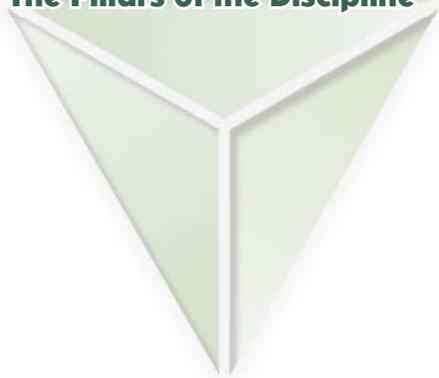


2004 Annual Report

Virginia Modeling, Analysis and Simulation Center

The Discipline of M&S

The Pillars of the Discipline



The “Discipline of M&S” is defined and supported by four components, or “pillars.” By defining ourselves in terms of these four pillars, VMASC can be viewed from the perspective of its core components. The following four pillars define and support “The Discipline of M&S:”

Resources

Resources comprise personnel and infrastructure including hardware, software, laboratories, buildings, and other physical equipment and materials. Our resources enable modeling and simulation and visualization research and development, and M&S graduate education, to be conducted in a richly interactive environment where new ideas can be formed and explored.

Modeling and Simulation Education

Through M&S graduate education, VMASC extends the frontiers of modeling, simulation and visualization knowledge, and provides educated M&S professionals to academia, industry and government.

Research and Development

Research and development extends the boundaries of our theoretical and practical application of modeling, simulation and visualization to solve real-time problems and issues. Current technologies are improved and new technologies created that are then integrated into customized solutions for our industry and government clients.

Collaborative Partnering

Partnering with academia, industry, and government to pursue research and development initiatives, and to solve decision-making problems, allows us to exchange new ideas in an open-forum, leading to better solutions; thereby extending and improving our understanding of and appreciation for potential M&S applications.

From the Executive Director

2004 marked VMASC's seventh year of operation. VMASC received over \$10 million in new awards, making 2004 its most successful year ever. My thanks go to the entire VMASC team—scientists, engineers, staff, students, and faculty—who contributed to this extraordinary level of external support.

Among the significant events of 2004 was the grand opening of the VMASC Battle Laboratory and Decision Support Center by Virginia Governor Mark Warner and Old Dominion University President Roseann Runte. This opening was made possible through the generous support of both the Commonwealth of Virginia and Old Dominion University, together with hundreds of hours of work on the part of the VMASC team. I especially commend the vision and leadership of Mark Phillips, Battle Lab Director, and Roland Mielke, VMASC Technical Director. During 2004, the Battle Lab broadened its support for the U.S. Joint Forces Commands Joint National Training Capability and its Joint Advanced Training Technologies Laboratory.



The intellectual capital of VMASC is its people. In 2004 we were fortunate to attract three new Senior Research Scientists: Dr. Wes Colley, Dr. Jessica Crouch, and Dr. Yuzhong Shen. Wes has a Ph.D. from Princeton and conducted research at both MIT's Lincoln Laboratory and the University of Virginia. Jessica's Ph.D. is from the University of North Carolina, and she completed a postdoctoral research appointment at Johns Hopkins prior to joining VMASC. Yuzhong completed his Ph.D. at the University of Delaware and came directly to VMASC upon completion of his graduate degree.

During 2004 we made significant progress in our joint research programs in medical modeling and simulation with Eastern Virginia Medical School through the National Center for Collaboration in Medical Modeling and Simulation. We were also successful in assembling a team of faculty, students, and staff to tackle a true grand challenge—modeling the social, political, and economic relationships that connect the members of an organization. Such organizational modeling demands a truly interdisciplinary team and has positioned VMASC at the forefront a new and exciting research endeavor.

Finally, in 2004, VMASC catalyzed a comprehensive analysis of the economic impact of Modeling, Simulation and Visualization in Hampton Roads, Virginia. Study results confirmed that the growth of MS&V activity in the region is rapidly accelerating.

As VMASC continues to attract the world's best talent in M&S and, through Old Dominion University's Graduate Programs in M&S, trains the next generation of M&S researchers and leaders, the Center's recognition as **the** leading M&S research and development organization is now secure. Join us in 2005 as the adventure continues.

R. Bowen Loftin
Executive Director

Inside the Report

Pillars and the Discipline.....	1	Joint Virtual Training Special Event	12
2004 Highlights.....	3	Medical Modeling and Simulation.....	12
Infrastructure		New researchers.....	13
Infrastructure Overview	6	Outreach	
Battle Laboratory Update.....	6	Membership Overview	14
Modeling and Simulation Education		2004 Industry Partners	14
Graduate Programs Overview.....	7	Economic Impact Study.....	15
2004 I/ITSEC Scholarship.....	7	Homeland Security.....	17
Army War College Fellow.....	8	Advisory Board	17
NATO/ODU Internship Program	8	Battle Lab Ribbon Cutting.....	18
Research & Development		Reference	
Research & Development Overview	9	Research & Development Projects	19
Research Team	9	Publications & Presentations.....	23
The Cutting Edge: Composability.....	11	Contact Information.....	26

VMASC At a Glance

The Virginia Modeling, Analysis and Simulation Center is a collaborative center of Old Dominion University's Frank Batten 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 academia, industry and government



Vision

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

Mission

- ▼ Engage in collaborative research and development in MS&V.
- ▼ Provide academia, industry and government 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.

Goals

- ▼ Be a premier MS&V research & development center.
- ▼ Be a respected independent provider of analysis and technical services.
- ▼ Be a leader in MS&V education.
- ▼ Be a stimulus for economic development within the Commonwealth of Virginia.

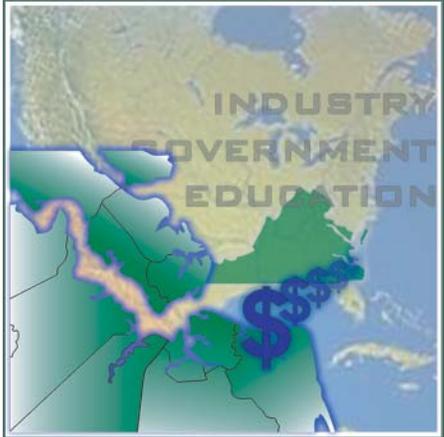
2004 VMASC Highlights

February

- ▼ VMASC was awarded a \$10 Million, 5-year contract to provide Battle Lab Modeling and Simulation (M&S) support to U.S. Joint Forces Command (USJFCOM).
- ▼ Under the sponsorship of the Hampton Roads Planning District Commission, VMASC and its members initiated a modeling, simulation and visualization Economic Impact and Cluster Analysis Study for the Hampton Roads Virginia region.

March

- ▼ The first test of VMASC's fiber-optic grid, scheduled for summer 2004, was announced in the Virginian Pilot newspaper. When activated, this grid will serve as Hampton Roads' gateway to the National LambdaRail.
- ▼ VMASC was awarded a \$22 Million 5 year contract to support USJFCOM with command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) program expertise.



April

- ▼ Four VMASC research papers were nominated for the Recommended Reading List (Best Paper List) for the upcoming Spring 2004 Simulation Interoperability Workshop (SIW).
- ▼ The Cryogenics Training Visualization was submitted by Jennifer Seevinck, VMASC Research Scientist, and selected for the Media Art Project's (MAP) Visualizing Science on-line exhibition.
- ▼ Eric W. Weisel successfully defended his M&S Ph.D. dissertation, "Models, Composability, and Validity" and received the second Old Dominion University M&S Ph.D.
- ▼ Mimi Nguyen, an M&S Ph.D. Candidate, was selected to receive a \$10,000 scholarship from the Fifteenth Annual Interservice/Industry Training, Simulation and Education Conference (I/ITSEC).
- ▼ Mr. Robert Harper, Northrop-Grumman Mission Systems, and Mr. Buck Marr, Lockheed-Martin Global Vision Integration Center, were elected Advisory Board Chair and Vice Chair respectively. Both will serve two-year terms.

May

- ▼ A ribbon cutting ceremony was held for our Battle Laboratory. Governor Mark R. Warner joined Suffolk Mayor E. Dana Dickens and officials from Old Dominion University, including President Roseann Runte, and USJFCOM to officially open the state-of-the-art facility.



- ▼ Dr. Roberto Revetria, professor at the University of Genoa, Italy, and Associate Director of the McLeod Institute of Simulation Science (MISS), Genoa Center, visited VMASC May 3-10, 2004. During his visit he presented the work of the MISS and identified common interests and potential collaboration efforts.
- ▼ For the 4th consecutive year, the best paper, and three others on the recommended reading list, were written by VMASC researchers at the Spring 2004 Simulation Interoperability Workshop (SIW So4). Of the more than 130 international papers, the conference committee selected 11 to be awarded the designation of "outstanding paper" (also known as SIWzie).

June

- ▼ "Using Web Services to Integrate Heterogeneous Simulations in a Grid Environment", co-authored by Dr. Andreas Tolk, was accepted for the 4th International Conference on Computational Science - ICCS 2004.
- ▼ VMASC received a second contract award from the Defense Modeling and Simulation Office, to continue its composability theory research.

July

- ▼ Dr. Andreas Tolk contributed two papers and conducted a tutorial on "Web-enabled Modeling & Simulation and the Global Information Grid," at the 2004 EuroSIW in Edinburgh, Scotland.
- ▼ Three papers written by VMASC and BCET researchers were published in the international refereed journal Information & Security, as part of a special issue focused on the topic of "Advances in Modeling and Simulation".
- ▼ Two new M&S graduate program courses debuted during the Fall 2004 semester: MSIM 795/895 - Enterprise System Dynamics, taught by Dr. Dave Dryer, and MSIM620 Introduction to Combat Modeling, taught by Dr. Andreas Tolk.
- ▼ The Base Object Models (BOMs) expert group met at VMASC for a day-long working meeting to continue the standardization process supported by the Simulation Interoperability Standardization Organization (SISO) and the Defense Modeling & Simulation Office (DMSO).

