2003 Annual Report
Old Dominion Center
McLeod Institute for Simulation Science of SCS
Prof. R. Bowen Loftin, Director

Message from the Director

We are pleased to present the Old Dominion Center of the McLeod Institute for Simulation Science of the SCS Annual Report for calendar year (CY) 2003. This report highlights our many accomplishments during the past year.

This past calendar year has been extraordinary for our organization. Not only did the Center continue its pattern of growth in sponsored research (to almost $7M), but also Old Dominion University's Graduate Programs in Modeling and Simulation reached a significant milestone with the award of our (and the world's) first Ph.D. in Modeling and Simulation—Dr. John Sokolowski in May 2003.

By the end of 2003, the Center's Battle Laboratory and Decision Support Center was fully operational and working in support of USJFCOM's Joint National Training Capability. Two Senior Research Scientists joined VMASC's world-class research team in 2003: Dr. David Dryer and Dr. Ryland Gaskins. Dr. Dryer, a West Point graduate, brings significant experience in System Dynamics and Collaborative Engineering Environments while Dr. Gaskins, a Ph.D. in Psychology, is a key contributor to our work in Modeling Human Behavior.

Partnerships with other universities, with industry, and with government continued to grow and strengthen in 2003. The VMASC Consortium membership reached 160 (97 active) in 2003 and major joint projects were underway with academic partners such as George Mason University and Eastern Virginia Medical School.

This report provides ample evidence of the strength and productivity of the Center's staff and of the collaborations in which we are engaged. As the nation's reliance on Modeling and Simulation deepens, the Center's dedication to its vision of being "a global leader in modeling and simulation (M&S) research and development and an integrator of M&S with visualization technologies" is also strengthening.

Organization Synopsis

The Old Dominion Center of the McLeod Institute for Simulation Science of the SCS is administered through the Virginia Modeling, Analysis and Simulation Center, a not-for-profit collaborative enterprise center of Old Dominion University's College of Engineering and Technology. We are partnered with academia, industry and government. Our foci are:

- Modeling, simulation and visualization research, development and education.
- Leveraging, promoting and cultivating simulation technology expertise through industry, government, and academia.

Vision
The center will be a global leader in modeling and simulation (M&S) research and development, an integrator of M&S with visualization technologies, and a portal for one of the nation's premier M&S educational program.

Mission
- Engage in collaborative research and development in modeling, simulation, and visualization (MS&V).
- Provide government, industry and academia with MS&V scientific/engineering applications, development and technical services.
- Promote education in MS&V through graduate degree programs, short courses, and certificate programs.
- Stimulate economic development through increased industry and government use of MS&V.

Facility
Primary Location: 7000 College Drive, Suffolk, Virginia USA
Secondary Location: Kaufman Hall, Old Dominion University, Norfolk, Virginia USA
Seven Development Laboratories:

Operations Research & Analysis	Constructive Modeling
Human Factors Engineering	Virtual Simulation
GIS/Database	Virtual Environments (Norfolk campus)
	CAVE Facility (Norfolk campus)

Simulation hardware, software and tools valued at over $5 million

International Collaboration
In October 2003 Prof. R. Bowen Loftin visited the MISS Center at the University of Genoa and gave a presentation outlining areas of potential collaboration. Plans were made to for the Old Dominion Center to host a researcher from the University of Genoa and to explore collaboration on the Extensible Modeling and Simulation Framework (XMSF).

Modeling and Simulation Graduate Programs

CY2003 Statistics

- First Modeling & Simulation Dissertation Proposal Awarded

  CAPT John Sokolowski, USN (ret) successfully defended the first Modeling and Simulation Ph.D. dissertation in March 2003 and was formally awarded his degree at the ODU Commencement ceremonies in May 2003. Dr. Sokolowski's dissertation research addressed modeling the human decision process performed by senior military commanders. An important accomplishment was the experimental confirmation of his model's ability to successfully model decisions in a specific domain.

