

Diversity of application domains for M&S



## ALABAMA—LEADING THE MODELING AND SIMULATION INDUSTRY

BY BILL WAITE

**M**odels and simulations are, simply, things we conceive or create whose purpose is to 'represent' or 'pretend to be' something else we are interested in. On the one hand, Newton's equation  $F = ma$  is a model of anything moving under the influence of a force. Similarly, toy tanks in a sandbox can be a model of armored warfare. On the other hand, extremely complex computer programs, perhaps combined with real-world software, man-machine interfaces, and even people and equipment might serve to simulate wildfire management, anti-terror or disaster-relief operations. This definition of a model as any static representation and a simulation as any dynamic representation of some part of a real or potential world is the basis for the diversity, ubiquity and significance of modeling and simulation (M&S).

The diversity of M&S can be illustrated briefly by indicating the many ways we can represent the world, the many ways we can use simulation, and the many domains in which M&S is valuable.

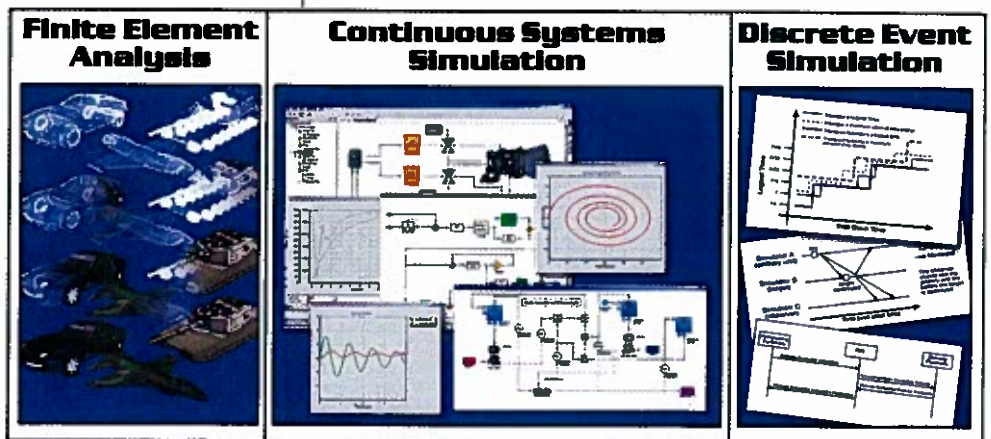
For instance, if we choose to represent the world as a set of surfaces and volumes of spatially distributed materiel, such as an aircraft moving through the atmosphere, we can use finite-element analysis, and computational fluid dynamics tools

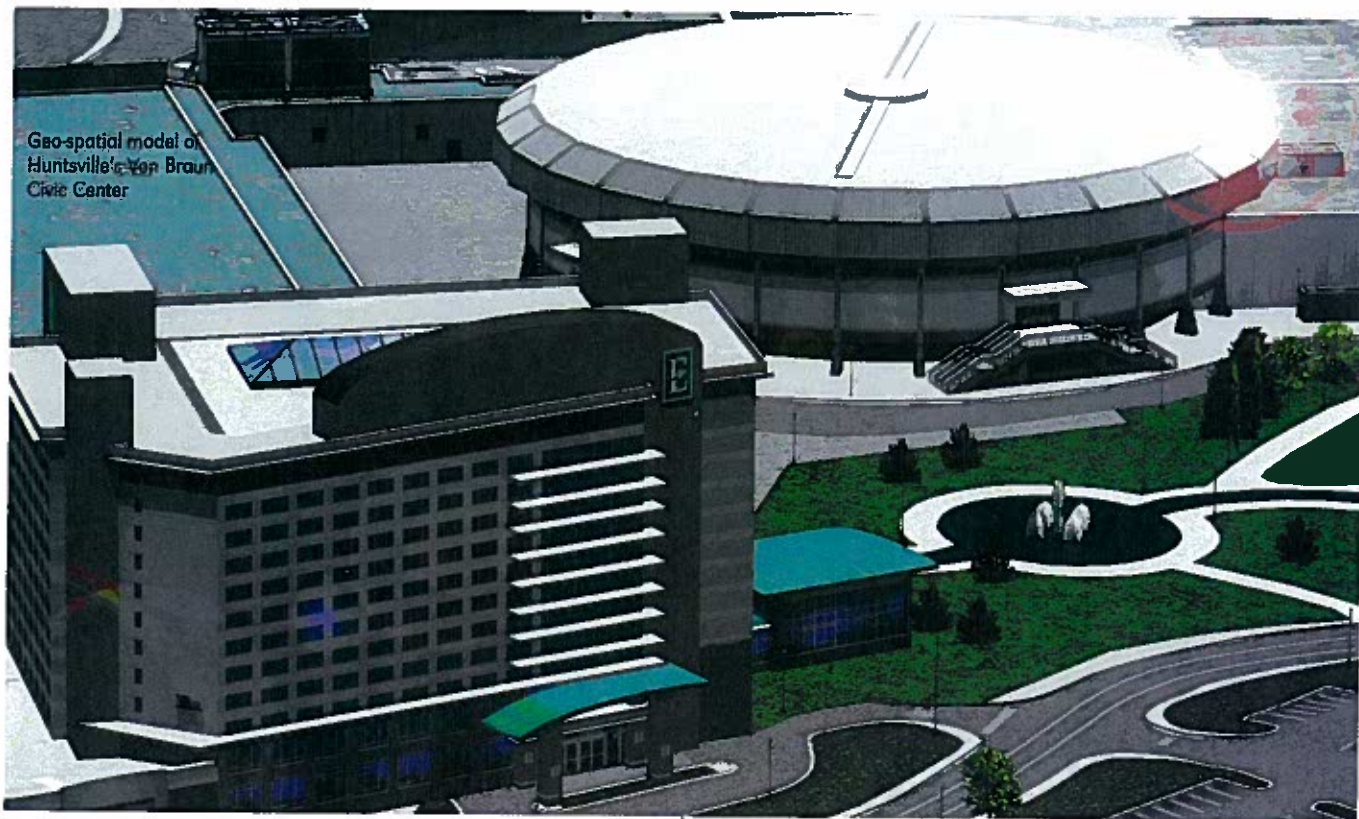
Illustration of alternate model representation schemas