July (continued)

- ▼ Three Papers with VMASC contributions were accepted for the NATO M&S Conference, “Modelling and Simulation to Address NATO’S New and Existing Military Requirements.”
- ▼ VMASC received a third award from the Defense Modeling and Simulation Office to continue its crowd modeling research.

August

- ▼ VMASC received the European Simulation Interoperability Workshop for the paper “Moving towards a Lingua Franca for M&S and C3I - Developments concerning the C2IEDM,” prepared by Dr. Andreas Tolk. Dr. Tolk’s paper was among the nine papers selected to receive the “SIWzie Award” from this conference.
- ▼ A collaborative VMASC and Eastern Virginia Medical School project, developed for The National Center for Medical Modeling and Simulation, was featured on WAVY TV 10’s 6 p.m. news broadcast.

September

- ▼ “Applicability of Open Standards,” an article by Dr. Andreas Tolk, was featured in Simulation Technology Online, a prominent journal in the field of Modeling and Simulation.
- ▼ VMASC hosted the “NATO Modelling & Simulation Group NMSG-027” meeting. Eighteen Experts from Canada, the Czech Republic, France, Germany, Spain, Sweden, and the United States discussed how to achieve the NATO M&S Master Plan objective to design an HLA federation, known as NATO PATHFINDER, with models and tools from participating NATO and Partnership-for-Peace (PfP) nations.

October

- ▼ VMASC was awarded a share of a \$2 million emergency response grant by the Hampton Roads Planning District. VMASC will use the award to develop a simulation system that realistically portrays the effects of a regional casualty event.
- ▼ Lockheed Martin’s new Global Vision Integration Center awarded VMASC a small contract to perform an independent assessment of their multi-resolution simulation system linking an aggregate-level simulation (JWARS) to an entity-level simulation (JSAF).
- ▼ VMASC was awarded a grant by the Department of Homeland Security for “Mass Casualty Model to Support MMRS Training and Analysis Requirements.”
- ▼ For the fifth time in a row, VMASC scored the Number 1 paper at the Simulation Interoperability Standards Organization (SISO) workshop. Since Fall 2002, a VMASC paper has been at the top of every US SIW Recommended Reading List.

December

- ▼ VMASC contributed a chapter to the the book ,“Decision Support in Agent Mediated Environments.” The VMASC chapter was directed to military applications, proving there is international recognition of VMASC’s expertise in this domain.
- ▼ The final report was published detailing the outcomes of the year-long modeling, simulation and visualization economic and cluster analysis study for the Hampton Roads Virginia region. A key outcome was the determination that modeling, simulation and visualization activities contributed \$413 Million in total regional economic output and accounted for more than 4,000 regional jobs in 2004.
- ▼ The results of the recently completed economic impact and cluster analysis study were reported in the Virginian Pilot and Daily Press newspapers, and were prominently reported at the I/ITSEC 2004 Conference in Orlando, Florida.

Infrastructure Update

The hardware and software infrastructure available to support VMASC faculty and researchers was enhanced significantly this year with the opening of the Engineering and Computational Sciences Building (ECSB) on the Norfolk Campus of Old Dominion University. VMASC occupies approximately 6,500 square feet in ECSB devoted to laboratories, faculty and staff offices, and support facilities.



The centerpiece of VMASC's ECSB facility is the Immersive Virtual Environments Laboratory. The lab is designed to create a multi-modal, interactive computer-generated environment using several large-scale visual display systems augmented by spatial audio systems and tracking systems. The laboratory includes a four-walled CAVE facility, a four-meter projection dome with magnetic tracking, and a 20' x 9' two-channel projection wall with spatial audio system housed in a 74-seat tiered theater environment.

Additional laboratories in ECSB include the Visualization Development Lab, the Modeling and Simulation Lab, and the Human Factors Engineering Lab. The Visualization Development Lab supports development of real-time, interactive computer graphics, data visualization, and prototype virtual environments. The Human Factors Lab is an extension of the Human Factors Engineering Lab located in VMASC's Suffolk facility and is designed to conduct usability testing and cognitive task analysis. Finally, the Modeling and Simulation Lab, an extension of the Constructive Modeling Lab located in the Suffolk facility, provides a modeling and simulation development environment in support of computer visualization research.

During the coming year, Old Dominion University will lead a consortium of higher education and research institutions to establish advanced, very high bandwidth, optical networking capabilities in Hampton Roads. Using a DWDM network architecture, this system will provide connectivity between VMASC's Suffolk and Norfolk facilities, between VMASC and the US Joint Forces Command's Joint Training, Analysis and Simulation Center (JTASC), and soon will provide a gateway to the National LambdaRail (NLR).

Battle Laboratory Update

2004 was a watershed year for the Battle Lab. New hardware, software and personnel were added that significantly enhanced the laboratory's technical capability. The Battle Lab received a Defense University Research Infrastructure Program (DURIP) grant from the Office of Naval Research that enabled the acquisition of a four meter and a three meter Vision Dome, as well as a Vision Station. Data storage capability was enhanced by addition of 12TB of hard drive capacity, the introduction of advanced data management software, and an optical-based network infrastructure. A reconfigurable command and control center was added to the Human Factors Engineering Lab to support C2 and HLS projects. These additions provide the Battle lab with several new technical dimensions that will increase the lab's ability to be responsive to our many customers.



Concurrently, new personnel were added, starting with Charles (Chuck) Turnitsa, Battle Lab Technical Manager, and followed by Will Richards and Joe Bricio, who collectively provide the Battle Lab with full time programming, geo-spatial and visual modeling support essential to many of the research tasks undertaken in the facility. Also joining the Battle Lab were Dr. Nathan Bailey and Mike Mihalecz (M&S PhD Candidate), both human factors psychologists. Both Nathan and Mike have rapidly become essential participants in many of our projects as the demand for human behavior modeling continues to grow. Additional hires, including a software engineer and a systems engineer, are planned for calendar year 2005.

2004 highlights included the Battle Laboratory's official opening, lead by Virginia's Governor Mark R. Warner, a high visibility technology demonstration, as the lead-in to Mr. Tom Browkaw's presentation at the Commonwealth of Virginia Information Technology Symposium (COVITS), and functioning as the lead integrator for an ambitious demonstration that linked 35 different Department of Defense simulations and systems in partnership with the new U.S. Joint Forces Command's Joint Advanced Training Technology Laboratory (JATTL).

We begin calendar year 2005 much stronger than we began calendar year 2004. During 2005, we expect to help Old Dominion establish a regional high-bandwidth optical network that will serve to connect VMASC to USJFCOM and to other regional M&S partners, as well as the National Lambda Rail (NLR). We look forward to these new challenges and to an exciting and rewarding year.

Graduate Programs Update

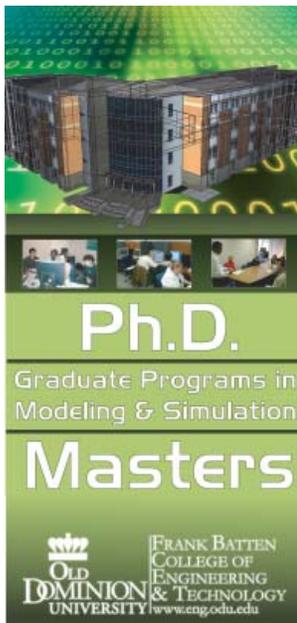
During 2004 Old Dominion University's Graduate Programs in Modeling and Simulation continued to mature and experience extraordinary growth. In May, 2004, the programs' second Ph.D., Dr. Eric Weisel, graduated. Dr. Weisel's dissertation research on model composability was supervised by VMASC's Chief Scientist, Dr. Mikel Petty. In addition to the programs' second Ph.D., six Master of Engineering in Modeling and Simulation were awarded in 2004, bringing the total number of masters degrees awarded to 36 since the programs' inception in 1998.



Eric Weisel, Ph.D. and Mikel Petty, Ph.D.

The demand for the masters and Ph.D. programs continues to grow. At the end of 2004, 55 masters and 42 doctoral students were enrolled.

In 2004, the masters program also began its first course offerings outside of Virginia through the Southern Maryland Higher Education Center. Programs at that site primarily serve students employed at the Naval Air Systems Command, Patuxent River. Due to strong student interest, doctoral courses were offered via distance learning for the first time in 2004. At the end of 2004, three doctoral students—two from the Naval Surface Warfare Center, Dahlgren Division and one from the Naval Air Weapons Station at Point Mugu, California—were taking core courses using Old Dominion University's TELETECHNET system.



Selected Current Ph.D. Projects

- ▼ Is twisting the view better? - Investigate methods for manipulating viewpoints in immersive battlefield visualization environments. (Robert King)
- ▼ A methodology for multi-model interoperation - Application of engineering methods to facilitate composability and reuse. (Jay Muguira)

Selected Current Masters Projects

- ▼ A conceptual framework for a computational team decision-making model. (Thomas Verna)
- ▼ Application and evaluation of a methodology for evaluating operational training simulations. (Karl Neal)
- ▼ Fine-tuning of mass-spring model properties for simulating realistic soft body deformation. (Sylva Girtelschmid)

2004 I/ITSEC Scholarship



Mimi Nguyen

Ms. Quynh-Anh (Mimi) Nguyen, a Ph.D. Modeling & Simulation student, was awarded one of two recipients of the \$10,000 Interservice/ Industry Training, Simulation and Education Conference (I/ITSEC) 2004 Scholarship. The I/ITSEC scholarships are offered to "stimulate student interest and university participation in preparing individuals for leadership in the Simulation, Training and Education community." Ms. Nguyen was selected based on her history of exemplary scholastic achievements in her M&S studies. She received her Master of Engineering degree in Modeling & Simulation from ODU, in May 2003, with a 3.96/4.0 GPA. She is currently a modeling and simulation PhD candidate with a 3.96 GPA. Ms. Nguyen has supported a variety of VMASC research projects while pursuing her degrees, most notably the crowd modeling project, which is directly related to her research interests in crowd modeling, behavior and cognitive models.