- 42 students enrolled in the M&S Master's Program with 28 graduates since program start

- 11 Masters of Engineering in Modeling and Simulation Program graduates in 2003

    - Jeremy Andrew Bryan
    - George A. Blacken
    - Carlin Drew Carpenter
    - Michael Vincent Chiaramonte
    - James Walling Cyre
    - Eric D. Halter
    - Dean Michael Major
    - Quynh Anh Huu Nguyen
    - Nga Dinh Pham
    - Mark A. Phillips
    - Hugh Edward Way

- 1 Masters of Science in Engineering/Modeling and Simulation Program graduate in 2003
    - Joseph Allen Hope

- 34 students enrolled in the M&S Ph.D. Program

- 1 Army War College Fellow
    - LTC Sandi Dittig, US Army National Guard

- 1 Fulbright Scholar
    - Hungria Berbesi

Project Activities

The table on the following page provides a summary of center projects for Calendar Year 2003. For more information on any project, go the following URL

http://www.odu.edu/engr/vmasc/Publications.shtml

Click on the report image to download a .pdf of the VMASC annual report for 2003. This report contains details on each of the projects listed in the following table.

Student involvement in center projects, as noted above, continues to grow. During CY2003 fifty-five students were engaged in center projects, several in more than one.

Subject	Project Title	PI	Sponsoring Agency
Engineering	Professional Engineering Services	J. Grosel	Joint Test and Evaluation Program
Information Systems Technology	Collaborative Information Environment Development	K. McCleskey	USJFCOM, Joint Experimentation Directorate
	IT Support to the Joint Warfighting Center (FY04)	B. Loftin, Ph.D.	USJFCOM, Joint Warfighting Center
M&S Technology	Configurable Port Simulation (CPortS)	J. Leathrum, Ph.D.	Military Traffic Management Command
	Effects Based Operations Support	K. McCleskey	USJFCOM, Joint Experimentation Directorate
	Extensible Modeling & Simulation Framework Distributed Common Experimentation Environment	A. Tolk, Ph.D.	USJFCOM, Joint Experimentation Directorate
	XMSF/DCEE Viewer Requirements Development	A. Tolk, Ph.D.	USJFCOM Joint Experimentation Directorate
	Integration of Live Systems into the Composable Mission Space Environment	A. Tolk, Ph.D.	George Mason University
	Joint Experiment Data Support System Development & Implementation	A. Tolk, Ph.D.	USJFCOM, Joint Experimentation Directorate
	Joint Operations Feasibility Tool Evaluation	M. Petty, Ph.D.	USJFCOM, Joint Experimentation Directorate
	Joint Simulation System Support Operational Evaluation Support	M. Petty, Ph.D.	Commander, Operational Test & Evaluation Force
	Oracle Financial System Development	K. McCleskey	Commander, Operational Test & Evaluation Force
	Synthetic Environments for Analysis & Simulation Modeling & Simulation Technical Development	J. Sokolowski, Ph.D.	USJFCOM, Joint Experimentation Directorate
Medical	National Center for Collaboration in Medical Modeling and Simulation (Phase 2)	B. Loftin, Ph.D.	Naval Medical Research Center
	National Center for Collaboration in Medical Modeling and Simulation (Phase 3)	B. Loftin, Ph.D.	U.S. Army Medical Materiel & Research Command
Training & Education	Army Training Support System Program Strategy Formulation	D. Dryer, Ph.D.	Army Training Support Center
	Cryogenics Training Course Development	R. Mielke, Ph.D.	U.S. Navy Center for Engineering Training
	I/ITSEC 2003 Conference Support	B. Loftin, Ph.D.	USJFCOM, Joint Warfighting Center
	Joint National Training Center Engineering Support	D. Dryer, Ph.D.	Naval Sea Systems Command
	Joint National Training Center Support (FY03)	B. Loftin, Ph.D.	USJFCOM, Joint Warfighting Center
	Joint National Training Center Support (FY04)	B. Loftin, Ph.D.	USJFCOM, Joint Warfighting Center
	Joint Professional Military Education Evaluation	B. Loftin, Ph.D.	USJFCOM, Joint Warfighting Center
	Modeling & Simulation Overview Course Development	M. Petty, Ph.D.	Defense Modeling & Simulation Office
Wargaming & Military Technology	Advanced Concept Technology Demonstration Support	J. Grosel	USJFCOM, Joint Requirements Directorate
	Engineering & Technical Support to the Joint Modeling & Simulation Division	J. Grosel	USJFCOM, Joint Training Directorate
	Engineering & Technical Support to the Joint Battle Center	J. Grosel	USJFCOM, Joint Battle Center
	Engineering & Technical Support to the Joint C4ISR Directorate	J. Grosel	USJFCOM, Joint C4ISR Directorate
	Engineering & Technical Support to the Joint Futures Laboratory	J. Grosel	USJFCOM, Joint Experimentation Directorate
	Engineering & Technical Support to the Joint Intelligence Directorate	J. Grosel	USJFCOM, Joint Training Directorate
	Engineering & Technical Support to the Joint Interoperability & Integration Directorate	J. Grosel	USJFCOM, Joint I & I Directorate
	Joint Concept Development & and Experimentation Campaign Plan Development	J. Grosel	USJFCOM, Joint Experimentation Directorate
	Simulation of Non-Combatant Crowds in Military & Para-military Scenarios	M. Petty, Ph.D.	Defense Modeling & Simulation Office
	Soldier CATT	B. Loftin, Ph.D.	U.S. Army Research Institute

