VMASC 2012

INNOVATION research REPORT 2012

VMASC
OLD DOMINION UNIVERSITY


virginia
MODELING,
ANALYSIS and
SIMULATION
CENTER

TABLE of CONTENTS

What is M&S?

Modeling and Simulation (M&S) has been around in one form or another for centuries, dating back to war games played by Romans in the antiquity. Originally, M&S involved live players interacting with each other to simulate an activity for training purposes in a realistic way. The evolution of mathematical computation coupled with a greater understanding of natural and physical phenomena allowed the use of mathematical techniques and formulas to extend the applicability of M&S. This eventually brought on the era of mathematical modeling which moved M&S into the domain of experimentation and scientific exploration. This expansion of M&S generalized the need for realism to the requirement to verify and validate models which is still entrenched solidly in M&S. In short, verification is ensuring the model is built as specified and validation is ensuring that the right model has been specified.

The advent of digital computers ushered the era of virtual simulations where real people interact with simulated entities in a computer. Increases in computing power ultimately lead to constructive simulations where simulated entities interact with one another. Digital computers are now used to not only solve very complex mathematical models but also to simulate them over time. The addition of probabilities and uncertainty has solidified the role of M&S as a tool for gaining insight into more and more complex problems by providing a range of solutions given a set of random or stochastic inputs instead of a unique or deterministic solution given a unique set of inputs.

Another huge advantage of using digital computers is the ability to implement algorithms that extended the use of M&S beyond just mathematical models but also to complex problems that are very difficult to represent in a clean mathematical way. In those cases M&S is used to simplify the problem and capture it in a conceptual model or formulate a modeling question that determines the goal of the model; and specify a set of algorithms which are then executed on a digital computer to provide answers that are then compared to the real problem or phenomenon.

Today, M&S combines algorithms, mathematical representations, probability, statistics, and uncertainty to give users a wide range of tools to model and simulate a problem. Most recently, the combination of live, virtual and constructive (LVC) simulations have emerged as the next challenge of M&S. If we are successful, M&S will allow the combination of real and simulated data in near real time. This will allow the inclusion of M&S into the web of things where people utilizing social media, real objects and tools such as cars and refrigerators along with models and simulations - interconnected in a coherent framework.

Currently, M&S is used ubiquitously in our everyday life from navigation systems and weather predictions to job training in the civilian and military world. Scientist from almost every domain, from social and political science to biology and chemistry, use M&S to gain insight, test new methods or to confirm existing theories. The M&S industry is continuing to thrive and advance at a rapid pace. Old Dominion University's Virginia Modeling, Analysis and Simulation Center stands at the nexus of these M&S innovations.

The Virginia Modeling, Analysis and Simulation Center is a university-wide multidisciplinary research center that emphasizes modeling, simulation, and visualization (MS&V) research, development and education.

VMASC is one of the world's leading research centers for computer modeling, simulation, and visualization. The mission of the Center is to conduct collaborative MS&V research and development, provide expertise to government agencies and industry, and to promote Old Dominion University, Hampton Roads and Virginia as a center of MS&V activities. Working with more than one hundred industry, government, and academic members, VMASC furthers the development and applications of modeling, simulation and visualization as enterprise decision-making tools to promote economic, business, and academic development. Annually, the Center conducts approximately $10M in funded research.

Old Dominion University is a state-assisted institution and one of only four Virginia schools in the Carnegie Research Universities (high research activity) category. The University offers a complete range of Modeling & Simulation degree options from Bachelor's to Ph.D.

With 14 years of applied M&S research, VMASC serves as a consortium of academia, industry, and government with the goal of applying and advancing simulation technology to benefit its members. VMASC has held true to that objective. Evidence of this can be found in the history of the Center from its modest origins as a venue for short-course, formal training of members of the Joint Training, Analysis, and Simulation Center (JTASC) to its expanding application foci, which is leading the way in modeling and simulation education and research. ODU's VMASC has successfully focused on developing a very progressive pathway into the future of modeling and simulation.

The Commonwealth of Virginia tasks VMASC with a fourfold mission: engage in collaborative research and development in modeling and simulation (M&S); develop the M&S workforce through education; provide M&S technical expertise to government and industry; and stimulate technology-related economic development.

We achieve this by being one of the few modeling and simulation research centers in the world to focus on truly multidisciplinary approaches in the discipline of modeling and simulation, allowing us to find innovative solutions for real world problems in wider areas of creative and necessary application.

message
VMASC executive director

This past year was a dynamic one for VMASC; dynamic in the sense that many changes took place in the realm of modeling and simulation especially here in Hampton Roads. With last year's announcement of the disestablishment of U. S. Joint Forces Command we were unsure of the impact on VMASC's military M&S research funding. As it turned out the majority of the technical M&S work still remains at JFCOM's successor organization, Joint and Coalition Warfighting. We continue to support this organization with several M&S research initiatives.

The closure announcement also gave us an opportunity to focus on other applied M&S research domains. We had previously diversified into three other areas: homeland security, transportation, and medical. We continued to build research depth in these areas while still supporting M&S research for DoD. This diversification and depth building paid off by bringing new research funding opportunities to light. In the homeland security area we developed several M&S initiatives for the Commonwealth of Virginia that address the security of critical infrastructure and better ways to serve various population segments throughout the Commonwealth when faced with disaster situations.

The medical area saw several significant initiatives. We continued to enhance the Patient Blood Management training simulation that we developed in conjunction with Englewood Hospital in New Jersey. We received a $2 million award from the Army's Telemedicine and Advanced Technology Center to develop a high end virtual training environment for military nurses. We also garnered funding for the National Center for Collaboration in Medical Modeling and Simulation (NCCMMS), a partnership between Old Dominion University and Eastern Virginia Medical School. This center has existed since 2004 but this was the first year we were able to obtain dedicated funding to fully stand up the center. It will develop a medical simulation testing laboratory much like Consumer Reports to provide unbiased assessments of medical simulation capability to hospitals and medical schools across the country. NCCMMS will also develop medical M&S research initiatives focused on providing better patient outcomes through simulation.