Army War College Fellow

Each year the Army War College, based at Carlisle Barracks, Pennsylvania, sponsors Senior Army Fellows at several universities. These include Harvard, Stanford, Tufts, University of Texas, Carnegie Mellon, Old Dominion, and other well-respected institutions. The War College Fellowships represent the most senior and formal form of Army education. All fellows are required to hold a master's degree and the selection process for the fellowship program is rigorous. Lieutenant Colonel Mike LoQuasto is the 2004/05 Old Dominion University Army War College Fellow.

Lieutenant Colonel LoQuasto holds a master's degree in interdisciplinary studies with a focus in systems design and analysis. A twenty-five year veteran assigned to the Army National Guard, he is branched in Armor and is a simulations training officer as well as a training developer. He has held positions of ever-increasing responsibility such as the Institutional Training Branch Chief, Army National Guard at the National Guard Bureau. Prior to being selected for Old Dominion University's fellowship, his duty assignment was Senior Army National Guard Advisor to the U.S.

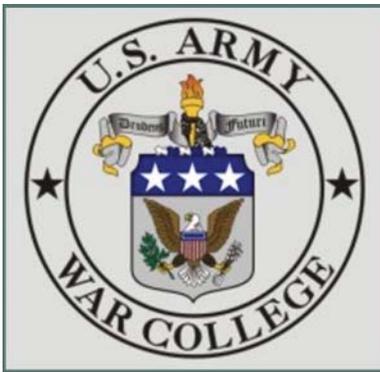


Lt.Col. Mike LoQuasto

Army Training and Doctrine Command.

Lieutenant Colonel LoQuasto proactively worked with the Army Training and Doctrine Command ensuring that the Army National Guard's contributions and capabilities were factored into all aspects of the Army National Guard unit re-set.

This year in the ODU fellowship, Lieutenant Colonel LoQuasto is studying at VMASC's Battle Lab. He is pursuing modeling and simulation methods combined with neuro-linguistic programming methods that can be applied to military institutional and collective training. Lieutenant Colonel LoQuasto also acts as an ambassador and liaison for the Army, providing the VMASC staff with the latest Army transformation information that allows the scientists to readily identify the subject and method of research that is most relevant and beneficial to matters of U.S. national security.



NATO C3 Agency/Old Dominion University Student Internship Program

In August, Ms. Quynh-Anh (Mimi) Nguyen and Mr. Robert King, two VMASC/ODU Ph.D. M&S students traveled to The Hague, The Netherlands, to be the initial participants in an exploratory Student Internship Program between the NATO C3 Agency (NC3A) and VMASC/ODU. This initiative was spearheaded by Dr. Andreas Tolk of VMASC and Mr. Thomas Kreitmair of NC3A. The two main project objectives were:

- ▼ To begin the process of establishing a successful collaborative working relationship between VMASC/ODU and NC3A.
- ▼ To provide ODU M&S students with the opportunity to gain some valuable real-world international experience in a challenging work environment.

Ms. Nguyen and Mr. King were selected as the program's initial participants based on their exemplary scholastic achievements as graduate M&S students. During their internship, Ms. Nguyen and Mr. King worked with Mr. Thomas Kreitmair integrating the Joint Semi-Automated Forces (JSAF) simulation within one of the NC3A's existing distributed simulation frameworks, to support live NATO exercises.

Based on the success of this initial internship, two more students will be selected for a similar internship during the summer of 2005.



Research & Development Update

2004 was a breakthrough year for VMASC Research & Development. In 2004 we were able to expand the total amount of R&D performed, while increasingly emphasizing R&D focused in VMASC's emerging areas of special strength. Regarding expansion, as VMASC's total awarded project activity approached \$10 million, the R&D portion of the total increased commensurately. Regarding focus, while VMASC has met and will continue to meet the needs of our key sponsors across a wide spectrum of M&S applications, we have been increasingly able to align our discretionary research with our areas of special expertise. Those special areas of expertise include:

- ▼ simulation integration, interoperability, and composability
- ▼ human behavior modeling, human factors, and human-machine interfaces
- ▼ visualization and virtual environments
- ▼ medical modeling and simulation
- ▼ homeland security, homeland defense, and non-attrition modeling
- ▼ simulation testing



Mikel Petty
VMASC Chief Scientist

This concentration of effort serves to accentuate our technical excellence and community prominence in those areas. That excellence was reinforced by the addition of several new Ph.D.-degreed senior research scientists to the VMASC research staff, and by the ever-increasing number of scientific publications produced by VMASC researchers. VMASC's unique organizational focus on M&S education program, M&S collaborative partnering, and M&S research and development, continues to synergistically benefit all three activities.

Research Team



R. Bowen Loftin, Ph.D.
Executive Director, VMASC
Director, Simulation Graduate Programs

Primary Research Expertises
Artificial intelligence
Distributed simulation



Mikel Petty, Ph.D.
Chief Scientist

Primary Research Expertises
Composability
Simulation development



Nathan Bailey, Ph.D.
Senior Research Scientist

Primary Research Expertises
Artificial Intelligence
Distributed Simulation



Lee Belfore, Ph.D.
Assistant Professor,
Electrical & Computer Engineering

Primary Research Expertises
Adaptive automation
Control/display evaluation



James Bliss, Ph.D.
Associate Professor,
Electrical & Computer Engineering

Primary Research Expertises
Artificial intelligence
Web-based visualization



Joe Bricio
Project Scientist

Primary Research Expertises
3D avatars
Collaborative environments



Wes Colley, Ph.D.
Senior Research Scientist

Primary Research Expertises
Mathematical modeling
Discrete event simulation



Jessica Crouch, Ph.D.
Senior Research Scientist

Primary Research Expertises
Adaptive automation
Control/display evaluation



David Dryer, Ph.D.
Senior Research Scientist

Primary Research Expertises
Interoperability
Multi-resolution simulation

2004 Awards & Recognition
Served on the DoD Architecture Framework (DODAF) Executable Overlay Working Group, sponsored by Defense Modeling and Simulation Office (DMSO) and the Assistant Secretary of Defense - Network & Information Integration (ASD-NII).



Hector Garcia
Virtual Environments Technical Lead
Primary Research Expertises
Distributed simulation
Collaborative environments



Ryland C. Gaskins III, Ph.D.
Senior Research Scientist
Primary Research Expertises
Human behavior representation
Crisis action-planning
2004 Awards & Recognition
President, Tidewater Chapter of the
Human Factors and Ergonomics Society



Frederic McKenzie, Ph.D.
Assistant Professor,
Electrical & Computer Engineering
Primary Research Expertises
Computer-generated forces
Military simulation



Roland Mielke, Ph.D.
Technical Director
Primary Research Expertises
Mathematical modeling
Decision support systems



Mark Phillips, ME
Battle Lab Director
Primary Research Expertises
Computer-generated forces
3D computer animation
2004 Awards & Recognition
Member, Human Systems Integration Sub-
Committee I/ITSEC.
Member, Technical committee
– Simulation Technology and Training
Conference (SIMTECT) Australia.



Will Richards
Project Scientist
Primary Research Expertises
Computer-generated forces
Network communications development
2004 Awards and Recognition
Completed masters thesis, “Converting
Real World Map Images To Match
Fictional Vector Data Via Artificial
Intelligence and Image Processing
Techniques.”



Mike Robinson
Project Scientist
Primary Research Expertises
Computer-generated forces
Network communications development



Mark Scerbo, Ph.D.
Professor, Psychology
Primary Research Expertises
Adaptive automation
Human-computer interaction
2004 Awards and Recognition
Elected Fellow of the Human Factors and
Ergonomics Society.



Jen Seevinck
Research Scientist
Primary Research Expertises
Simulation education
Virtual reality



Yuzhong Shen, Ph.D.
Senior Research Scientist
Primary Research Expertises
Computer-generated forces
Network communications development



John Sokolowski, Ph.D.
Senior Research Scientist
Primary Research Expertises
Computer-generated forces
Enterprise simulation



Andreas Tolk, Ph.D.
Senior Research Scientist
Primary Research Expertises
High level architecture
Task analytic techniques
2004 Awards & Recognition
Executive Committee, Simulation Interop-
erability Standards Organization (SISO).
Vice-chair of the SISO Study Group on
Extensible M&S Framework Profiles and
the SISO Study Group on Coalition Battle
Management Language.
5 “swize” awards.
Presented a tutorial on “M&S in the Global
Information Grid (GIG)” during I/ITSEC
in Orlando, Florida.



Chuck Turnitsa
Battle Lab Manager
Primary Research Expertises
Artificial intelligence
Interoperability

New Senior Research Scientists



Nathan Bailey, Ph.D.

Dr. Nathan Bailey joined VMASC as a Research Scientist in July 2004. Nathan recently completed his Ph.D. in Industrial/Organizational Psychology with an emphasis in Human Factors from Old Dominion University. He also holds a B.A. and M.S. in psychology. Dr. Bailey is primarily interested in human interaction with complex systems and their impact on operator performance.