Accomplishments for 2003

The Center continued to maintain its presence at the forefront of modeling, simulation, and visualization research and development. The following is a partial list of 2003 accomplishments:

- The Center became a new partner in the XMSF Group, which is intended to contribute to fulfilling the requirements for software system support for the transformation of the armed forces.
- United States Senator John Warner visited the Center's main facility in April.
- Papers by Center researchers placed 1st and 3rd out of approximately 110 papers at the Spring 2003 Simulation Interoperability Workshop.
- The Battle Lab activated MATRIX, a 64-processor 32-node computational cluster to be used in examining parallel processing problems in both the modeling and simulation domains and in areas of pure computational research.
- The Center began collaboration with General Dynamics' research and development teams to support the design and implementation of the Joint Experimentation Data Support System (JEDSS).
- Dr. James Bliss worked to develop a Cooperative Research and Development Agreement (CRDA) between the Center and the Army Research Institute.
- Dr. David Dryer launched distributed collaborative environment and enterprise system engineering initiatives resulting in three new project awards as well as enhanced consortium and Center research capabilities.
- Dr. Rick McKenzie served as Vice-Chair for the Special Interest Group on Simulation (SIGSIM) of the ACM
- Mark Phillips, Battle Lab Director, was appointed to the Human Systems Integration (HSI) subcommittee of the Interservice/IndustryTraining, Simulation Education Conference (I/ITSEC).
- Dr. Mark Scerbo was interviewed for an article in *Soundings*, a military newspaper, titled, "Protecting the Protectors: New Simulator could help troops guard bases, run checkpoints."
- Robert D. King, Ph.D. Candidate, successfully presented his dissertation proposal, "Is A Twisted View Better?" for the degree of Doctor of Philosophy Engineering with a Concentration in Modeling and Simulation.
- The Center began assisting in the development of operational test and evaluation methodologies for the Joint Simulation Systems, as well as developing test procedures, criteria, and metrics that are relevant to the operational requirements.
- The Center was awarded a subcontract from Eastern Virginia Medical School to continue the development of the National Center for the Collaboration of Medical Modeling and Simulation.
- The Center participated in the Initial Connectivity Test (ICT) of the U.S. Joint Forces Command's Distributed Continuous Experimentation Environment (DCEE).

