [simulated] models [such as helicopter cockpits] to life by making them independent objects that have unique behaviors and characteristics," according to company literature. These industry standards are Microsoft's Component Object Model (COM) architecture and ActiveX technology. This means programmers do not need to know how to do 3D programming to work with 3DLinx.

COM is the basic architecture of the simulation, and ActiveX is the defined object model built on top of that architecture, said Johnson.

Global Majic Software, based in Huntsville, Ala., builds 3D simulations, visualizations and training environments for government agencies. Global Majic Technical Services (GMTS), a sister company, was part of a contract team, hired by the U.S. Army Aviation and Missile Command (AMCOM)

Deputy Commander for Systems Acquisition (DSA) Utility Helicopters Program Office to demonstrate the potential of COM and distributed component object model (DCOM) technology as a simulation based acquisition strategy. The COM/DCOM demonstration was integrated in AMCOM Aviation & Missile Research, Development, and Engineering Center's Advanced Prototyping, Engineering, and eXperimentation (APEX) Laboratory.

The prime contractor was Camber Corporation, also of Huntsville, but much of the technical expertise was provided by GMTS, said Steve Donley, GMTS president and chief executive officer, in an interview.

Donley said that AMCOM has not endorsed 3DLinx or Global Majic Software's other commercial tools, but that the COM/DCOM technology demonstration was highly successful. "COM/DCOM were shown to be possible solutions for Simulation for Modeling, Acquisition, Requirements, and Training (SMART) compliant environments," said Donley.

Global Majic Software, which was founded in 1994, does not actually build simulation models, said Johnson. However, it provides "object-oriented" software that allows users to move models around. An example would be if the Army were to use 3DLinx to design helicopter cockpits. "Object-oriented" means that each instrument in the cockpit would be considered a separate entity. This lets designers insert, remove and move around instruments at will. In fact, the company has trademarked what it refers to as "living models."

Johnson said the program allows users to move things around. It allows them to "change things around to see what is the best [layout for a cockpit]."

"We don't create the models," said Johnson in an interview. "Once the model is created, we [add an] attachment. We supply the mathematics."

What Global Majic engineers decipher are the mathematical equations that will determine a simulated object's behavior. They can determine the effects wind and pressure changes would have on an aircraft. They can ascertain how a aircraft would fly if it were carrying missiles, how it would fly once the missiles are detached and how the missiles, as independent objects, would travel under severe weather conditions, such as high wind.

Johnson said there are 80 properties that can be trained in aircraft mathematics.

"You can make an F-18 fly like a real F-18," he said. "Missiles are independent objects that can be shot off."

Each "independent object" is given a unique code, said Johnson. When a user purchases 3DLinx, he or she can change the properties, such as wind and velocity, but cannot change the code.

One example is a bowling pin or bowling ball. The developer can determine how the ball would roll or how the pins would interact under certain properties-weight, velocity, curve and point of impact. Another developer can replicate the ball or pin and change the properties without changing the code.

“If it can be mathematically described,” said Johnson, “it will run like the real thing in our simulations.”

Living objects, as opposed to “living models,” are much more difficult to simulate. To determine human movements or actions, sensors are usually attached to the person being simulated. This can be seen in commercials for 989 Sports’ Sony Playstation’s NFL Gameday football video game television commercials. In its latest installment, St. Louis Rams running back Marshall Faulk can be seen hooked to these sensors. Although the commercial takes a humorous approach to simulating realistic movements of athletes, Johnson claims this currently is the most popular way to determine human action.

“Mathematically describing how people move is very hard,” said Johnson. “Things like airplanes, missiles and bowling balls are much, much easier.”

The program also can be used for terrain and radar simulation. This allows users to view terrain in 3D and make sure that there is overlapping radar coverage. This means that 100 percent of the area is under radar. Overlapping means that if one radar battery is out, an overlapping radar is providing coverage for that designated area.

3DLinx is a Windows-based software product that runs on a Pentium-class processor. The Standard Edition retails for \$895. The program also is being used in the video game industry. However, Johnson said he is unaware as to how the product is being used in that fashion.

“The gaming companies are even more secretive than the defense stuff,” he said. This is because the companies do not want competitors to get the jump on a game that is under development.

“A typical, good quality game takes 40 people and two years [to create],” said Johnson. “A good year [of that] is development time.” Johnson believes that 3DLinx can cut that time in half.

But when it comes to defense, said Johnson, “we’re opening up a whole new market.”