He is presently examining factors that influence monitoring performance in aviation systems including operator trust in automation and task complexity effects. In addition, he has studied the efficacy of adaptive automation for reducing workload and improving operator performance.

Dr. Bailey's second broad area of interest includes the design, implementation, and evaluation of training systems, especially in virtual environments. Specifically, beginning in 2001, he worked on a project for the Office of Naval Research to design and test the effectiveness of military checkpoint training in a virtual environment. Dr. Bailey has also conducted research on visual perception within dynamic displays and maintains an interest in other facets of human-computer interaction including software and hardware usability.



Wes Colley, Ph.D.

Dr. Wes Colley came to VMASC as a Visiting Research Scientist from the University of Virginia during the summer of 2004. Dr. Colley is now a full-time VMASC researcher. He is working on a Homeland Security project that will model the medical response to release of a bioagent in urban environments. The model will feature multi-agent architecture on a large parallel system.

Dr. Colley received his Ph.D. in astrophysical sciences from Princeton University in 1998. During his graduate work, Dr. Colley focused on gravitational lensing and cosmology. His team at Princeton settled a decades-old controversy over the Hubble constant measurement implied in a particular lens system, Q0957+561. He used Hubble Space Telescope imaging of another lens system, Cl0024, to measure the mass of a cluster of galaxies at high redshift, and exploit the lens's magnification to create an "Einstein Telescope," in which a gravitational lens (here the cluster of galaxies) is the "objective lens" and the Hubble Space Telescope is the "eyepiece."

Dr. Colley then moved to the Harvard-Smithsonian Center for Astrophysics as a post-doctoral fellow where he continued his work in gravitational lensing. Dr. Colley then joined the Space Control Group of M.I.T.'s Lincoln Laboratory as a technical research staff member. Dr. Colley returned to astrophysics as a lecturer at the University of Virginia for the last two years.



Jessica Crouch, Ph.D.

Dr. Jessica R. Crouch works in the VMASC East laboratory where she focuses on the development of physically-based models. Her research interests include soft tissue modeling, surgical simulation, 3D image analysis, and the application of fast finite element methods to simulation problems.

Dr. Crouch received her Ph.D. in computer science from the University of North Carolina at Chapel Hill in 2003. After earning the Ph.D. she completed a postdoctoral fellowship in the Computer Integrated Surgical Systems and Technology Engineering Research Center at Johns Hopkins University. She also holds master's and bachelor's degrees in computer science from UNC-Chapel Hill, and the University of Richmond, respectively.



Yuzhong Shen, Ph.D.

Dr. Yuzhong Shen received the BSEE degree from Fudan University, Shanghai, China, in 1990, the MSCE degree from Mississippi State University, Starkville, Mississippi, in 2000, and the PhD degree from the University of Delaware, Newark, Delaware, in 2004.

Dr. Shen spent 8 years from 1990 to 1998 in telecommunications industry as an engineer at Hua-Guang Technologies, Weifang, China. From 1998 to 2000, he was a research assistant at the National Science Foundation Engineering Research Center for Computational Field Simulation at Mississippi State University. His work covered areas of scientific visualization, including geological data visualization and ocean visualization, computational algorithm development, and multiresolution display. From 2000 to 2004, he was a teaching assistant and a research assistant in the Department of Electrical and Computer Engineering at the University of Delaware, where he developed nonlinear multivariate signal processing methods for various applications, such as 3D surface smoothing and color image processing. Dr. Shen joined VMASC in the summer of 2004.

Collaborative Research & Development

Joint Virtual Training Special Event (JVTSE) at I/ITSEC 2004

The VMASC Battle Laboratory was at the center of the 2004 I/ITSEC JVTSE. Under the sponsorship of the United States Joint Forces Command (USJFCOM), Joint National Training Capability (JNTC) and VMASC, our Battle Laboratory staff served as the coordinating and integrating agent for over X industry and government participants in this ground-breaking event. This Joint demonstration was led by the United States Air Force, and featured the capability to provide distributed mission operations (close air support task). This landmark event showcased the new Advanced Training Technology Capability (ATT) and laboratory (JATTL).



More than 35 simulations and systems were integrated in just over a week and established on the show floor with participation from all services, as well as the Defense Threat



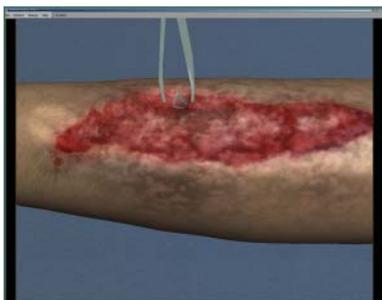
reduction agency, the UK Ministry of Defence and the Swedish Wargame Center. More than 9000 feet of fiber optic cable was strung, under the leadership of the lead engineer and VMASC Battle Laboratory Director, Mr. Mark Phillips, and by Mr. Mark Williams, the lead communications and network engineer for the JATTL. This successful event has laid the confidence and groundwork for a much larger demonstration in 2005, under the supervision of the US Army. VMASC is privileged to be a core asset in support of the Department of Defense through its close ties with USJFCOM.

Medical Modeling and Simulation

Simulators have been a standard component of training, for many years, in a variety of contexts including aviation, driver education, military ground operations, weapons training, and command and control operations for air traffic control and power plants. By contrast, simulation technology is just beginning to find its way into medical training and curricula. Members of VMASC are working closely with surgeons and other medical personnel at Eastern Virginia Medical School, the Naval Medical Center at Portsmouth, and the Uniform Services University of the Health Sciences to help usher in this new technology for training medical professionals.



To date, projects at VMASC have addressed a wide range of topics in medical modeling and simulation, from training individual procedures to modeling the Hampton Roads regional medical response to a mass casualty event. Researchers have been establishing the effectiveness of commercial systems for instructing common intravenous procedures such as cannulation and phlebotomy as well as surgical procedures such as arthroscopy and colonoscopy. In addition, researchers have begun to examine the contextual factors that can compromise the ability to perform medical procedures. Several experiments were conducted in ODU's CAVE virtual environment and showed that even simulated combat conditions had an adverse effect on the ability of medical students and residents to perform emergency surgical procedures.



Members of VMASC are also working to create the next generation of medical simulation technology. Efforts are underway to develop a stand-alone training system for wound debridement that incorporates visual, auditory, and haptic displays operating on new algorithms for representing tissue properties. Members are also developing an augmented garment that can be worn by simulated patients who are used to training medical students how to take a history and perform physical exams. The augmented garment would reproduce the physiological sounds that correspond to various underlying conditions when the patient is examined with a stethoscope.

Collaborative Research & Development (continued)

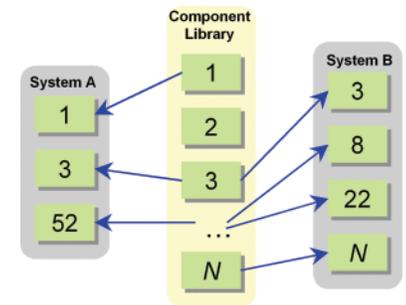
Modeling and Simulation for Homeland Security

The VMASC led Homeland Security Modeling and Simulation project can dramatically improve the way civil authorities train for and combat natural and manmade disasters, including terrorists' attacks. The system includes the first ever fully simulation embedded Command and Control (C2) system. The C2 system, developed by Loyola Enterprises, Inc., is fully integrated with a GIS viewer and can be used in support of both real world and training operations. Coordination with federal agencies and military officials is simulated and the C2 system provides an interactive capacity for live responses in both simulated and real world environments. The Emergency Preparedness Federation (EMPRED FED) simulation engine, developed by Northrop Grumman Mission Systems, is based on existing military applications simulations (JCATS, JIMM, JTLS). Intended for use in training at the Emergency Operations Center level, EMPRED FED has an exceptional range of current simulations capabilities and almost unlimited potential for expansion. EMPRED FED has demonstrated the ability model terrorists' attacks using high explosives, toxic gases, nerve agents (WMD), and conventional weapons. In follow on phases, capabilities will be expanded to include the full range of CBRNE threats. EMPRED FED is HLA compliant and thus capable of integrating a host of existing applications. Additional commercial partners in the project include Booz Allen Hamilton, Evidence Based Research, DDL Omni, and VisiTech Ltd. Academic partners include ODU, George Mason University, Hampton University, Norfolk State University, and the Eastern Virginia Medical School.

The Cutting Edge

Composability

Composability is the capability to select and assemble simulation components, in various combinations within a simulation system to satisfy specific user requirements. The defining characteristic of composability is that different sets of components can be composed in different ways, each suited to some distinct purpose, and the different compositions will be usefully valid. Composability is more than just the ability to assemble simulations from parts; it is the ability to combine and recombine components into different simulation systems to meet different needs.

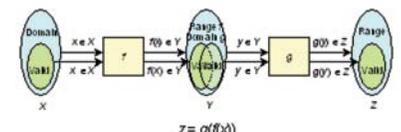


VMASC has developed a theory of simulation composability using formal reasoning. Our formal, mathematical work is a counterpoint to projects approaching composability from a software engineering perspective. We started from established theories, including logic and computability theory, to place our work on a solid basis. Our goal is to produce a formal theory that enables the determination in a mathematical, algorithmic way of characteristics of interest of a composition of models, such as whether their combined computation is valid.

VMASC's composability research has achieved the following results:

1. Examined composability terminology and levels of composable components and proposed common definitions of composability and related terms that have been widely used and cited.
2. Developed formal definitions of model, simulation, and validity consistent with their common informal meanings as the basis for a formal theory.
3. Determined, for several classes of models and forms of validity, whether separately valid models can be assumed to be valid when composed.
4. Generalized the computational complexity of model selection.
5. Surveyed software engineering approaches to achieving composability in practice.
6. Showed that a simple form of composition is theoretically sufficient to assemble any composite model.