The area of transportation M&S saw two significant developments. ODU is a member of a five university team that was awarded the designation as a Tier One University Transportation Center, one of only ten across the country. Our center is focused on green transportation initiatives with VMASC providing modeling and simulation capability to the team of researchers. We also formed the Center for Innovative Transportation Solutions (CITS) and entered into an agreement with the City of Virginia Beach to provide transportation modeling research for a series of challenges facing the city.

As you can see we have had a busy year and the coming year appears to be even busier. Modeling and simulation has truly developed into its own academic discipline and profession and VMASC is proud to contribute to the effort.

John A. Sokolowski, Ph.D.
VMASC Executive Director

message
ODU MSVE academics director

The Department of Modeling, Simulation and Visualization Engineering (MSVE) had another foundation-building year during 2011-2012. The transition from an academic program to a full-fledged academic department within the Batten College of Engineering and Technology (BCET) will be completed during the next academic year and MSVE will achieve near steady-state operation at that time. I am pleased to present this brief look at our progress and growth during 2011-2012.

DEPARTMENT GROWTH AND EXPANSION

FACULTY - During 2011-2012, the department lost one faculty member and hired two new faculty members. Dr. Guoqing Zhou resigned his faculty position to assume the role of Vice President for Research and International Affairs at Guilin University of Technology (China). Dr. Bharat Madan was hired as Professor of MSVE. Dr. Madan has bachelors and masters degrees in electrical engineering and received his Ph.D. in Detection and Estimation Theory from the Indian Institute of Technology – New Delhi. His research interests focus on cyber security and include: information security and assurance; stochastic modeling of networks for performance, reliability, security and availability analysis; and M&S of computer networks, sensor networks and mobile ad hoc networks. Dr. Masha Sosonkina was hired as Professor of MSVE. Dr. Sosonkina has bachelors and masters degrees in applied mathematics and received the Ph.D. in Computer Science from Virginia Tech. Her research interests include: computational science and engineering; high performance computing and applications; parallel numerical algorithms; and distributed and cloud computing. The MSVE Department now has a faculty consisting of 10 full-time faculty, 12 adjunct faculty, and two faculty with joint (secondary) appointments.

STAFF - MSVE added a third staff position during 2011-2012. Ms. Jayne Massey joined the department as an administrative assistant and department secretary.

DEPARTMENT ADVISORY BOARD - During spring 2012, MSVE established a Department Advisory Board. Initial board members are: Mr. John Dannon, Lockheed Martin; Mr. Jack Ezzell, ZelTech; Mr. Rob Lisle, HII-Newport News Shipbuilding; Dr. Tom Mastaglio, Mymic; and Mr. Jack McGinn, Secutor Systems. The board acts in an advisory capacity representing the views of the M&S community; promotes the department regionally and nationally; and supports the delivery of the department's academic programs.

STUDENT PROFESSIONAL ORGANIZATION - The MSVE Department initiated a student chapter of the Society for Computer Simulation (SCS), International. SCS will serve as the main student professional organization for MSVE; the student chapter is open to both undergraduate and graduate students interested in modeling and simulation. Dr. Jim Leathrum serves as the faculty advisor.

ACADEMIC PROGRAMS: UNDERGRADUATE M&SE PROGRAM IMPLEMENTATION - The department completed the implementation of the junior year of the M&SE program during 2011-2012 and prepared to offer the senior year of the M&SE program during 2012-2013. Senior core courses being developed include: MSIM 441: Visualization for M&SE; MSIM 487W: Capstone Design I; and MSIM 488: Capstone Design II. In addition, a number of new M&SE technical elective courses also are being prepared and include: distributed simulation; introduction to game development; modeling autonomous robotic systems; and M&S for cyber security. We expect to graduate students from the M&SE program for the first time in May 2013.

ONLINE MASTERS PROGRAM - MSVE introduced an asynchronous web-based Master of Engineering program in Modeling and Simulation (ME-M&S) during 2011-2012. The degree program consists of 10 three-credit courses, seven core courses and three elective courses; all courses are available online. There is no thesis requirement for this program. We now are able to deliver our ME-M&S program to students located around the world.

PROGRAM IMPACT - Old Dominion University is the only U.S. university offering bachelors, masters, and doctoral programs in Modeling and Simulation. During 2011-2012, MSVE enrollment included 36 undergraduate majors, 45 masters students, and 38 doctoral students. In addition, MSVE had 24 students enrolled in our undergraduate minor program. During that same period, MSVE awarded 8 masters degrees and 3 doctoral degrees. Bachelors degrees will be awarded for the first time in 2012-2013.

UNIVERSITY PERSPECTIVE

M&S STEERING COMMITTEE - M&S academics continues to expand its reach across campus. All six academic colleges continue to offer M&S graduate certificate programs or graduate emphasis areas. The M&S Steering Committee gained new leadership as Dr. Ginger Watson was appointed committee chair. A faculty recommending body, the Committee is charged with developing and enhancing interdisciplinary and multidisciplinary M&S academic opportunities. The Committee awarded 24 graduate assistantships to students working towards graduate M&S degrees and certificates; they also help to coordinate the university's many academic program offerings that now serve over 170 ODU students who either are studying M&S or applying M&S within their own discipline.