- The Center hosted Boeing Day on Wednesday, October 8, which included Boeing briefings/working lunch, a tour of the Center's facilities, and a reconvene for questions, discussion of potential areas for collaboration and one-on-one sidebars.
- Center Ph.D. students, James Muguira and John J. Daly, each placed two additional papers at the Fall 2003 SIW.
- The Center hosted the on-line proceedings for the first workshop on Web Enabled M&S.
- The Center partnered with United States Joint Forces Command (USJFCOM) at the 2003 Interservice/Industry Training, Simulation & Education Conference (I/ITSEC) in Orlando, FL. The major demonstration drew a crowd of more than 120 spectators and showed how the capabilities of all military branches can work together in training and in national defense.
- The Center was featured in an article in *National Defense Magazine* and two articles in *The Virginian Pilot.*

Dr. R. Bowen Loftin, Executive Director

- Was quoted in an article in the *Philadelphia Inquirer* about the work of Analytical Graphics, a software firm located in Malvern, PA. He commented on the usefulness of computer animations replicating flight information.
- Was interviewed by Radio National in Australia on the challenges and successes of modeling human behavior.
- Continued to serve as Chair of the IEEE Computer Society Technical Committee on Visualization and Graphics, the National Center for Simulation Board of Directors, and the National Training Systems Association Executive Committee

Dr. Mikel Petty, Chief Scientist

- Led development of new formal theory of simulation composability.
- Led development of new crowd simulation capability.
- Had his paper ranked 1st on conference "Recommended Reading List" (i.e., Best Paper) at the Spring 2003 Simulation Interoperability Workshop.
- Was appointed Area Editor of the journal SIMULATION: Transactions of the Society for Modeling and Simulation International.
- Was appointed Associate Editor of the journal Journal of Defense Modeling and Simulation.

Dr. Ryland C. Gaskins III, Senior Research Scientist

- Was quoted in an article in the *Philadelphia Inquirer* about the work of Analytical Graphics, a software firm located in Malvern, PA. He commented on the usefulness of computer animations replicating flight information.
- Chaired a session on Human Effects and Crowd Behavior at the Non-Lethal Technology and Academic Research Symposium, November 2003.
- Chaired a session on Human Effects and Crowd Behavior at the Non-Lethal Technology and Academic Research Symposium, November 2003.

- Presented Technical Progress report of Crowd Modeling Techniques and participated in a Crowd Modeling Workshop to identify essential variables to be included in modeling crowd behavior. San Antonio, TX, November 2003.

Dr. John Sokolowski, Senior Research Scientist

- John A. Sokolowski successfully defended his Ph.D. dissertation, "Modeling the Decision Process of the Joint Task Force Commander." The successful defense allowed for his May graduation as the world's first Ph.D. in modeling and simulation.
- Was featured in an *Inside Business* article detailing his accomplishment in earning the world's first Ph.D. in modeling and simulation, and discussing his research at VMASC.

Dr. Andreas Tolk, Senior Research Scientist

- An extract from his award-winning paper, "Avoiding Another Green Elephant," was featured in an article in *Simulation Technology Magazine*.
- Collaborated with LTC Dietmar Kunde (MOVES/NPS) to write "Decision Support Systems in the Military Environment," the sixth chapter of *Innovations in Support Systems*.
- His proposal, "JSB Composability and Web Services Interoperability via Extensible Modeling and Simulation Framework (XMSF), Model Driven Architecture (MDA), Component Repositories, and Web-based Visualization," co-authored with Dr. Don Brutzman, was selected for funding to support The United States Air Force Joint Synthetic Battlespace (JSB-AF).
- Represented the Center as a partner within the Extensible M&S Framework (XMSF) core group comprising of NPS, GMU, ODU, and SAIC
- Was elected to serve on the Executive Committee (EXCOM) of the Simulation Interoperability Standards Organization (SISO) through 2006
- Was re-elected to serve on the C4I Planning & Review Panel (C^4I PRP) of the Simulation Interoperability Workshop (SIW)
- Was elected chair of the SISO Study Group on the C^4ISR/Simulation Technical Reference Model
- Was elected vice-chair of the SISO Study Group on Extensible M&S Framework (XMSF) Profiles
- Served as Invited Speaker and Technical Evaluator for the NATO M&S Group during the Conference on C^3I and M&S Interoperability held in Antalya, Turkey, 9-10 October 2003
- Served as a Founding Member on the Conference Committee of the First Annual Workshop on Web-enabled Modeling and Simulation (WebSim), held in Reston, VA, 27-30 October 2003, during which he chaired the Policy Track
- Was invited to participate in the SCS Subject Matter Expert Panel Discussion on Priorities for M&S Standards, conducted as a special event during I/ITSEC in Orlando, Florida, 4 December 2003
- Received three awards from SISO for his publications "A Common Framework for Military M&S and C^4I Systems," "The Levels of Conceptual Interoperability Model (LCIM)" – co-authored with James Muguira, and "Modeling and Simulation Integration with Network-