The current phase of VMASC's composability research has two parts. First, we are developing formal semantic meta-models, which are descriptions of model semantics, that can be used to determine if the semantics of a composition of models are valid. Second, we are comparing our composability theory with existing simulation and related theories to learn how to improve the theory by using the insights of those theories.



Advisory Board

This past year was an important and active year for VMASC, and I am most gratified to serve as Chairman. During 2004, the Advisory Board reflected renewed activity and growth with new members from both industry and government. I characterize our Board's performance in 2004 as "energized," for we undertook actions that potentially could have profound and long-term benefit to VMASC, the Commonwealth, and the Hampton Roads Region.

For the first time since the center's formation, the Board took an active leadership role with the Regional Economic Impact and Cluster Analysis Study. A significant number of Board members brought industry sponsorship to the study and took a leading role in the process from definition of MS&V to providing key domain expertise and cluster mapping activities. Results of the study were significant, reasoned, and impressive.

The Advisory Board deliberated on the study results and elected to use the Advisory Board Executive Committee to further evaluate the study recommendations, and to determine the best way to capitalize on the significant footprint of MS&V within the Hampton Roads Region. One key recommendation involved the area of Homeland Security and Disaster Recovery, specifically the feasibility of establishing a training and experimentation center within Hampton Roads to increase our national exposure as a nexus of MS&V. The Executive Committee is evaluating this recommendation and is working closely with regional and state organizations to refine and solicit support for such a facility.

Continued industry, academic and local and state government support, coupled with innovation and experience, will result in collaborative benefits to all VMASC members. In my view, the potential for growth of MS&V technology in Hampton Roads is enormous and the region is truly a nexus for decision support and command & control in training and experimentation. I believe the coming year will demonstrate the accuracy of this statement.



Robert R. Harper, Jr.
Chairman, VMASC Advisory Board
Northrop Grumman Corp.



Robert Harper, Advisory Board Chair
Buck Marr, Advisory Board Vice-Chair

Industry Members

ANTEON Corporation
AT&T
Boeing Company
Booz•Allen•Hamilton
CAE
Computer Sciences Corporation
CUBIC
DDL Omni Engineering
General Dynamics-AIS
IBM
Lockheed Martin
Loyola Enterprise
Northrop-Grumman Mission Systems
Raytheon
SAIC

Federal Government

Army Research Institute
CDSA – Dam Neck
NASA Langley RC
NATO/ACT
SDDCTEA
US Joint Forces Command

University Members

Christopher Newport University
College of William & Mary
George Mason University
James Madison University
Norfolk State University
Old Dominion University
University of Virginia
Virginia Commonwealth University
Virginia Polytechnic University

Federal M&S Agencies

Air Force Agency for M&S

State, Local Government and Agencies

City of Suffolk
Hampton Roads Economic Development Alliance
Hampton Roads Partnership
Virginia's Center for Innovative Technology

At-Large Members

Naval Post-Graduate School

Executive Director of VMASC

Economic Impact Study

Overview

The Modeling, Simulation & Visualization (MS&V) Economic Impact and Cluster Analysis Study for Hampton Roads Virginia was conducted under the sponsorship of the Hampton Roads Planning District Commission, through a contract issued by the Old Dominion University Research Foundation to ANGLE Technology, Inc.

The following companies and organizations provided significant technical and financial support:

Industry: Boeing Company, BMH Associates, Booz-Allen-Hamilton, DDL Omni Engineering, General Dynamics-AIS, Lockheed Martin Global Vision Integration Center, Northrop-Grumman Mission Systems, SAIC

Government: City of Hampton, City of Norfolk, City of Portsmouth, City of Suffolk, City of Virginia Beach, Hampton Roads Economic Development Alliance, Peninsula Alliance for Economic Development

Findings

- ▼ The MS&V cluster contributed \$413 million annually to the region's output in 2004. This is projected to increase to \$764 million in 2009. The largest share of this increase will occur within the service sector.
- ▼ The MS&V cluster accounted for \$248 million in gross regional product (GRP) in 2004. This is projected to increase to \$482 million in 2009.
- ▼ The MS&V cluster generates slightly over 4000 jobs in Hampton Roads each year. This is projected to increase to nearly 7000 new jobs in 2009.
- ▼ The largest fraction of the cluster generated jobs, 2700 are in the service sector. The MS&V cluster contributed to a regional increase in population of 765 people in 2004. This is projected to increase to over 4300 people in 2009.
- ▼ The overall average salary for the private sector was \$59,405. The average industry salary for Engineering and Architectural Services was \$59,614; while Research and Test Services was \$58,180; and Computer and Data Process Services was \$59,017.
- ▼ The annual change in the number of MS&V jobs expected over the next 2 years is approximately 18% per year indicating very strong job growth over the near term. The annual change in the number of MS&V jobs expected over the next 5 years is approximately 12% per year indicating solid job growth over the mid term.

Hampton Roads Regional Strengths
M&S Decision Support/Command & Control
M&S for Training
Medical Modeling & Simulation

Key Observations

- ▼ MS&V provides a significant contribution to the regional economy.
- ▼ Significant growth is projected across all reported impact measures.
- ▼ Potential exists to capture more defense activity and to diversify into other regional commercial markets over the next 5 years.
- ▼ Challenges for the MS&V cluster include workforce training and development issues and the local availability of specialized MS&V training.
- ▼ There is a need to foster the participation of Small and Medium Size Enterprises (SME) across the overall MS&V cluster. Presently, they support specialized niches, i.e. focused on specific agencies such as NASA, etc.
- ▼ JTASC was the catalyst that helped launch additional MS&V organizations that further leveraged the JTASC capabilities. Concurrently, the Joint Forces focus of the current MS&V activity tends to channel MS&V activity to key DoD organizations and contractors.
- ▼ There are significant growth opportunities in the areas of Joint Training, Experimentation and DoD Transformation, Homeland Defense, Intelligence, Medical M&S, and Environmental/Remote Sensing activities both within the US and worldwide.
- ▼ Development of new MS&V capabilities may require investment in the establishment of "Centers of Excellence" in emerging areas such as Homeland Security. Such an initiative will require a coordinated regional effort, at both the State and Federal levels, to be successful.

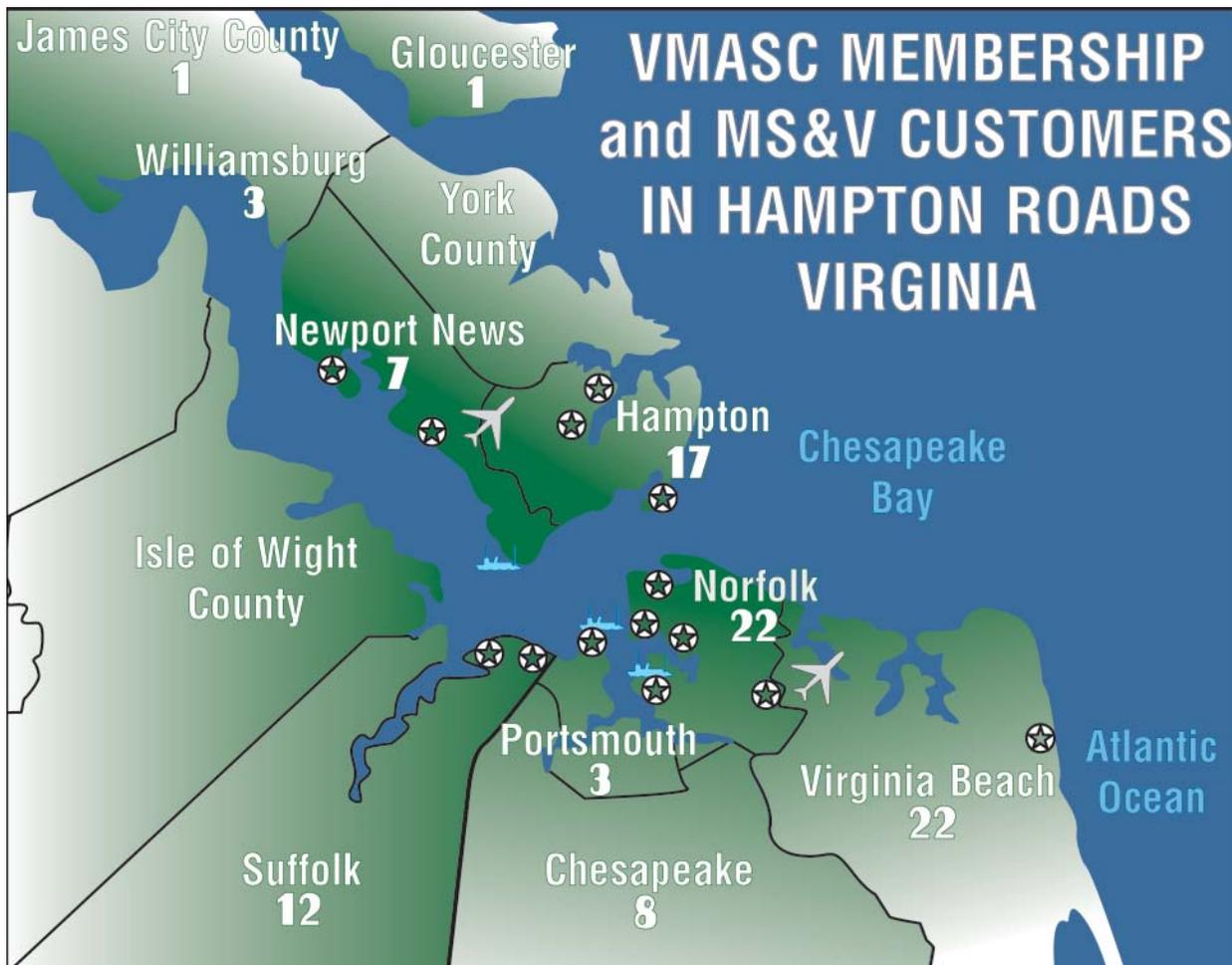
Recommendations

The region can accelerate the growth of the MS&V cluster through:

- ▼ Increase regional MS&V networking by building on the leadership of VMASC, through its academic, industry and government members, and survey respondents, and supporting and developing the activities of the many regional economic development organizations.
- ▼ Identify and implement a large collaborative regional project to focus the group and develop network communications. A proposed project was the development of a national training center for homeland security and disaster recovery.
- ▼ Expand educational opportunities at the undergraduate, community college and high school levels, as well as develop specialized training and certification courses to continually educate the existing MS&V workforce.
- ▼ Market programs by the economic development organizations to attract more vendors & suppliers, with a goal of developing a central MS&V marketing focus and a coordinated marketing strategy that limits duplication and expands reach.

