Test Run
Software to simulate procurement

by Richard Bray

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DND's Viriginia Poter in a helicopter simulator at Ottawa's Carleton University

Soon you will see commercials offering to take you *There*. And where is *There*? It's nowhere, except your computer screen and in your imagination, because *There* is the latest online simulation that attempts to build a complete virtual world in cyberspace.

And what does that have to do with public sector procurement? Just this. The closer computers can come to duplicating the real world and the people who live in it, the more purchasing people will be able to use modeling and simulation to recommend, make and manage better buying decisions.

Modeling is usually understood as the representation of something in the real world using mathematics. Common modeling applications are the design of a physical object on a computer or the management of processes inside a factory.

Simulations attempt to duplicate or create phenomena. Scientists use simulations to look at chemical reactions, weather conditions or the performance of an aircraft, among others. The fundamental challenge of most simulations is to gather the right information and balance it correctly.

Today, modeling and simulation (M+S) is mostly the domain of computer gamers, academic and scientific researchers and the defence industry. But tomorrow, M+S will help governments study the potential consequences of all their decisions in advance, including complex procurements. In Canada, the Department of National

Defence (DND) is making a major investment in modeling and simulation.

Defence applications have moved well past the single user stage, where one pilot might learn about a new aircraft, to networked systems involving dozens if not hundreds of planes, ships and vehicles. Humans control some of these networked systems, others are under computer control. The information they provide shows planners how to handle different situations, but it also provides valuable insights about what the military should be buying for tomorrow's battlefield.

Virginia Poter, director of DND's Materiel Acquisition and Support Program, believes most procurement people will first see M+S techniques show up in costing.

"Costing, for sure," she said. "There will be a couple of areas where I think models and costing can go together. One is risk.

Simulation enables interactive scenario planning and anticipates future developments. This wave of technology change includes tools that draw on all of an organization's data and information, then combines them with human and artificial intelligence to create future scenarios. Using simulation, governments can build complex, interactive models of virtual trends, demographics and processes both to anticipate and influence future developments.

– Accenture 2002 Report
"*Technology in Government: Riding the Waves of Change,*" p. 18

Whether it be risk associated with technology, programmatics or change management, we can use models."

Poter said DND has developed a software tool that presents the user with a simple checklist of risks and then translates these into a projection of how much contingency is required on a project, expressed as a percentage of the total budget. Costing tools provide a consistent set of principles for costing proposals, so competing proposals can be compared in constant dollar terms.

This is a good example of how managers can replace intuition with solid numbers when assigning risk, but it is only one piece of the challenge of modeling an entire procurement.

As her colleague, Dr. Ahmed Shalabi points out, the goal of any design process is to maximize simultaneously three variables through the life cycle: performance, cost and time.

"It's nice that we've picked on cost, because we've got nice tools for that but right now, for performance, we don't know," Shalabi said. "There are lots of things that industry does right now for product development, but how do you measure performance in acquisition?"

Because military organizations and their supporting industries have been using modeling and simulation for years in many different applications, there is a depth of M+S experience. But this experience has not yet reached the stage where it can take a complete, complex procurement from concept all the way through to disposal.

"I think M+S is not well-integrated right now as a holistic concept," Poter said. "I think we're doing pieces of it like costing models, but these models are used for discrete, fixed purposes and do not connect together as part of a larger picture. What we want to be able to do eventually is link models like this costing model to other parts of the business. For example, we will want eventually to link this costing tool to our cost schedule performance measurement system."

According to Shalabi, there are a number of models throughout the DND acquisition process, but they do not necessarily cooperate with each other. Changes to the life-cycle component, for example, may not be reflected in the definition of requirements. "It may not have been included, so what we're trying to do is look before we define the requirements and get those models straightened away first," Shalabi said. "We want to develop and evolve our models to greater degrees of fidelity. So the same model that helps define the requirement would be refined to look at other downstream components like training or life cycle costing."