Centric Command and Control Architectures" – co-authored with John J. Daly. This leads to 10 consecutive awards, including 5 best paper awards.

Visualization in Modeling and Simulation

Below are brief descriptions of Modeling and Simulation Projects that include significant visualization components:

- Crowd Modeling: Created a Mogadishu/Somalia database and the virtual characters as well as their real-time animation loops for integration with the crowd federate component to JSAF.
- Prostate Cancer: Developed methods and techniques for the rapid generation of 3D models of patient-specific prostates for use in the estimation of tissue removal as a means to measure the success/effectiveness of a prostate operation.
- Venturi Lab: Developing a 3D model of VRML of an interactive science laboratory to be accessed online.
- Soldier-CATT: Completed an evaluation of technology to be included in the Army's virtual warrior initiative.
- Modeling a Cryogenics Plant: Developing 3D animations of a cryogenics system's components to illustrate how such devices work.
- National Center for Collaboration in Medical Modeling and Simulation: The objective is to develop and integrate modeling and simulation technology into medical education, patient care and research, with the goal of transforming the way in which medical personnel are educated and trained and leveraging the investment made to develop these technologies by training more personnel, in less time, with more effective results; to develop modeling and simulation solutions to the planning, training, and execution of medical responses to events that produce mass casualties.
- Ms. Jen Seevinck presented Sticky Traffic, a site specific and responsive computer-generated video installation that responds to movement in the environment to visualize dynamic space and create narrative, at the Graphite 2003 conference, a Siggraph-sponsored conference on computer graphics and interactive techniques in the Australasia and South East Asia region.

2003 Selected Publications and Presentations

Belfore II, L. A. "Simulation in Environmental and Ecological Systems," Chapter 13 (pp. 295-314) in Applied System Simulation: Methodologies and Applications, (edited by Mohammad S. Obaidat and Georgios I. Papadimitriou), Kluwer Academic Publishers, Boston. 2003.

Belfore II, L. A., R. R. Mielke, and K. C. Kunam. "A Framework for Creating VRML Visualizations from Discrete Event Simulations. Proceedings of the 2003 International Symposium on Collaborative Technologies and Systems (CTS'03), Orlando, Florida. January 19-24, 2003.

Boone, C. M., J. P. Bliss, E. N. Headen, D. R. Lampton, B. Clark, and G. Martin. Usability of after action review displays. Proceedings of the Huntsville Simulation Conference. Huntsville, AL. 2003.

Brutzman, D., K. Morse, J. M. Pullen, and A. Tolk. "Extensible Modeling and Simulation Framework." Presentation during the MOVES Open House, Naval Postgraduate School, Monterey, CA. August 5, 2003.

Brutzman D. and A. Tolk. "JSB Composability and Web Services Interoperability via Extensible Modeling & Simulation Framework (XMSF), Model Driven Architecture (MDA), Component Repositories, and Web-based Visualization." Study prepared for Joint Synthetic Battlespace (JSB) Analysis of Technical Approaches (ATA) Studies & Prototyping, U.S. Air Force. November 2003.

Carr, F. J. Caylor, J. Lacetera, and A. Tolk. "C4ISR/Sim Technical Reference Model – Sourcebook." Fall Simulation Interoperability Workshop 2003, Paper 03F-SIW-124, Orlando, Florida. September 2003.