Growth Areas
Computer Gaming
Entertainment
Homeland Security
Transportation Modeling
Distribution Systems
Manufacturing Systems

This map represents the number of VMASC members in each Hampton Roads city since VMASC formation. Each star denotes the location of a regional MS&V customer.

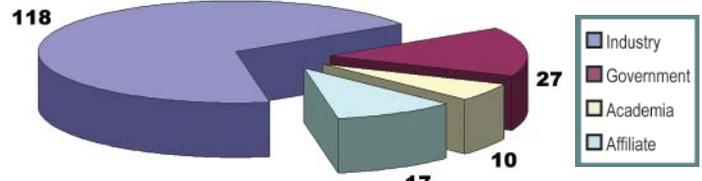


Membership Update

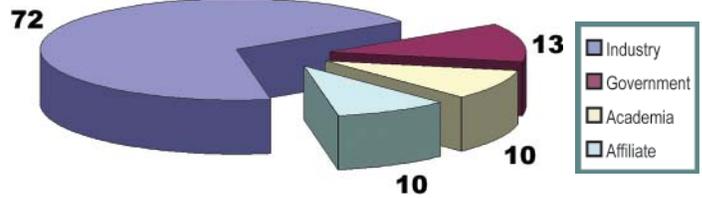
New industry members

- ▼ AEGIS
- ▼ ANTEON
- ▼ CUBIC
- ▼ Collabworx
- ▼ Elumens
- ▼ Evidence Based Research
- ▼ IBM
- ▼ Object Raku Technology, Inc.
- ▼ Pelican
- ▼ Pitch AB
- ▼ SAIC
- ▼ Simulab

Historic Membership (172 members since formation)



Active Membership (105 member partners)



2004 Industry Partners



Battle Lab Ribbon Cutting Ceremony

May 6, 2004



President Roseann Runte and officials from the University and the United States Joint Forces Command to participate in the May 6 event

The VMASC Battle Lab is an innovative computer simulation laboratory designed to provide the advanced modeling and simulation infrastructure necessary to support VMASC's core research areas. The Battle Lab is a place to use simulation to investigate new methods of war-fighting. In a military setting, this is a direct application. In a university setting, this allows students to investigate the frontiers of simulation. The Battle Lab is also a Decision Support Center, providing enterprises with new methods of conducting and evaluating their business practices. This allows for advanced testing capabilities as we explore "what if" scenarios. These Battle Lab applications not only allow for the exploration of new, experimental solutions, but also allow users to do so at a vastly reduced cost. Simulations can take the place of actual manpower. The computers can run the simulations at greater speeds than real-time, allowing larger spaces of "time" to be generated and evaluated in a smaller "real" time. To achieve this end, the Battle Lab has access to over \$3 million in simulation software and almost \$1 million in computer simulation hardware.



What was unveiled on May 6 is a state-of-the-art facility for modeling and simulation that will help solidify Virginia's international leadership in these areas. It will also help Old Dominion University reinforce its leadership in graduate programming by creating an innovative laboratory for our Master's and Ph.D. programs in Modeling and Simulation. These graduates are highly specialized and they are likely to stay in Virginia.



This is a success story by any definition. The VMASC Battle Lab is a perfect example of what higher education can achieve for society when it collaborates with a broad spectrum of public and private partners. The VMASC Battle Lab will continue to evolve as research and business needs evolve and as our government, academic, and industry partners, present and future, become engaged with the Battle Lab. We seek collaborators who will actively work with us to strengthen our rapidly growing modeling and simulation graduate programs and to advance the discipline of modeling and simulation.

Research & Development Projects

The proceeding is a list of 2004 VMASC Research and Development projects grouped by area of expertise. For additional information on these projects, please visit VMASC online at <http://www.vmasc.odu.edu> or contact Mikel Petty, Chief Scientist, at 757.686.6210 or via email at mpetty@odu.edu.

Simulation integration, interoperability, and composability



JNTC JRD3

Air Operations BML

Integrate the Air Planning System into the BML and migrate it to a joint combat simulation.

Sponsor: Defense Modeling and Simulation Office

Composability

Develop formal mathematical theory of simulation composability, including validity of simulation component compositions and component meta-models.

Sponsor: Defense Modeling and Simulation Office

Experiment Command and Control Interface (XC2I) – Development of a federation viewer that produces an open-standard based common operational picture for a HLA federation.

Sponsor: Defense Modeling and Simulation Office

JWFC Integration Support

Perform M&S system integration in support of Joint Warfighting Center experiments and exercises.

Sponsor: United States Joint Forces Command

JNTC JRD3

Provide life cycle methodology development and analytic support for the Joint National Training Capability’s Rapid Distributed Database Development effort.

Sponsor: United States Joint Forces Command

JNTC Prototyping

Help design and prototype the Joint National Training Capability’s Joint Advanced Training Technology Laboratory.

Sponsor: United States Joint Forces Command

NCEE M&S Integration

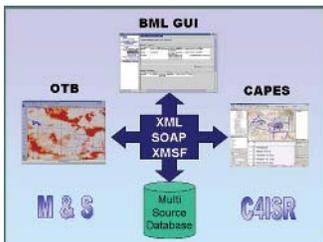
Prepare a technical strategy and implementation plan to integrate an effects-based M&S capability into the NCEE System Engineering Toolset.

Sponsor: United States Navy

XMSF Core and Technical Support

Identify and evaluate approaches to develop a set of web-based technologies and services, applied within an extensible framework, to enable M&S applications to interoperate.

Sponsor: Defense Modeling and Simulation Office



XMSF Extensible Battle Management Language

XMSF DCEE

Link simulation viewer to experimentation environment using web-based communications technologies.

Sponsor: Defense Modeling and Simulation Office

XMSF Extensible Battle Management Language

Migrate the prototype Battle Management Language to a web-service oriented environment and its supporting information exchange to the NATO standard C2IEDM.

Sponsor: Defense Modeling and Simulation Office

Human behavior modeling, human factors, and human machine interface

Crowd Modeling

Implement real-time simulation of crowd behavior that is interoperable with existing military simulations and has a psychological basis for its behavior models.

Sponsor: Defense Modeling and Simulation Office



Crowd Modeling

Decision and Planning Superiority

Conduct experiments related to human factors issues, including information gathering, collaborative planning, and negotiation.

Sponsor: Army Research Laboratory and United States Joint Forces Command

Submarine Human Performance Measurements

Perform cognitive task analysis and activity link analysis to improve submarine communications systems.

Sponsor: Space and Naval Warfare Systems Center

Visualization and virtual environments

Enhanced Visualization

Acquire and employ hemispherical dome visualization system for M&S applications.

Sponsor: Office of Naval Research

Soldier CATT Technology Assessment

Assess virtual environment technology capabilities for future individual combatant training system.

Sponsor: United States Army



Soldier CATT Technology Assessment

VTS3 Analysis

Model and visualize overall enterprise architecture for training support system.

Sponsor: United States Army

Medical modeling and simulation

Augmented Patient

Generate multimodal simulated outputs of medical diagnostic tools to supplement human patient role-players.

Sponsor: Office of Naval Research

Medical Simulator Evaluation

Evaluate training transfer effect and validity of existing medical simulators.

Sponsor: Naval Health Research Center

Prostate Surgery Visualization

Compare success rates of open and laparoscopic prostate surgeries using visualization.

Sponsor: Eastern Virginia Medical School

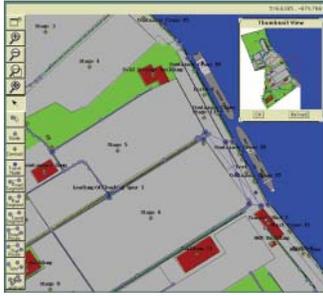


Medical Simulator Evaluation

Wound Debridement

Develop virtual environment simulation, with both visual and haptic feedback, of wound debridement process for medical training.

Sponsor: Office of Naval Research



CPortS

Homeland security, homeland defense, and non-attribution modeling

CPortS

Develop discrete event simulation of seaport operations, including cargo and vehicle movement, supported by large database of worldwide ports.

Sponsor: United States Army

Effects-Based Operations

Design models to predict effects of operations on cultural, economic, political, and psychological dimensions.

Sponsor: United States Joint Forces Command

Homeland Defense M&S

Implement simulation of homeland defense scenarios for training, analysis, and decision support.

