

# Special Issue: Gaming Technology

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This issue, a special issue comprised of selected reviewed and revised papers from the Interservice/Industry Training, Simulation and Education Conference (I/ITSEC '05), showcases the interest and promise in gaming technology in training, simulation, and education. Highlighted are efforts in the development of open source game engines, massively multi-player environments for large-scale distributed training environments, and the use of graphics processing units (GPUs) for offloading computationally intensive algorithms from traditional CPU implementations, leading to higher-fidelity environments at reduced costs.

As the Training and Education Community explores and embraces the use of game-based simulations (i.e., simulations built on gaming engines), they are continuously challenged by the requirement to pay licensing fees for the proprietary game engines or to pay the game engine owners to do the development work. The financial burden of this is one thing, but when coupled with the lack of flexibility to adapt to new missions, environments, and enemies, the licensing scheme is unacceptable for most DoD operational training environments. In the first paper, "Delta3D: A Complete Open Source Game and Simulation Engine for Building Military Training Systems," McDowell, Darken, Sullivan, and Johnson present a game engine robust enough to be used across a number of military domains, flexible enough to accommodate changes/enhancements as they develop, and progressive enough to benefit from the adoption of a contemporary, open source software distribution policy. This paper reviews how the researchers at NPS addressed each of these challenges in the development of Delta3D and captures many of the issues, proposed solutions, and demonstrated the efficacy of the proposed approach.

Mayo, Singer, and Kusumoto, in the next paper, "Massively Multi-Player (MMP) Environments for Asymmetric Warfare," present an effort using massively multi-player (MMP) gaming technology to provide a distributed training environment for asymmetric warfare. The research focuses on the preliminary evaluation of whether this technology could be used to augment normal unit training, as well as the development of a prototype system that was used in the evaluation. The authors explain a number of features in the system that are either uncommon in traditional defense entity-level training simulations but common in MMP environments or uncommon in MMP environments but common in traditional entity-level training simulations. The paper is a comprehensive look at the issues associated with adapting MMP environments for training in urban and asymmetric warfare.

The use of GPUs has become commonplace in many game consoles (e.g., Playstation 3, Xbox 360, etc.) and PC-based systems for rasterization of 3-D primitives. Further, the rate of improvement in GPU performance has been and is expected to continue to be superior to that same measure for CPUs. As such, the GPU has become an attractive alternative to CPUs for offloading some of the computationally expensive algorithms. A number of papers build on this theme.

Winner of the I/ITSEC 2005 Best Paper Award, "UAV Swarm Control: Calculating Digital Pheromone Fields with the GPU," considers the utility of using GPUs to execute insect-inspired, pheromone-based algorithms designed to control swarms of unmanned aerial vehicles (UAVs). Walter, Sannier, Reiners, and Oliver detail the reformulation of a pheromone-based swarm control algorithm, ADAPTIV, in a form compatible with the vertex-stream and pixel-oriented programming model of a GPU. This paper provides a clear description of challenges in the development and implementation of this algorithm and an assessment of the GPU performance of ADAPTIV by comparing it with a CPU version over a number of notional battlefield dimensions.

The next paper, "Using Graphics Processor Units to Accelerate OneSAF: A Case Study in Technology Transition," by Verdesca, Munro, Hoffman, Bauer, and Manocha reports on the results of a technology transition effort attempting to transfer candidate algorithms in OneSAF (e.g., line of sight, collision detection) into a highly-vectorized form for efficient processing on the GPUs. Significantly, in this effort, they found improvements in performance factor on the order of 10–20 times. This work places a measurable milestone in the path to providing more robust large-scale training environments.

Finally, "An Analysis of Engagement Algorithms for Real-Time Weapons Effects," by Mann, Fisher, Kraus, Lowndes, and York, describes a spectrum of engagement model algorithms ranging from low fidelity to high fidelity that can also benefit from the implementation on GPUs or physics processing units (PPUs). Further, they examine the advantages and disadvantages of each in the context of live training and testing through the exploration of trade-offs in fidelity and computational requirements/execution time and the theorization on the ramifications of using low-fidelity models in training.

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