Catanzaro, J. M., M. W. Scerbo, F. D. McKenzie, M.A. Phillips, N.R. Bailey, and R.B. Loftin. A Virtual Environment for Training Military Checkpoint Guards. In *Proceedings of the Human Factors and Ergonomics Society 47th Annual Meeting*, Denver, CO. October 13-17, 2003. pp. 2074-2078.

Clark, B. R., D. R. Lampton, G. A. Martin, and J. P. Bliss (in preparation). User Manual for the Dismounted Infantry Virtual After Action Review System. (Research Product). Alexandria, VA: US Army Research Institute for the Behavioral and Social Sciences.

Daly, J. J. and A. Tolk. "Modeling and Simulation Integration with Network-Centric Command and Control Architectures." Fall Simulation Interoperability Workshop 2003, Paper 03F-SIW-121, Orlando, Florida. September 2003.

Dryer, D. A., Jacobs, D. A., Swart, W. (2003). The model for e-engineering team adaptation (MeTA): A project framework to improve the agility and performance of global engineering teams. Special Issue on eTransition, International Journal of Computer Integrated Manufacturing, 16 (4/5), 334-345.

Loftin, R. B. "From Outer Space to Inner Space-the Application of Virtual Environments for Training and Education." Keynote Address, Medical Symposium, SimTecT 2003 Conference, Adelaide, South Australia. May 26, 2003.

Loftin, R. B. "Grand Challenges in Medical Modeling and Simulation," 2003 Virtual Worlds and Simulation Conference, Orlando, FL, January 20, 2003.

Loftin, R. B. "Grand Challenges in Modeling and Simulation." Keynote Address, Tidewater Chapter of Sigma Xi Annual Banquet, Christopher Newport University. April 18, 2003.

Loftin, R. B. "Grand Challenges in Modeling and Simulation." Keynote Address, SimTecT 2003 Conference, Adelaide, South Australia. May 27, 2003.

Loftin, R. B. Multisensory Perception: Beyond the Visual in Visualization. *Computers in Science and Engineering 5*(4). July/August, 2003. pp. 565-568.

Loftin, R. B. “Overview of Research Activities.” Institute for Creative Technologies Defense Modeling and Simulation Office Workshop on DoD and Entertainment Collaborations, Marina del Rey, CA. April 15, 2003.

Loftin, R. B. “Overview of Research Activities in Human Performance Modeling.” Annual Meeting of The Technical Cooperation Program HUM-TP-2, Royal Tunbridge Wells, United Kingdom. April 24, 2003.

Loftin, R. B. “Overview of VMASC Research and Development.” Old Dominion University Computer Science Colloquium. February 28, 2003.

Loftin, R. B. “VMASC Programs in Modeling & Simulation and Homeland Security.” 71st Annual Symposium of the Military Operations Research Society, Quantico, VA. June 10, 2003.

Loftin, R. B. “VMASC—Lessons Learned in Developing the Center.” Keynote Address, Alabama Modeling & Simulation Council, Huntsville, AL. October 29, 2003.

Loftin, R. B., M. W. Scerbo, F. D. McKenzie, J. M. Catanzaro, N. R. Bailey, M. A. Phillips, and G. Perry. Training in Peacekeeping Operations Using Virtual Environments. In *Proceedings of the North Atlantic Treaty Organization Research and Technology Agency Human Factors and Medicine Panel Symposium on Advanced Technologies for Military Training*, Genoa, Italy. October 15-17, 2003.

McKenzie, F. D., M. D. Petty, and J. Catanzaro. "An Experimental Application of a Trait-Based Personality Model to the Simulation of Military Decision-Making." *Information & Security.* Accepted 2003.

McKenzie, F. D., M. Scerbo, J. Catanzaro. "Generating Nonverbal Indicators of Deception in Virtual Reality Training." Journal of WSCG. Vol. 11, No. 2. February 2003. ISSN 1213-6972. pp. 314-321.

McKenzie, F. D., M. W. Scerbo, J. Catanzaro, and M. A. Phillips. Nonverbal indicators of malicious intent: Affective components for interrogative virtual reality training. *International Journal of Human-Computer Studies, 59.* 2003, pp. 237-244.