Sponsor: United States Joint Forces Command

MMRS Mass Casualty

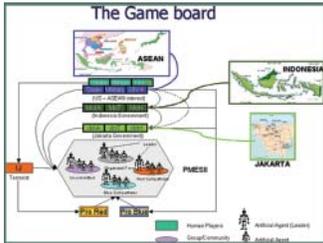
Develop training and analysis simulation of regional mass casualty events for Metropolitan Medical Response System.

Sponsor: Department of Homeland Security

Homeland Security Collaborative Environment

Model distributed collaborative interactions concerning homeland security so as to conduct process improvement analysis.

Sponsor: United States Joint Forces Command



SEAS

SEAS

Enhance agent-based model of political, economic, social, and infrastructure aspects of an urban area.

Sponsor: United States Joint Forces Command

M&S Education

M&S Overview Course – Prepare and offer graduate-level university survey course of M&S concepts, categories, methods, and practices.

Sponsor: Defense Modeling and Simulation Office

M&S Custom Training Courses – Prepare and offer specialized M&S training courses, customized for specific clients’ requirements.

Sponsors: Various

Cryogenics Training

Develop simulation and visualization content for military cryogenics training program.

Sponsor: United States Navy

Simulation Testing

JWARS-JSAF Assessment

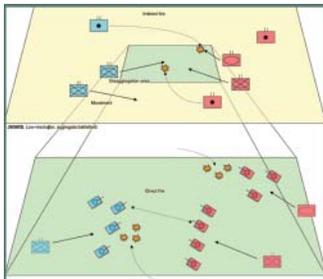
Conduct capabilities- and correlation-based assessment of multiresolution simulation linking JWARS and JSAF.

Sponsor: Lockheed-Martin

JOFT Validation

Perform independent validation of model of logistics transportation and sustainment feasibility.

Sponsor: United States Joint Forces Command



JWARS-JSAF Assessment

M&S Testing Support

Design and test doctrine-based methodology for operational testing of large command staff training simulations.

Sponsor: United States Navy

Other Expertise Areas

UAH Consulting

Consult to new M&S research center on research projects and program development.

Sponsor: University of Alabama in Huntsville

NRO Advanced Futures Lab

Consult on M&S laboratory capabilities and infrastructure.

Sponsor: National Reconnaissance Office

Joint Experimentation Multi-National Seminar

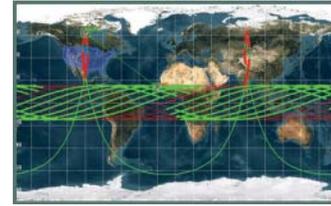
Organize seminar to adapt joint experimentation events to multi-national requirements.

Sponsor: United States Joint Forces Command

Training Range Requirements

Develop a tool to generate and integrate training range usage, implementation, and performance requirements using M&S.

Sponsor: United States Army



NRO Advanced Futures Lab

Engineering Technical Services & Student/Faculty Support

Net-Centric Communications, Capabilities and Integration and C4 Transformation Technical and Engineering Support

Support operational and functional requirements development and assessment, policy analysis, capability assessment and integration of C4ISR systems of systems in support of Combatant Commands warfighting requirements.

Sponsor: United States Joint Forces Command

Joint Experimentation Information Management and Knowledge Management Integration

Provide Information Management and Knowledge Management research, evaluation and experimentation support of concept-based hypothesis for near, mid, and far term and review of state-of-the-art technology capabilities and concepts.

Sponsor: United States Joint Forces Command, Joint Experimentation Directorate & Joint Futures Laboratory

C4ISR Science and Technology Research, Assessment and Evaluation

Provide Science and Technology research, assessment and evaluation services to support the Joint Systems Integration Commands leadership of near-term transformation of Joint Force C4ISR capability through technology assessments and insertion in support of Combatant Commands.

Sponsor: United States Joint Forces Command, Joint Systems Integration Command

NATO and Multi-National Modeling and Simulation Technical and Engineering Support

Technical and engineering support for NATO/Multi-National M&S, NATO M&S activities, workgroups & committees, and provide the JWFC Sim/C4 Group with related support and products associated with their Modeling and Simulation mission.

Sponsor: United States Joint Forces Command, Joint Warfighting Center

Joint Interoperability & Integration and Joint Battle Management Command & Control Technical and Engineering Support

Support for the development, planning, management, integration and implementation of operational concepts, doctrine, requirements, and architectures needed for current and future joint operational capabilities in battle management command and control.

Sponsor: United States Joint Forces Command

Publications & Presentations

- Bailey, N. R. The effects of operator trust, complacency potential, and task complexity on monitoring a highly reliable automated system. Unpublished doctoral dissertation, Old Dominion University, Norfolk, VA.
- Bailey, N. R. and M. C. Mihalecz. *Primer on cognitive task analysis for the Joint Rapid Distributed Database Development System*. (Special Report BL-002-2004). Suffolk, VA: Old Dominion University, Virginia Modeling, Analysis, and Simulation Center.
- Belfore, L. A., M. D. Petty, E. K. Lada, and J. Garcia. "Capabilities and Intended Uses of the Joint Operations Feasibility Tool", *Proceedings of the Spring 2004 Simulation Interoperability Workshop*, Arlington VA, April 18-23, 2004, pp. 596-604.
- Berbesi, H. and D. A. Dryer. Seeing the Labyrinth: Visualizing a DoD Training Support System of Systems. *Proceedings of the Interservice / Industry Training Simulation and Education Conference (I/ITSEC '04)*, Orlando, FL, Paper No. 1749.
- Bliss, J. P., C. Fallon, E. N. Headen, and R. C. Gaskins III. Crowd reactions to sublethal weapons: Universal triggers for crowd violence. *Proceedings: Annual conference for the Human Factors and Ergonomics Society*, New Orleans, LA.
- Bliss, J. P., C. Fallon, E. N. Headen, and R. C. Gaskins III. Crowd Reactions to Sublethal Weapons: Universal Triggers for Crowd Violence. *Non-lethal Technology and Academic Research Symposium NTAR VI*, November 2004, Winston-Salem, NC.
- Boone, C. M., R. C. Gaskins III, and M. D. Petty. *Crowd Behavior Observation*. *Proceedings: Human Factors and Ergonomics Society's 48th Annual Meeting*, New Orleans, Louisiana.
- Boone, C. M., R. C. Gaskins III, and M. D. Petty. *Observations Of Crowd Behavior*. Poster presented at the 2004 Conference on Behavior Representation in Modeling and Simulation, Arlington, Virginia.
- Boone, C. M., R. C. Gaskins III, M. D. Petty, and T. M. Verna. Observations of Crowd Behavior, *Proceedings: Behavioral Representation in Military Simulation*.
- Brutzman, D., A. Tolk. "JSB Composability and Web Services Interoperability via Extensible Modeling & Simulation Framework (XMSF) and Model Driven Architecture (MDA)." *Society of Photo-Optical Instrumentation Engineers (SPIE) Proceedings of the Conference Enabling Technologies for Simulation Sciences VIII, Defense and Security, Vol. 5423 Paper 38*, Orlando, FL, April 2004.
- Colley, W. N. "Comments on College Football Computer Rankings," *American Statistician*, 58: #3, 191-192
- Dryer, D. A. and H. Berbesi. Evolving DODAF: An Integrated Training Enterprise - Delivery Architecture Framework. *Proceedings of the Interservice / Industry Training Simulation and Education Conference (I/ITSEC '04)*, Orlando, FL, Paper No. 1695.
- Dryer, D. A., L. A. Belfore, M. D. Petty, M. Phillips, H. Garcia, J. Seevinck, R. B. Loftin, and T. Mastaglio. "A Methodology for Rapid Assessment of Simulation Technology and Application to Soldier CATT", *Proceedings of the Fall 2004 Simulation Interoperability Workshop*, Orlando FL, September 19-24 2004, pp. 403-414.
- Gaskins, R. C. III, C. M. Boone, T. M. Verna, and M. D. Petty. Cognitive and Behavioral Psychology for Crowd Modeling. *Proceedings: NATO Modeling and Simulation Group Modeling and Simulation to Address NATO's New and Existing Military Requirements*. Koblenz, Germany, October 6-8, 2004.
- Gaskins, R. C. III. "Crowd Control." Chair of session at the Non-lethal Technology and Academic Research Symposium, Washington, DC, November 2004.
- Gaskins, R. C. III. "Crowd Modeling"; with R. McKenzie, R. Gaskins, and E. Weisel; Defense Modeling and Simulation Office; Human Performance in Modeling and Simulation Program Review; Alexandria VA; January 28, 2004.