MSVE-VMASC PARTNERSHIP - The partnership between MSVE and VMASC continued to strengthen. Highlights from 2011-2012 include:

- MSVE assisted VMASC organize and host the 2012 Capstone Conference; 48 student papers were presented.
- VMASC and MSVE agree to develop a series of television informercials to highlight the importance of modeling and simulation regionally.
- The VMASC Advisory Board presented scholarships to five MSVE students to attend the MODSIM Conference.
- VMASC awarded three graduate research assistantships to MSVE students; additional awards are planned for next year.
- Nine of the VMASC senior researchers were appointed as adjunct faculty in MSVE where they taught courses and mentored students.
- VMASC and MSVE cooperated to host summer camps on computer gaming and autonomous robotic systems; they also hosted BCET's Engineering Early Advantage Program (EEAP) for entering female freshmen engineering students.

In summary, 2011-2012 was a very productive year for the Old Dominion University M&S Enterprise. We are recognized nationally and internationally for our innovative M&S research and our unique M&S academic programs. Next year promises to be even better.

Roland R. Mielke, Ph.D.
University Professor
Chair, Department of Modeling, Simulation and Visualization Engineering (MSVE)

news EVENTS

SUMMER 2011

Risk Analysis Article by VMASC Researchers Featured on DHS Web Site - A paper by Dr. Barry Ezell, Dr. John Sokolowski and Dr. Andrew Collins was not only selected as one of 2010's "Contribution to Best Issue-Linked Paper Set" by Risk Analysis, but was also featured on the Department of Homeland Security's web site. The work, "Probabilistic Risk Analysis and Terrorism Risk" (Risk Analysis, 30[4]: 575-589) by Barry Ezell, Steve Bennett, Detlof von Winterdelft, John Sokolowski and Andrew Collins is currently featured on the DHS Office of Risk Management and Analysis Mission's homepage as a reference article.

Sokolowski and Mielke On U.S. Dept of Education Panels - Two Old Dominion University modeling and simulation experts appeared on panels in the U.S. Department of Education's Modeling and Simulation Stakeholders Meeting in Washington, D.C., on July 27. John Sokolowski, executive director of ODU's VMASC, took part in a panel discussion about modeling and simulation in engineering design and manufacturing, in the practice of medicine, and in military and defense. Roland Mielke, University Professor and chair of the Department of Modeling, Simulation and Visualization Engineering in the Batten College of Engineering and Technology, moderated the second panel, on visualization and analysis teaching and training.

VMASC Awarded Prime Contractor Status Under Seaport-e MAC Program - In July 2011, the Virginia Modeling, Analysis and Simulation Center became a prime contractor under the Seaport Enhanced (Seaport-e) Multiple Award Contract (MAC) vehicle program. Established by NAVSEA Warfare Centers, Seaport-e is a web-based, e-business procurement portal designed to make the Navy more efficient and effective in contracting for professional support services and enhancing small business participation. Thomas Reese, VMASC's Director of Business Development and Technology Transfer stated of the honor "This award represents a significant achievement in advancing VMASC's strategic plan to expand and diversify its customer and industry partner base.

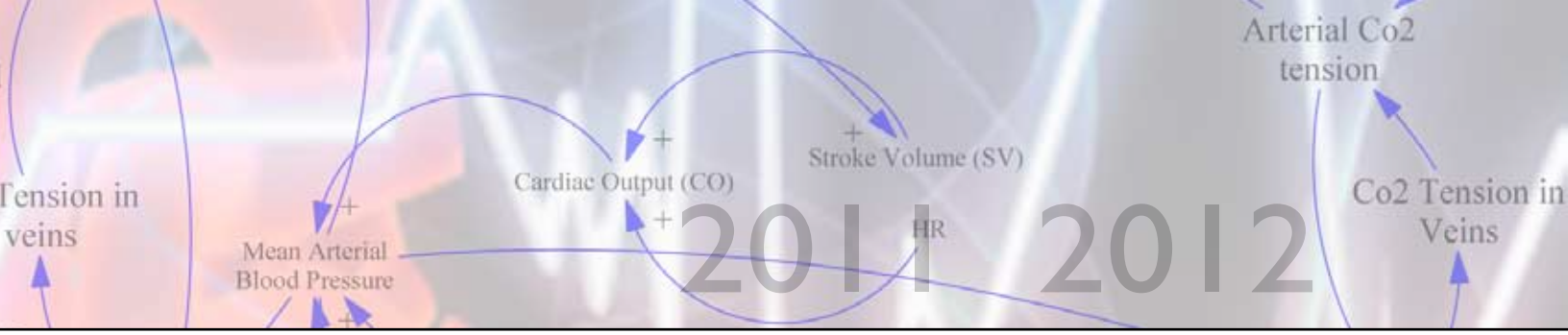
FALL 2011

Research Study Provides Valuable Data for Emergency Planners Assisting Vulnerable Populations - VMASC researchers Joshua Behr, Rafael Diaz and Barry Ezell received a $113,000 grant from the Perry Fund for the Study of Critical Issues to study valuable information in planning assistance for medically fragile and vulnerable populations. By generating maps of the area's at-risk communities, they will demonstrate which neighborhoods are made up of medically fragile and at-risk populations. Dr. Behr states, "Fully understanding the vulnerability of many social and economic population segments is essential to disaster planning and mitigation efforts, including the staging of materials and emergency services personnel prior to the storm making landfall as well as response and recovery efforts in the weeks and months following the event." The study goes far beyond simply identifying the communities that are most at risk from things like wind and storm surge. For example, more accurately estimating the spatial placement of residents that will not or cannot evacuate allows planners to more efficiently gauge where to place shelters and stage resources and personnel.

Sokolowski and Tolk Elected to International M&S Positions - VMASC Executive Director and ODU associate professor for modeling, simulation and visualization engineering Dr. John Sokolowski and Dr. Andreas Tolk, ODU professor for engineering management and systems engineering were elected to the board of directors of the Society for Modeling and Simulation. Tolk was elected for a three year-term and holds the position of secretary of the board. Sokolowski was elected for a one-year term. Tolk also recently served as special issue editor for the Journal of Simulation. Together with John Miller, a professor at the University of Georgia, he edited vol. 5, issue 3, Special Issue on Enhancing Simulation Composability and Interoperability Using Conceptual/Ontological Models.