McKenzie, F. D., R. Hussein, J. Seevinck, P. Schellhammer, and J. Diaz. "Prostate Gland and Extra-Capsular Tissue 3D Reconstruction and Measurement." In Proceedings of the Third IEEE Symposium on BioInformatics and BioEngineering (IEEE BIBE 2003). Washington, DC. March 10-12, 2003.

McKenzie, F. D., R. Hussein, P. Schellhammer, and J. Diaz. "Quantifying Prostate Surgery Success through 3D Reconstruction and Measurement." The 11th Annual Medicine Meets Virtual Reality (MMVR) Conference. Poster presentation. Newport Beach, California. January 22-25, 2003.

McKenzie, F. D., J. Diaz, P. Schellhammer, and R. Hussein. "Towards Statistical Inferences of Successful Prostate Surgery." In Proceedings of the 25th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (IEEE EMBS 2003). Cancun, Mexico. September 17-21, 2003.

Mielke, R. R. and M. A. Phillips. “Development and Application of an Academic Battle Lab.” Proceedings of the 2003 Interservice/Industry Training, Simulation and Education Conference, Orlando, FL. December 1-4, 2003.

Morse, K. L. and M. D. Petty, "High Level Architecture Data Distribution Management Migration from DoD 1.3 to IEEE 1516." *Concurrency and Computation: Practice and Experience.* Accepted 2003.

Petty, M. D. "Benefits and Consequences of Automated Learning in Computer Generated Forces Systems." *Information & Security*. Accepted 2003.

Petty, M. D. and E. W. Weisel. "A Composability Lexicon." *Proceedings of the Spring 2003 Simulation Interoperability Workshop*, Orlando FL. March 30-April 4 2003. pp. 181-187. (Ranked 1st on conference "Recommended Reading List", out of 110 papers.)

Petty, M. D. and K. L. Morse, "The Computational Complexity of the High Level Architecture Data Distribution Management Matching and Connecting Processes." *Simulation Modelling Practice and Theory.* Accepted 2003.

Petty, M. D., E. W. Weisel, and R. R. Mielke. "Computational Complexity of Selecting Models for Composition." *Proceedings of the Fall 2003 Simulation Interoperability Workshop*, Orlando FL. September 14-19 2003. pp. 517-525.

Petty, M. D., E. W. Weisel, and R. R. Mielke. "A Formal Approach to Composability." *Proceedings of the 2003 Interservice/Industry Training, Simulation and Education Conference*, Orlando, FL. December 1-4 2003. pp. 1763-1772.

Petty M. D. and E. W. Weisel. "A Formal Basis for a Theory of Semantic Composability." *Proceedings of the Spring 2003 Simulation Interoperability Workshop*, Orlando FL. March 30-April 4 2003. pp. 416-423.

Petty, M. D., F. D. McKenzie, and R. C. Gaskins. Requirements Analysis, Psychological Models, and Design Issues in Crowd Modeling for Military Simulation. *Proceedings of the Huntsville Simulation Conference 2003*, Huntsville, AL. October 29-31 2003.

Scerbo, M. W., J. P. Bliss, E. A. Schmidt, S. A. Thompson, T. D. Cox, and H. J. Poland. A comparison of the CathSim™ system and simulated limbs for teaching intravenous cannulation. Proceedings of the Medicine Meets Virtual Reality Conference. 2004.

Sokolowski, J. A. “A Comparison of Military Synthetic Environments and Virtual Battlespaces”, Interservice/Industry Training, Simulation and Education Conference, Orlando, FL. December 2003.

Sokolowski, J. A. Enhanced Decision Modeling Using Multiagent System Simulation. *SIMULATION: Transactions of The Society for Modeling and Simulation International*. Vol. 79, No. 4. April 2003. pp. 232-242.

