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Feature Article

Simulation of Human Behavior Helps Military Training Models

by Sandra I. Erwin

Training drills conducted by the U.S. military services increasingly feature more digital simulations, said Army Col. Wm. Forrest Crain, director of the Defense Modeling and Simulation Office. He also noted that the simulation technology available today falls short in many areas.

“The number of simulation-supported training events is steadily growing,” he said. This fiscal year, the Defense Department conducted 22 simulation-driven multi-service exercises. But the use of computer models in military planning does not always work as advertised. “Computers in 1964 predicted the United States would win Vietnam War,” Crain said in an interview in Tysons Corner, Va. “In 1990, computers predicted there would be tens of thousands of casualties in the Gulf War.”

The reason those models didn’t work was because they couldn’t properly simulate human behavior, he explained. The next generation of simulations will need to address the “representation” of human behavior, Crain said. “We’ve barely scratched the surface.”

The Defense Modeling and Simulation Office (DMSO), which reports to the Pentagon’s director of research and engineering, is responsible for advocating investments by the military services in simulations technologies, which are used for everything from weapon design, to troop training and war planning.

“The proper role that DMSO has is to support the community at large, rather than a specific program,” said Crain. One exception to that policy has been DMSO’s direct involvement in the troubled JSIMS (joint simulation system) program. The project started in 1994, and was conceived as the “flagship” modeling and simulation technology that eventually would replace outdated legacy systems. JSIMS would be used in distributed training, mission planning and mission rehearsal. But JSIMS has been plagued by delays and budget cuts, and, currently, is scheduled to become operational in late 2002. DMSO officials were asked to become more closely involved with JSIMS, in order to save the program and the Defense Department’s large investment.

“The cost of the program exceeded \$1 billion, to develop a ‘simulation of

simulations' to support the training of all services," said Crain. But he believes the expense will be justified, if JSIMS can replace the dozens of simulations that the individual services have developed. "At least 30 or more models and simulations were used in Korea for the Ulchi Focus Lens exercise" last year, said Crain. "Those models and simulations represent various pieces within the services—air defense, air campaign, ground fighting simulations. JSIMS is replacing all that."

Another joint simulation program under way, called JMASS, aims to provide a common repository of digital models, which would facilitate "simulation-based acquisition," said Cindy Porubcansky, program manager of the joint modeling and simulation system (JMASS). "We are building tools and services to build models. We are not a simulation. We are a toolkit," she explained.

DMSO will be taking an active role in simulation-based acquisition, said Crain. This capability allows weapon developers to design and build systems entirely in digital environments. The technology has been used in programs such as the Joint Strike Fighter and in commercial Boeing jets. Air Force Lt. Col. Eileen Borjman is DMSO's liaison to the Pentagon for simulation-based acquisition (SBA) projects. "I found that when you don't have someone with an assigned responsibility, no one is held responsible to coordinate," Crain said.

SBA, however, has been hampered by the lack of model sharing among the services and by unresolved issues such as protection of intellectual property and technical data rights. "I don't know that we are far enough along in SBA right now to say that it will or will not work," said Crain. "We are looking at the databases of each service. ... It's important for them to have access to each other's databases to fight in a joint environment. There is hesitation sometimes to release the database, because it may or may not be used for what it was originally intended."

Michael F. Bauman, director of the Army's Training and Doctrine Command's analysis center, said SBA only will work if the military services and the industry revamp the conventional ways of doing business.

"We have some real institutional roadblocks in our business," he said. "I call it the 'dirty little secret of our business.' We are unable to share sensitive data," both proprietary system data and "plain old intelligence data, which are the basis to our scenarios," said Bauman. "I have enormous amounts of data that I would like to share with industry and I am frustrated that I am not able to share it. ... We have not fixed this problem satisfactorily to enable collaboration."

SBA, he added, "isn't going to happen until some of these impediments are removed. We are not going to have a sufficiently realistic data structure underpinning all that, to allow collaboration.