and techniques. Alternatively, if we choose to think of the world as a set of objects that assume one after another a set of more or less continuously varying statistics of being (position, attitude, velocity, etc.), such as may characterize a car moving along the highway, we can use any of a wide range of 'continuous' system simulation. Finally, considering the world to be represented as objects interacting occasionally in a series of events results in a 'discrete-event' M&S schema.

Uses for simulation are equally varied. We may use simulation to conduct analysis-of-alternatives, for systems engineering design, to facilitate test and evaluation of products, or to support training of systems operators or of teams whose cooperation is essential to mission success. Education in any subject at all levels can be supported by use of modeling and simulation.

Finally M&S is employed in virtually every field of endeavor in a modern society. Defense and aerospace come immediately to mind, as does homeland security and disaster management. In fact, however, every other department and significant agency of government — energy, commerce, transportation, justice, NASA, NOAA, etc. — and every aspect of industrial and modern social administration uses modeling and simulation to one degree or





Geo-spatial model of Huntsville's Von Braun Civic Center

another

Recently, the United States Congress recognized this diversity, ubiquity and relevance of M&S to the national well-being when on July 16, 2007, the House of Representatives passed H. Res. 487, noting that:

*"...modeling and simulation in the United States is a unique application of computer science and mathematics..."*

*"...members of the modeling and simulation community in government, industry, and academia have made significant contributions to the general welfare of the United States....";*

*the House resolved that it ... "recognizes modeling and simulation as a National Critical Technology"....*

Just as Alabama led the establishment of a national missile and defense capability, it is leading evolution of national M&S workforce development, industrial administrative infrastructure and the market for modeling and simulation goods and services. This leadership is manifest as the consequence of collaborative efforts of government, industry and academia.

Besides products and services, members of the Alabama community influence the evolution of the M&S industry by their



Variety of uses of M&S at U.S. Army

leadership participation in several professional societies and trade associations. Three such efforts are particularly notable. The establishment of the Alabama Modeling and Simulation Council (AMSC), a not-for-profit industry cooperative, was instrumental in establishing Alabama on a par with other states having similar organizations. Secondly, members of the Alabama community are instrumental in establishing and managing effort leading to certification of simulation professionals worldwide. Finally, Alabama is unique in supporting the only continuing modeling and simulation event sponsored by international societies - the Huntsville Simulation Conference. Interesting indications of the degree to which M&S is knit into the fabric of the state are: sponsorship of simulation projects in science fairs, the existence of special awards in such technical events as the IEEE Future City, and in ongoing efforts to support M&S as a curricular topic in city secondary schools.

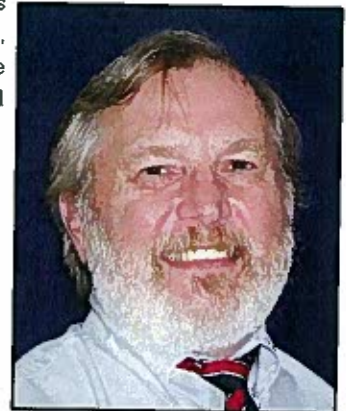
As a consequence of the collaboration among government, industry and academia, there is a robust M&S community of practice within Alabama, and there is considerable influence by the Alabama community on the national and international M&S industry.

The progress of modeling and simulation in Alabama is exciting. According to a 2005 survey by the University of Alabama in Huntsville and the AMSC, there were 80 commercial companies, in addition to government and academic organizations, in the greater Huntsville area that consider M&S

product or service a significant source of revenue, and more than 6,000 individual practitioners; and those numbers were growing at a rate of about 10 percent per year. The state has established a place of prominence in this critical emerging industry, based on demonstrated diversity and excellence in a highly transferable technology. In fact, this influence reaches far beyond the borders of Alabama or the nation.

The future of M&S in Alabama, however, is even more interesting and auspicious than its past progress. As recognition of the value of modeling and simulation technology improves, M&S will take its place in the inventory of the characteristics that make Alabama unique in all the world. As advocacy of M&S by city and state leaders as an investment-target and as a value-offering to our customers and colleagues improves, our strategic position in the emerging M&S international market will likewise improve.

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