Sokolowski, J. A. Enhanced Military Decision Modeling Using a Multiagent System Approach. In *Proceedings of the 12th Conference on Behavior Representation in Modeling and Simulation (BRIMS).* Scottsdale, AZ. May 12-15, 2003. pp. 179-188.

Sokolowski, J. A. "Introduction to Continuous and Real Time Simulation", MSIM 601 Lecture, Old Dominion University. September 2003.

Sokolowski, J. A. Modeling the Decision Process of a Joint Task Force Commander. Ph.D. Dissertation, Old Dominion University, Norfolk, VA. May 2003.

Sokolowski, J. A. "Modeling the Decision Process of a Joint Task Force Commander", Medin Lecture Series, Institute for Simulation Technology/University of Central Florida. July 2003.

Sokolowski, J. A. Representing Knowledge and Experience In RPDAgent. In *Proceedings of the 12th Conference on Behavior Representation in Modeling and Simulation (BRIMS).* Scottsdale, AZ. May 12-15, 2003. pp. 419-422.

Sokolowski, J. A. "Simulation for Training and Experimentation", MSIM 601 Lecture, Old Dominion University. November 2003.

Tolk, A., Michael R. Hieb: "Building and Integrating M&S Components into C4ISR Systems for Supporting Future Military Operations," 2003 Western Multi Conference (WMC'03), International Conference on Virtual Worlds and Simulation (VWSIM'03), Orlando, Florida, January 2003.

Tolk, A. "Beyond Technical Interoperability – Introducing a Reference Model for Measures of Merit for Coalition Interoperability." 2003 Command and Control Research and Technology Symposium, Washington, D.C. June 2003.

Tolk, A. "A Common Framework for Military M&S and C4I Systems." Spring Simulation Interoperability Workshop 2003, Paper 03S-SIW-031, Vol. I. pp. 246-257. Orlando, FL. April 2003.

Tolk, A. "Improving Military Information Technology Through Common Conceptual Models." Presentation during NDIA/AFEI Enterprise Integration EXPO 2003, Vienna, Virginia. September 23, 2003.

Tolk, A. "Overview of recent Findings of the Study Groups of the Simulation Interoperability Workshop dealing with C3I and M&S Interoperability." Proceedings of the *Conference on C3I and M&S Interoperability* held in Antalya, Turkey. 9-10 October 2003. NATO Publication RTO-MP-123, Paper Nr. 1, Neuilly sur Seine, France. 2003.

Tolk, A. "Technical Evaluation Report – MSG-022/SY-003/25 Conference on C3I and M&S Interoperability." Proceedings of the *Conference on C3I and M&S Interoperability* held in Antalya, Turkey, 9-10 October 2003. NATO Publication RTO-MP-123, Neuilly sur Seine, France, 2003.

Tolk A., D. Kunde. "Decision Support Systems in the Military Environment." Chapter 6 in Tonfoni G. and Jain L. (Eds.): "Innovations in Decision Support Systems," pp. 175-210,

International Series on Advanced Intelligence, Advanced Knowledge International, ISBN 0-86803-980-2, Magill, Adelaide, Australia. 2003.

Tolk A., J. M. Pullen: “Ideas for a Common Framework for Military M&S and C3I Systems,” European Simulation Interoperability Workshop 2003, Paper 03E-SIW-032, Stockholm, Sweden, June 2003.

Tolk, A. and J. A. Muguira: “The Levels of Conceptual Interoperability Model (LCIM).” Fall Simulation Interoperability Workshop 2003, Paper 03F-SIW-007, Orlando, Florida. September 2003.

Tolk A. and S. Solick. “Using the C4ISR Architecture Framework as a Tool to Facilitate V&V for Simulation Systems within the Military Application Domain,” Spring Simulation Interoperability Workshop 2003, Paper 03S-SIW-029, Vol. I, pp. 225-234, Orlando, FL. April 2003.

Weisel, E. W., R. R. Mielke, and M. D. Petty. "Validity of Models and Classes of Models in Semantic Composability." *Proceedings of the Fall 2003 Simulation Interoperability Workshop*, Orlando FL. September 14-19 2003. pp. 526-536.