In contrast to the United States, the dominant force in defence industries, Canada is looking to "commercial off-the-shelf" (COTS) solutions for its equipment needs, adapting them to military needs rather than building them from scratch.

Poter said, "Like the US, DND uses models to help define the requirements. However, in the US, models are used by industry to build and refine prototypes to meet the requirement of the military. Joint Strike Fighter is a prime example. In that project, computer engineers have a virtual, or 'synthetic' environment in which they fly synthetic aircraft, to determine which performance characteristics are most important."

Instead of such multi-billion dollar efforts, which are clearly unaffordable for Canada's military, Poter said, Canada is looking at how modeling and simulation can help equip the Forces in a COTS environment.

"In DND, we are investigating how best to use models to support requirements definition to help refine our doctrine, determine the optimal mix of equipment/personnel, refine our strategies for in-service support, and for deciding whether we need to make a new purchase," she said. "That is more where we are focussing. In some aspects like integrated logistics support, we have one tool called LOGAN, or Omega PS Analyzer. I think that is a real success story that came out of DND. We developed the algorithm that underlies this tool. It helps the life cycle materiel managers figure out their spare parts model for equipment. It helps figure out what will be needed to support equipment under different usage rates and conditions."

'Cost as independent variable' is a simulation technique that looks at a fixed cost on a consistent basis and then calculates how much performance that buys. More effective life cycle costing is another goal of modeling and simulation specialists. That is what Poter calls the challenge of relating the initial cost of equipment, the part that costs 20 percent to buy, to the 80 percent needed to maintain it throughout its in-service life.

"How do you model the cost over the in-service life of a piece of kit," Poter asks. "This is important because maybe the Cadillac is the better choice than the Volkswagen, if you look at the life cycle cost instead of just the upfront acquisition piece. You need some models to predict what the cost of repairs is going to be based on

CAE simulator of Moneypoint power plant, Ireland

something like mean time between failures. You have to do some 'what if' analysis, to get a handle on the costs associated with each type of acquisition choice."

If simulations do a good job on variables like costing, and progress is being made on measuring performance, can procurement specialists look at less tangible factors like the impact of future innovation on their projects?

"Today, no. But do I think we'll be able to? Yes, I think so," Poter said. "There is a lot happening in this field. Just to keep on top of everything that's happening out there is difficult."

In the future, procurement officials will be able to sit down with their program counterparts and show them the different possible futures of their acquisitions, using different sources of data to model the world. With simulation software, managers will be able to see the impact of today's decisions on tomorrow's outcomes.

The key to that kind of complex simulation is interoperability. Systems and the data they process must be able to communicate with each other. To make that happen, the M+S community must develop standards. That is beginning to happen, but Poter thinks it is too early in the game to publish fixed standards.

"What is the implication for industry and competition? Are we going to smother some young, up and coming company that is the next star five years out because we have mandated this and they couldn't get a contract? I think we really need to make sure we know what we're doing," she said.

Within DND itself, Ahmed Shalabi says there is a lot going on in pursuit of interoperability. "Is it coordinated? Yes, in some

ways. It's going to take another three or four years before we can say yes, we have interoperability for using modeling and simulation within DND. I don't think we're there yet."

So how long will it be before the front-line procurement person routinely uses simulations? Virginia Poter says it is already happening, at least on a conceptual level.

"But they may not realize they're doing it. If I look at something like 'cost as independent variable', I think people doing procurement even today would say yes, they do that, at least notionally," she said.

"In many cases, there is a rudimentary model underpinning their work as they plan procurements. But more sophisticated models are on the way. I think it's like the early days of cars. You had to be a mechanic to drive one. Today, I don't know how it works under the hood but I can turn the key and drive. I think it won't be long before we get there. The power is amazing."

The day may well come when procurements require vendors to submit their proposals not as boxes of paper, or stacks of CD-ROMs, but as simulations that buyers can study from a whole range of perspectives, testing the supplier's proposed options within the "world" their program wants to create.

Computer gamers will certainly get to *There* first, but government purchasers aren't far behind. ᨆ

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