Diaz and Behr Win Best Paper Award at European Conference - VMASC's Dr. Joshua Behr and Dr. Rafael Diaz were recently awarded Best Paper Award for a paper they presented at the 8th International Mediterranean and Latin American Modelling Multiconference in Rome, Italy in September 2011 entitled "A System Dynamics Approach to Modeling the Cost Elements of Chronic Disease Management Interventions" (Diaz R, Tulpule M, Behr JG [2011]). The duo have focused their latest research on health care management, an aspect that can be greatly improved in efficiency and analysis with modeling & simulation tools. The abstract for the award-winning paper is as follows: Medical treatment for chronic conditions forms a major portion of the US healthcare expenditure. Chronic diseases are generally associated with ailments without any permanent cure which significantly affect the health status, lifestyle, mobility and longevity of patients. A variety of chronic disease management interventions have been deployed to help patients better manage their medical condition. The main purpose of such interventions is to improve their health condition while achieving cost savings through a reduced healthcare utilization rate.

VMASC Researchers Win Best Paper at MODSIM 2011 - A submission by three Old Dominion University researchers was selected as the top paper at the recent MODSIM Modeling and Simulation Conference in Virginia Beach. The paper, "Interoperability Standards for Medical Simulation Systems," initially was selected as the top paper in the medical M&S track at the conference. The three ODU authors - Andreas Tolk, professor of engineering management in the Batten College of Engineering and Technology; Saikou Diallo, research assistant professor at ODU's Virginia Modeling, Analysis and Simulation Center; and Jose Padilla, research scientist at VMASC - say this recognition affirms that their body of research on interoperability in modeling and simulation concepts could have applicability across many more disciplines. "This paper makes a very, very strong case for modeling and simulation as a science, not just as a tool," said Tolk, who recently returned from the NATO M&S Symposium in Bern, Switzerland, where he served as the technical evaluator for NATO's Research and Technology Organization. ODU is well



positioned at the forefront of interoperability research in modeling and simulation because of the multidisciplinary M&S expertise that already exists at the university. In the past two years, interoperability research at VMASC has attracted nearly $1 million in investment, mostly from the Department of Defense. The field is still maturing and gaining acceptance, however. "Ideally, we will get M&S to the level of mathematics," Diallo said. "Interoperability is a widely used term, but it's not yet widely accepted. On an informal level, you might believe it would work, but until we scientifically prove it, show the numbers, it won't gain full acceptance."

ODU/VMASC Faculty Win Governor's Technology Award

- Two modeling and simulation research projects of Old Dominion faculty members were among 14 winners of 2011 Governor's Technology Awards presented at a lunchtime ceremony Sept. 26 in Richmond. ODU's Virginia Modeling, Analysis and Simulation Center (VMASC) produced a winner with its innovative study of homeowners' strategic mortgage defaults. The project, which won in the category of Cross-Boundary Collaboration in Modeling and Simulation, is led by Michael J. Seiler, professor and Robert M. Stanton Chair of Real Estate and Economic Development in ODU's College of Business and Public Administration, and Andrew J. Collins, research assistant professor with VMASC. "Strategic Mortgage Default in the Context of a Social Network: An Epidemiological Approach" is the title of the project of Seiler and Collins. The researchers have looked beyond homeowner defaults caused by economic circumstances such as job losses. Falling home prices and the prospect of being underwater for many years have caused countless others to voluntarily, or strategically, default on their mortgages. The Governor's Technology Awards were presented at the 2011 Commonwealth of Virginia's Innovative Technology Symposium.

WINTER 2012

VMASC & HREDA Demo at I/ITSEC 2011

- In late November, VMASC participated in the 2011 I/ITSEC Conference hosted at the Orange County Convention Center in Orlando, Florida. With many industry members participating and exhibiting, VMASC was represented by faculty and staff members on-hand to demonstrate & discuss M&S research in the following focus areas: Transportation, Homeland Security & Military Defense, and M&S Interoperability. Members of Old Dominion University's MSVE Department also attended to inform participants about the University's varied M&S degree options and expertise. Once again, it was VMASC's honor to partner with the Hampton Roads Economic Development Alliance (HREDA) to co-host the 4th annual I/ITSEC Hampton Roads Reception in Orlando, which drew M&S leaders from industry, government and academia. VMASC was also a proud sponsor of the Serious Games Showcase & Challenge. The purpose of the showcase & challenge is to "identify innovative game based solutions to problems that could affect the military both today and in the future". This event and the I/ITSEC conference certainly illustrate the strong regional partnerships that exist among M&S companies in Hampton Roads as well as our dedication to advancing M&S and supporting economic development within the region, the Commonwealth, and nationally.

Banks and Sokolowski Publication Garners Media Attention

- VMASC's John Sokolowski and Catherine Banks recently published a paper in the International Journal of System of Systems Engineering. In a December press release, the journal's editors singled out the duo's innovative approach to modeling climate change, for applying social sciences to produce necessary research in the field: "Catherine M. Banks and John A. Sokolowski of the Virginia Modeling, Analysis, and Simulation Center (VMASC) at Old Dominion University in Suffolk, Virginia, reemphasize that the consensus among scientists is that there has been and will continue to be an overall rise in global average temperatures....The VMASC team points out that there is a significant gap in research regarding the nature of the human-environment interaction with water resources management on policy areas such as health, food security, and nature conservation...The team has now suggested that the modeling of any aspect of climate change and the detailed modeling of the potential human effect on climate change must take into account the human-environment relationship as a complex system; i.e., models must fully characterize and represent the human behavior component on the environment. "Direct experiments on the real world system are not feasible," the team says, "[our] modeling methodology offers an alternative investigation as to how the complex systems found within the human-environment relationship might react to proposed efforts to reverse the effects of climate change." "Assessing the human-environment relationship: a complex-systems methodology to modeling climate change" in Int. J. System of Systems Engineering, 2011, 2, 329-346