- Gaskins, R. C. III. "Developing a Crowd Model for Military Simulation"; with R. McKenzie, R. Gaskins, and E. Weisel; Old Dominion University; Computer Science Department Colloquium; Norfolk VA; February 5, 2004.
- Gaskins, R. C. III. "Developing a Crowd Model for Military Simulation"; with R. McKenzie, R. Gaskins, and E. Weisel; Old Dominion University; Effects Based Operations Research Working Group; Norfolk VA; April 8, 2004.
- Gaskins, R. C. III. "Human Behavior Representation" National Institutes for Aerospace; Langley, VA; September 30, 2004.
- Gaskins, R. C. III, C. M. Boone, T. M. Verna, and M. D. Petty. Methodology for Psychological Based Crowd Modeling, Proceedings of The Technical Cooperation Program, Human Performance Technical Panel 2 (TTCP HUM TP 2).
- Gaskins, R. C. III, C. M. Boone, T. M. Verna, J. P. Bliss, and M. D. Petty. Psychological Research for Crowd Modeling Proceedings: Behavioral Representation in Military Simulation.
- Gaskins, R. C. III, C. M. Boone, T. M. Verna, J. P. Bliss, and M. D. Petty. "Psychological Research for Crowd Modeling", *Proceedings of the 2004 Conference on Behavior Representation in Modeling and Simulation*, Arlington VA, May 17-20, 2004, pp. 401-402.
- Gaskins, R. C. III, C. M. Boone, T. M. Verna, J. P. Bliss, and M. D. Petty. *Psychological Research for Crowd Modeling*. Poster presented at the 2004 Conference on Behavior Representation Modeling and Simulation, Arlington, Virginia.
- Leathrum, J., R. Mielke, S. Mazumdar, R. Mathew, Y. Manepalli, V. Pillai, R. Malladi, and J. Joines. "A Simulation Architecture to Support Intratheater Sealift Operations", *Mathematical and Computer Modelling*, vol. 39, issues 6-8, pp. 817-838, March 2004.
- Loftin, R. B., M. W. Scerbo, F. D. McKenzie, and J. M. Catanzaro. Training in Peacekeeping Operations Using Virtual Environments. *Computer Graphics and Applications* 24(4), pp. 18-21, July/August, 2004.
- Loftin R. B., J. X. Chen, and L. Rosenblum. Visualization Using Virtual Reality. In C.R. Johnson and C.D. Hansen, Editors. *Visualization Handbook*. New York: Academic Press, 2004. pp. 479-89.
- McKenzie, F. D., Q. Xu, Q. H. Nguyen, and M. D. Petty. "Crowd Federate Architecture and API Design", *Proceedings of the Fall 2004 Simulation Interoperability Workshop*, Orlando FL, September 19-24, 2004, pp. 574-587.
- McKenzie, F. D., H. Garcia, Q. H. Nguyen, J. Seevinck, and M. D. Petty. "Mogadishu Terrain Generation and Correlation for Crowd Modeling", *Proceedings of the Spring 2004 Simulation Interoperability Workshop*, Arlington VA, April 18-23, 2004, pp. 944-950.
- Mihalecz, M. C. *RD3 system requirements: Employing a human-centered approach*. Paper presented at the RD3 W-IPT Conference, Colorado Springs, CO.
- Mihalecz, M. C. *Interviewer Training Manual – RD3 User Requirements Elicitation Survey*. Suffolk, VA: Old Dominion University, Virginia Modeling, Analysis, and Simulation Center.
- Mihalecz, M. C. & Bailey, N. R. (2004, November). *Preliminary Data Analysis of the User/Programmer Survey Questionnaire for the Joint Rapid Distributed Database System*. Paper presented at the JRD3 I-IPT Conference, Williamsburg, VA.
- Mihalecz, M. C. and N. R. Bailey. *Preliminary data analysis of the user/programmer survey questionnaire for the Joint Rapid Distributed Database Development System*. (Special Report BL-003-2004). Suffolk, VA: Old Dominion University, Virginia Modeling, Analysis, and Simulation Center.
- Mihalecz, M. C. *Recommendations for Rapid Distributed Database Development user/programmer survey questionnaire*. Suffolk, VA: Old Dominion University, Virginia Modeling, Analysis, and Simulation Center.

- Katherine L. Morse, Ryan Brunton, J. Mark Pullen, Priscilla McAndrews, Andreas Tolk, James Muguira. "An Architecture for Web Services Based Interest Management in Real Time Distributed Simulation." Proceedings of the 8th IEEE International Symposium on Distributed Simulation and Real Time Applications (DS-RT 2004), pp. 108-115, Budapest, Hungary, October 2004.
- Morse, K. L., M. D. Petty, P. F. Reynolds, W. F. Waite, and P. M. Zimmerman. "Findings and Recommendations from the 2003 Composable Mission Space Environments Workshop", *Proceedings of the Spring 2004 Simulation Interoperability Workshop*, Arlington VA, April 18-23, 2004, pp. 313-323.
- 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*, Vol. 16, Iss. 15, December 2004, pp. 1527-1543.
- Hieb, M. R., J. M. Pullen, W. P. Sudnikovich, A. Tolk. "Developing Battle Management Language into a Web Service." Spring Simulation Interoperability Workshop 2004, Washington, D.C., April 2004.
- Morse, K. L., M. D. Petty, P. F. Reynolds, W. F. Waite, and P. M. Zimmerman. "Summary of the 2003 Composable Mission Space Environments Workshop", *Simulation Technology*, Volume 7, Issue 2, September 9, 2004.
- 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*, Volume 12, Issues 3-4, July 2004, pp. 217-237.
- Petty, M. D., F. D. McKenzie, R. C. Gaskins III, and E. W. Weisel. "Developing a Crowd Federate for Military Simulation", Proceedings of the Spring 2004 Simulation Interoperability Workshop, Arlington VA, April 18-23, 2004, pp. 483-493.
- Petty, M. D., E. W. Weisel, and R. R. Mielke. "Overview of a Theory of Composability", Proceedings of the Huntsville Simulation Conference 2004, Huntsville AL, October 19-21, 2004.
- Petty, M. D. "Simple Composition Suffices to Assemble Any Composite Model", *Proceedings of the Spring 2004 Simulation Interoperability Workshop*, Arlington VA, April 18-23, 2004, pp. 299-307.
- Phillips M. A. and W. Bizub. "LASIX for Joint Training – Introducing the Joint Advanced Training Technology Laboratory, Interservice/Industry Training Simulation and Education Conference 2004.
- Pullen, J. M., R. Brunton, D. Brutzman, D. Drake, M. Hieb, K. Morse, A. Tolk. "Using Web Services to Integrate Heterogeneous Simulations in a Grid Environment." Computational Science - ICCS 2004: 4th International Conference, Kraków, Poland, June 6-9, Proceedings, Part III, Series: Lecture Notes in Computer Science, Publisher: Springer-Verlag Heidelberg, pp. 835 – 847, 2004.
- Scerbo, M. W., J. P. Bliss, E. A. Schmidt, S. N. Thompson, T. D. Cox, and H. J. Poland. A Comparison of the CathSim™ system and simulated limbs for teaching intravenous cannulation. In J. D. Westwood et al. (Eds.), *Medicine meets virtual reality*, 12, (196-198). Amsterdam: IOS Press.
- Scerbo, M. W. Medical virtual reality simulation: Enhancing safety through practicing medicine without patients. *Biomedical Instrumentation & Technology*, 38, 225-228.
- Scerbo, M. W., L. J. Weireter, J. P. Bliss, E. A. Schmidt, and H. Hanner. An examination of surgical skill performance under combat conditions using a mannequin-based simulator in a virtual environment. NATO RTO Human Factors in Medicine, St. Pete Beach, FL.
- Scerbo, M. W. Virtual reality simulators in medicine: Current and future concerns. A panel presented at the 48th Annual Meeting of the Human Factors & Ergonomics Society, New Orleans, LA.
- Schmidt, E. A., M. W. Scerbo, J. P. Bliss, and S. N. Thompson. Skill acquisition with a VR simulator for phlebotomy. The Second Conference on Human Performance, Situation Awareness, and Automation, Daytona Beach, FL.
- Tolk A., K. Galvin, Michael Hieb, Lionel Khimeche: "Coalition Battle Management Language," Fall Simulation Interoperability Workshop 2004, pp. 724-735, Orlando, Florida, September 2004.

- Tolk, A. "Composable Mission Spaces and M&S Repositories – Applicability of Open Standards." Spring Simulation Interoperability Workshop 2004, Washington, D.C., April 2004.
- Tolk, A.. "Moving towards a Lingua Franca for M&S and C3I – Developments concerning the C2IEDM." European Simulation Interoperability Workshop 2004, pp. 91–102, Edinburgh, Scotland, June 2004.
- Tolk, A.. "XML Mediation Services utilizing Model Based Data Management." Proceedings of the 2004 Winter Simulation Conference, IEEE Catalog Number 04CH37614C, pp. 1476-1484, Washington, DC, December 2004.
- Turnitsa C., S. Kovvuri, A. Tolk, L. DeMasi, V. Dobbs, W. Sudnikovich. "Lessons Learned from C2IEDM Mappings within XBML." Fall Simulation Interoperability Workshop 2004, pp. 792-801, Orlando, Florida, September 2004.
- Turnitsa, C. Web Enabled Command And Control Interface Tool (presented at WebSim, October 2004)
- Weisel, E. W. and M. D. Petty. "Reference Scenarios for Crowd Federate Validation", *Proceedings of the Fall 2004 Simulation Interoperability Workshop*, Orlando FL, September 19-24, 2004, pp. 415-423.
- Weisel, E. W., M. D. Petty, and R. R. Mielke. "A Survey of Engineering Approaches to Composability", *Proceedings of the Spring 2004 Simulation Interoperability Workshop*, Arlington VA, pp. 722-731, April 18-23, 2004.

Website and Contact Information

Suffolk Facility

7000 College Drive
Suffolk, VA 23435

Executive Director

R. Bowen Loftin, Ph.D.

bloftin@odu.edu

Technical Director

Roland R. Mielke, Ph.D.

rmielke@odu.edu

Norfolk Facility (VMASC East)

4700 Elkhorn Avenue
Norfolk, VA 23529

Chief Scientist

Mikel D. Petty, Ph.D.

mpetty@odu.edu

Telephone: 757.686.6200

Fax: 757.686.6214

General Manager

Kevin McCleskey

kmcclesk@odu.edu

Web Site

www.vmasc.odu.edu

Battle Lab Director

Mark Phillips, M.E.

mphilip@odu.edu

Graduate Program Information

msimgpd@odu.edu

Marketing Director

William L. Younger, Jr.

byounger@odu.edu



Virginia Modeling, Analysis and Simulation Center
7000 College Drive
Suffolk, VA 23435
www.vmasc.odu.edu
1EN65