“People don’t want to give data away, because it can be used against them. We see that all the time. ... You have to be able to share data and accept the risk that there will be people out there who will be trying to use it to their own advantage,” Bauman said. “The downside does not justify lack of sharing. The upside is much greater.”

High Level Architecture

DMSO, meanwhile, is in charge of the so-called “HLA transition” that was mandated for all Defense Department simulations. HLA stands for “high level architecture,” and is the standard with which all simulations had to comply by October 1, 2000. HLA was conceived as a way to make simulations compatible with each other, so they can be networked and shared among military services and allied forces.

Crain did not expect that every simulation would be HLA-compliant by the deadline. “There are still some loose ends that we have to face,” he said. “There is no guarantee that there’ll be enough money to convert all models to HLA standard for interoperability.

“This is not to be interpreted as a ‘backing off,’” he said. “Interoperability is still the goal. HLA is still the standard for interoperability.”

The October 1 deadline was set about four years ago by the Pentagon, as the “no-can-play date,” said Crain. The plan was for HLA to drive the development of new simulations. Legacy simulations would have to be migrated to the new standard. Earlier this summer, DMSO predicted that more than 200 simulations would not be able to be HLA compliant by October 1. The agency also estimated that the HLA transition for each legacy simulation would cost \$50,000. For 200 simulations, the expense would be \$10 million. “But the more significant problem is the skills and technical expertise that are needed to develop for all those simulations,” Crain said. “We don’t have enough around to do all those models and simulations. So it’s the people skills and the money that are factors” causing the delays.

“That is not to say that we are going to slide back the date,” he cautioned. “We have stood up an HLA task force headed up by DMSO’s deputy director, Navy Capt. Dave Johnson. It has representatives from all the services and joint community. They are looking at what should be the next step.

“It’s possible that some may perceive this as a ‘backing off’ from the original goal. That is not the case. ... We just have to recognize that we will not be there on time.” The October 1 deadline did not apply to non-U.S. NATO simulations and models.

In the long term, Crain also aims to improve the quality of simulations used for urban warfare training. Most simulations available today represent areas such as jungles, deserts and woods. But few offer high-fidelity, realistic models of cities, he explained. Urban combat modeling is difficult, said Crain, because each building is different from the other, and there are many

Crain, because each building is different from the other, and there are many components to each building. Not only does the simulation have to replicate the inside of a building, but also the sewer systems, the railways, the subway. “You have a multidimensional environment, rather than rolling in the open field.

“You encounter other factors we are not prepared very well to model,” he said, such as the “impact of firing weapon systems through a wall, the impact on communications, if buildings interrupt the direct line of sight.

“Now, you are dealing with cases when you are fighting up and down, from one floor to the next, instead of laterally. It is a significant problem. When you are trying to do that level of modeling, where do you go to get the data that tells you how that building is built?” Cost is another problem. The higher the resolution, the more it costs to develop models, said Crain. Currently, “the best option we have [for urban training] is live training facilities.”

Bauman believes more money needs to be invested in “acquisition models that will tell us how to acquire targets in those clutter environments.

“I would bet that Sprint and AT&T have better models of communications in urban and complex areas. I can’t prove that. [But] we don’t have models to tell us how these systems work in these kinds of environments.”

He agreed with Crain’s comments that models of human behavior remain wanting. “We don’t have the models. I know we can create the digital environments, but we want to create the models of what is going on in those environments. ... We cannot represent how humans make decisions.”

Behavioral psychologists claim that they are doing “wonderful studies” about the effects of sleep deprivation, fatigue and stress. “But that is not what I’m talking about.” These psychologists “don’t really understand how humans make decisions.

“If we understood how people make decisions, we could tailor simulations and training to enhance people’s abilities. If you could make a digital model of Saddam Hussein, I could take it to the basement of the White House and help [officials learn how to] negotiate with [him] and respond in a realistic way.

“Until we do this well,” said Bauman, “we have to continue to figure out how to integrate war fighters into our simulations.”