Tolk Leads Successful M&S Conference in Asia

- Andreas Tolk, professor of engineering management and systems engineering in Old Dominion University's Batten College of Engineering and Technology, recently chaired the Military Training and Simulation Asia (MTSA) conference in Singapore. The conference, held at the end of September, demonstrated a clear cultural acceptance in Asian countries of using digital technologies like modeling and simulation to train military personnel. As defense budgets increase in several Asian countries, there are more options for investments in equipment and technologies in the military, providing an opportunity for modeling and simulation training to become more prominent. Conference topics provided practical advice on how simulation and training can help drive modernization by focusing on pre-deployment training, war gaming and data modeling. Tolk, a worldwide expert in the field of modeling and simulation interoperability and composability, stressed to conference attendees that a key facet of technology integration and cost control is the movement toward net-centric integration of simulation command and control. That means efforts must be made to ensure lessons learned in one discipline of modeling and simulation are applied across other disciplines, preventing technology researchers from continually having to reinvent the wheel. "MTSA 2011 was generally perceived to be a success and can become a regular event focusing on the needs and opportunities of this region,"Tolk said. Subject experts from Turkey, Singapore, New Zealand, Australia, the Philippines, Cambodia and South Korea also spoke at the conference.

news EVENTS

Dr. Barry Ezell Named VMASC Cheif Scientist

- Barry Ezell, a research associate professor at ODU's VMASC, has been named the center's chief scientist. Ezell, 47, a retired Army officer and combat veteran, came to VMASC with 20 years' experience in military decision-making, operations research and risk analysis for the Department of Defense (DOD), and Department of Homeland Security (DHS). A research expert in areas such as all-hazards risk and decision analysis, operations research systems analysis, insurgency and terrorism modeling and simulation, and capabilities-based assessment, Ezell has led a number of multidisciplinary research projects on VMASC's behalf. Most recently, he was principal investigator for Virginia's Office of Veterans Affairs & Homeland Security's Hampton Roads Full Scale Exercise, a four-day multipronged simulation of a number of emergency scenarios for Hampton Roads, including the aftermath of a devastating hurricane. Ezell was also project manager for the DHS Office of Risk Management and Analysis' Methodological Enhancements to the Risk Assessment Process for Informed Decision Making (RAPID), and is doing ongoing applied modeling and simulation research for DHS in a number of other disciplines.

VMASC Hosts An Open House

- The Virginia Modeling, Analysis and Simulation Center held its first Open House in November 2011, letting the regional community see and experience the many application of modeling & simulation. Members of federal, state and local governments, along with the military and other industries, including health care and manufacturing, were invited to get firsthand accounts of the Center's work. Presentations were given by VMASC researchers and demonstrations were also set up for transportation, virtual worlds and immersive environments. The event purpose of the event was to showcase the wide variety of industries in which modeling and simulation can be used. "In any industry you can name, there's opportunity that modeling and simulation can be applied," said VMASC Business Development Director Thomas Reese in an interview with *The Suffolk News Herald*. Researchers gave overviews to the visitors on many new M&S projects, including our patient blood management training tool and a body of simulation work for emergency preparedness training. The diverse turnout during the day exposed many groups of people to the many ways that modeling and simulation is being used in their lives every day.

ODU and VMASC Faculty, Staff Present at 2012 TRB Annual Meeting

- ODU Transportation Research Institute faculty participated in the 91st Annual Transportation Research Board (TRB) held in January in Washington, D.C. The presenters included Professor Asad Khattak, Assistant Professor Mecit Cetin, Assistant Professor ManWo Ng, Dr. Michael Robinson, Dr. Jun Duanmo, and several graduate students. ODU faculty, staff and students presented 15 research papers/posters, reflecting collaborations between various ODU entities, e.g., Transportation Research Institute and Virginia Modeling, Analysis, and Simulation Center, and other universities. At the conference, the Fourth Annual Lunch for related faculty, researchers, students and transportation partners was held at the Lebanese Taverna, with participation from colleagues at various universities, Virginia Department of Transportation, and the Hampton Roads Metropolitan Planning Organization.

National Modeling and Simulation Coalition Holds Inaugural Congress, Sokolowski Moderates at Event

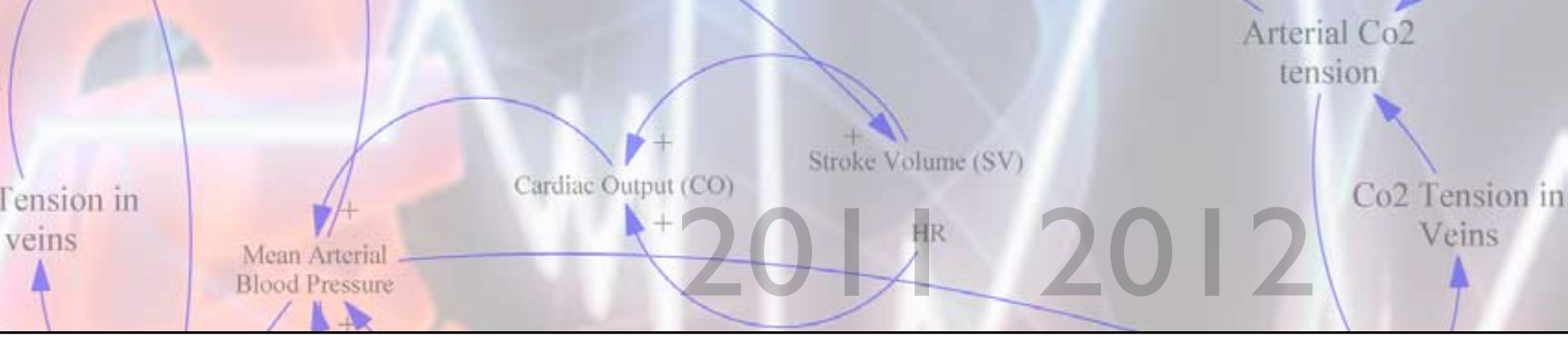
- The Inaugural Congress of the National Modeling and Simulation Coalition (NMSC) was held on February 6, 2012, in Washington D.C. This was the first annual convention of organizations interested in realizing the potential of House Resolution 487 of 2007 declaring Modeling and Simulation (M&S) a "National Critical Technology". NMSC brought together pproximately 500 senior executives from corporate, academic, government and other organizations as well as members of the U.S. House of Representatives M&S Caucus. The event featured Executive Director Dr. John Sokolowski as moderator on two panels focused on technology, research and development in modeling and simulation.

VMASC Researchers Developing 100-Year Sea Level Rise Decision Model

- According to scientific projections, global seas are projected to rise noticeably in the next 100 years as the climate warms and polar ice caps melt. Hampton Roads will be one of the urban areas in the United States most affected by rising seas. But what does that mean for agriculture? How will this impact the energy grid? And where should we build hospitals to serve a population that's likely to migrate throughout the region as areas are affected by high water? Researchers at Old Dominion University's Virginia Modeling, Analysis and Simulation Center (VMASC) are looking at these issues from a multidisciplinary perspective. With the aid of a $45,000 seed grant from ODU's Climate Change and Sea Level Rise Initiative (CCSLRI), the researchers and students have designed a continuously running simulation of the next 100 years, which decision-making authorities can use to help guide urban planning, health care and emergency preparedness decisions.

"The main idea is we're trying to construct a parallel universe," said Saikou Diallo, research assistant professor at VMASC and a co-PI of the project. "You model an area, and anything that you can see you try to model, including people." The result is CoRSE, the Continuously Running Simulation Environment sea level rise decision model. The model takes publicly accessible data in 17 domains - from agriculture and food, to energy, to emergency services, to water - and models the interconnections among those interests on a map of Hampton Roads, over a 100-year time period. CoRSE isn't meant to be a crystal ball, but rather a tool for local and national leaders to make sure decision-makers are mindful of potential impacts that choices might have, even on completely different areas of interest.

Jose Padilla, project co-PI and a research assistant professor at VMASC, said the simulation also represents a paradigm shift in the way human behavior is modeled. CoRSE makes no assumptions that people are going to follow the "right" course of action in the face of rising seas, and that uncertainty is built into the model. The model builds upon the infrastructure data taxonomy created by the U.S. Department of Homeland Security (DHS). But Padilla said CoRSE takes that as a starting point, and uses it to create a simulation-based tool for studying human dynamics - people, their interactions and their dynamics with the region where they live and work. Most of the design work for CoRSE has been tackled by graduate students Jeffrey Brelsford, Christopher Lynch, Olcay Sahin and Hamdi Kavak in ODU's Modeling, Simulation and Visualization



Engineering program. Mike Robinson, research assistant professor at VMASC, is also part of the team. The simulation currently uses off-the-shelf technology. The hope is for the final simulation to include a custom application designed at VMASC, one that's still user-friendly (Web-based) and mines data from public sources. In the meantime, VMASC researchers say CoRSE can serve three purposes for local decision-makers: as a tool to decide on resource allocations, as a decision-support tool and as a training test bed. The U.S. Department of Defense has already expressed interest in CoRSE and plans to visit VMASC later this year to look at what the team has designed.

M&S Expertise Leads To University Transportation Centers Grant as Part of Consortium

- Old Dominion University and VMASC are part of a consortium of four schools that will share in a 2012 University Transportation Centers (UTC) tier 1 grant. The research will focus on "transportation for livability by integrating vehicles and the environment," or TranLIVE for short. As a tier 1 grant recipient, ODU will share in a $3.5 million grant (requiring matching funding from participant schools) as part of a team led by the University of Idaho, and including Virginia Tech, Syracuse University and Texas Southern University. ODU's share will be approximately $600,000, plus matching funds. ODU professor Asad Khattak will work with two co-PIs, Mike Robinson, research assistant professor at VMASC, and Mecit Cetin, assistant professor of modeling and simulation research. The initial key research goals of this research are to integrate real-time data systems and advanced transportation applications to better manage congestion while minimizing environmental impacts, and to develop modeling, simulation and visualization tools that assess energy, environmental and emission impacts of transportation systems to support transportation decision making at the local, regional and national levels.

SPRING 2012

Office of Research Grant Leads to Collaboration Between VMASC, Business College

- Two researchers at ODU's Virginia Modeling, Analysis and Simulation Center (VMASC) received a $37,000 multidisciplinary seed grant from the Office of Research in December 2010 to develop a training simulation for blood management during surgery. Working with Dr. Aryeh Shander of Englewood Hospital and Medical Center in New Jersey, one of the world's leading researchers in the patient blood management field, VMASC Executive Director John Sokolowski and Catherine Banks, research associate professor at VMASC, developed a Web-based simulation training tool, Physician Training in Patient Blood Management, that teaches optimal blood management practices for patients undergoing surgery. But how do health professionals find out such a tool exists? They soon might, thanks to a unique collaboration between VMASC and ODU's College of Business and Public Administration (CBPA).

Sokolowski and Gilbert Yochum, dean of the business college, had been speaking for some time about teaming up so that CBPA students could explore commercial applications for the modeling and simulation innovations developed by VMASC researchers. A course was created in the M.B.A. program, New Venture Creation, taught by Mike Provance, assistant professor of business management. The course was introduced during the fall 2011 semester. The handful of students in Provance's class were given the blood management simulation and essentially told, "Commercialize this." The students did an analysis of the market, discovering that no such product existed in commercial form. They costed it, developed a pricing analysis and a selling model, and looked at avenues for accessing the seed funding such a venture would require. "They developed a business plan that an entrepreneur could take and form a company around. And it's not just this particular model. This company could provide medical modeling and simulation tools to the health care industry," Sokolowski said. While the engineers at VMASC knew the simulation tool had clear commercial value, they simply didn't have the expertise to take it to market, a service the M.B.A. students clearly provided, Sokolowski noted. "The partnership that was formed by our two organizations is a clear success story on how to collaborate among groups here at ODU," he said. Yochum agrees. He hopes further collaborations can be established with VMASC researchers in the days ahead. "This is the best of all worlds for our M.B.A. students: hands-on practice in the application of classroom theory. It is one of the best examples I can think of for advancing the college and university strategic interests," he said.

Sokolowski, Banks Present Medical M&S Research in Copenhagen

- VMASC executive director John Sokolowski, and Dr. Catherine Banks returned from the 13th Annual Network for Advancement of Transfusion Alternatives (NATA) Symposium with a wealth of information and a sense of validation that the immersive simulation training tool under development at VMASC is of great interest to medical professionals throughout Europe and Africa. VMASC's Patient Blood Management tool is a clinical approach to patient safety aimed at improving patient outcome by minimizing or eliminating blood transfusions. The medical conference, attended by over 500 primarily physicians from 38 countries including Nigeria and South Africa, is an international network of medical practitioners and researchers whose primary goal is to provide education in the field of transfusion medicine, with a specific focus on transfusion alternatives. Specific interest in the tool came from physicians from Great Britain, Denmark, Poland, and Nigeria. Interestingly, these countries are all at different levels of capability in terms of transfusion alternatives and patient blood management.

VMASC Research Used in Recent DHS Preparedness Toolkit

- The Department of Homeland Security's Threat and Hazard Identification and Risk Assessment Guide Comprehensive Preparedness Guide (201 Supplement 1: Toolkit First Edition April 2012) features in the first few pages an article by VMASC researchers - Probabilistic Risk Analysis and Terrorism Risk (originally published in Risk Analysis. Volume 30, Number 4, pp. 575–589. 2010). Used as an important DHS reference, this article describes a number of existing and potential approaches to terrorism risk analysis, with particular attention to the application of probabilistic risk analysis. The authors, VMASC researchers Barry Ezell, John Sokolowski and Andrew Collins as well as Steven Bennett and Detlof von Winterfeldt, explore a number of existing and potential approaches for terrorism risk analysis, focusing particularly on recent discussions regarding the applicability of

news EVENTS

probabilistic and decision analytic approaches to bioterrorism risks and the Bioterrorism Risk Assessment methodology used by the DHS and criticized by the National Academies and others. The DHS Guide particularly touts "Tools for Terrorism Risk Analysis," a section within the article that presents three categories of tools unique to probabilistic risk analysis that should be applied to terrorism risk, including logic trees, influence diagrams, systems dynamics models, game theory models, and Bayesian networks.

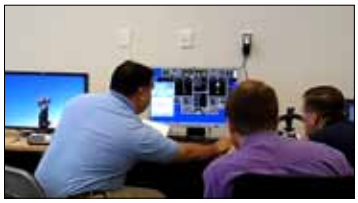
VMASC Awarded $2 million for Immersive Training for Nurses - On May 1, 2012 a team of researchers from Old Dominion University and VMASC received approximately $2 million in grant funding from the Telemedicine and Advanced Technology Research Center (TATRC) (DOD) to create a highly interactive training software program for Navy and Army nurses promoting core medical/surgical skills. These skills act as the foundation for pre-deployment trauma and teamwork training. This study called "A Theoretically Driven Investigation of the Efficacy of an Immersive Interactive Avatar Rich Virtual Environment in Pre-deployment Nursing Knowledge and Teamwork Skills Training" will involve the partnership of Drs. Yiannis Papelis, Ginger Watson, Menion Croll, Bridget Giles, and Andi Parodi, as Principal Investigator. Additionally, this team will collaborate with a pioneer in the serious gaming industry, Breakaway, LtD, and a group of Nurse Corps officers representing the Army and Navy. This two-year effort will culminate in the creation of a highly interactive software program that will link clinical training with TeamSTEPPS, a patient safety program designed by the DOD and AHRQ to inextricably link content to practice.

SUMMER 2012

Center's Risk Analysis Research Recogonized as "Most Important" By Leading Journal - Work by researchers at VMASC was cited as one of the 10 most important accomplishments in risk analysis in the past 20 years. The June 2012 issue of the journal Risk Analysis cited "Applying Intelligent Agent Models to Terrorism" as No. 8 on the list of risk analysis advancements. Much of the research work citied featured proposed methods and models for assessing and comparing threats, vulnerabilities and consequences of attacks to help allocate defensive priorities. A research paper by VMASC scientists John Sokolowski, Barry Ezell and Andy Collins, and Steven P. Bennett and Detlof von Winterfeldt, "Probabilistic Risk Analysis and Terrorism Risk," was cited as one of the key sources of that accomplishment in risk analysis.

NCCMMS Grant Builds On ODU, EVMS Medical M&S Collaboration - A $600,000 grant from the commonwealth of Virginia's Office of Economic Adjustment (OEA) will help the National Center for Collaboration in Medical Modeling and Simulation (NCCMMS) - a joint venture of Eastern Virginia Medical School (EVMS) and VMASC - extend its partnership in medical modeling and simulation into vital new areas. The center is under the co-direction of C. Donald Combs, vice president and dean with the School of Health Professions at EVMS, and John Sokolowski, executive director of VMASC. The first initiative is the Laboratory for Investigation, Validation and Verification of Emerging Simulators (LIVES). LIVES aims to be the Consumer Reports of medical modeling and simulation devices and software, providing independent testing and assessment so medical entities have an unbiased view of these kinds of tools. The grant funding also established The SimLab, a new research laboratory that aims to act as a hub for collaborative medical modeling and simulation research.

ODU, VMASC Using M&S to Improve Air Traffic Management - Researchers at VMASC have conducted several research projects with NASA Langley to develop M&S architectures and enhance NASA simulation tools used in evaluating new concepts in air-traffic management. One such tool is NASA's Airspace and Traffic Operations Simulation (ATOS). This summer, under a recently awarded $66,000 project, VMASC researchers are working closely with NASA researchers to further enhance these simulation capabilities, including investigating alternative approaches for in-flight testing of distributed air traffic management concepts. Yiannis Papelis, research professor at VMASC, is the principal investigator for the project. Working with Papelis is Menion Croll, a VMASC senior project scientist and project co-investigator. Papelis and Croll are working closely with NASA researchers to obtain the hardware, integrate it into ATOS, develop new or existing models and conduct a demonstration of the approach.



ODU to Launch New Transportation Center in Virginia Beach, VA - In an agreement with the Virginia Beach Development Authority, Old Dominion University will launch the Center for Innovative Transportation Solutions (CITS) in Virginia Beach Town Center, positioning the city and university at the forefront of transportation research for the region and beyond. The center will focus on developing and applying innovative techniques, including the expansive use of modeling and simulation, to address a broad variety of transportation challenges and issues facing the region, state and nation. Six researchers will be housed at CITS, including researcgers from Old Dominion's Batten Collefe of Engineering and VMASC's Transportation Applied Research Area.

Sokolowski Named President-Elect of World's Premier M&S Organization - VMASC executive director John Sokolowski was named president-elect of the Society for Modeling and Simulation International (SCS), the world's premier M&S organization. Sokolowski, who will serve as president-elect until June 30, 2013, then spend the next 12 months as the society's president, said its mission lines up perfectly with what VMASC strives to accomplish. Sokolowski states, "It's probably the organization that's been around the longest that has been focused on how modeling and simulation can serve society, and it's certainly an honor to be able to serve this group."


Arterial Co2
tension
Stroke Volume (SV)
Cardiac Output (CO)
Tension in
veins
Mean Arterial
Blood Pressure
HR
Co2 Tension in
Veins
2011
2012
Time left:
Score: 53

ODU Researchers Develop M&S Cube App to Share Modeling and Simulation

Researchers at Old Dominion have developed an iPad app that introduces users to the world of modeling and simulation (M&S).

The M&S Cube was developed in the Modeling and Simulation Interoperability Lab at ODU's Virginia Modeling, Analysis and Simulation Center (VMASC). The ODU Research Foundation subscribed to the iOS Developer Program, facilitating access to Apple's app ecosystem.

The free app is available for download from the iTunes online store at http://itunes.apple.com/us/app/m-s-cube/id541665433?mt=8 (search using the keywords M&S Cube, VMASC or ODURF).

Jose Padilla, research assistant professor at VMASC and co-principal investigator for the initiative, said the app was created to provide a point of reference for "all things M&S," with information ranging from M&S-related conferences and journals to news and jobs. Developing a compendium of M&S conferences was one of the drivers. "When we asked around the (VMASC) building about M&S conferences, everyone would give you a different list. We wanted this to be a one stop for M&S users," Padilla said.

It's called the Cube because it has six main components:

- M&S 101: A brief overview of what modeling and simulation is, including a list of definitions and basic terms.
- Global: The app provides the location of organizations, from corporations to universities, engaging in M&S activities. This list is updated constantly.
- M&S Markets: Based on North American Industry Classification coding, the app illustrates how M&S is applied to different industries. It provides samples of companies, educational centers and commercial products that industry uses.
- Resources: A compendium of M&S-related information sources, ranging from sites of interest, to books, to software.
- M&S Today: A daily aggregator of news about modeling and simulation around the world, as well as job postings.
- Support Information: Includes information about the app and about VMASC.

Padilla said the app could play an important role in education, as the fields of science, technology, engineering and math (STEM) receive more attention from school divisions and governments. "Modeling and simulation is a discipline that uses math and supports disciplines ranging from social sciences to engineering, making it a good candidate to exposing people to STEM studies," Padilla said.

Also, trends in technology show sales of desktop computers falling while sales of so-called tablets (and smartphones, for which VMASC is also developing an app) are increasing. "We saw this as an opportunity, an area to explore. It allows people working in M&S to take their technology with them," Padilla said. The app is currently available only on the iPad, although an app for Android and other iOS devices should be available in a few months.

Saikou Diallo, a research assistant professor at VMASC and co-PI on the project, said the information on the app is aimed not only at researchers and educators, but also at entrepreneurs who might be interested in investing in a modeling and simulation startup. "It gives them a breadth of what M&S application areas are," he said. "We want to provide a one-stop shop for M&S needs, and do it by design."

Hamdi Kavak, a doctoral student in ODU's Modeling, Simulation and Visualization Engineering program, wrote the software for the app after Padilla and Diallo created the concept. D'An Knowles Ball, VMASC's manager of marketing and communications, provided graphic design support.

As providers of M&S research, technology and products get exposed to the app, they can contact VMASC for inclusion in what may well become a far more extensive compendium of M&S resources, Padilla said.

Old Dominion's VMASC, one of the world's leading research centers for computer modeling, simulation and visualization, is a university-wide multidisciplinary research center that emphasizes modeling, simulation and visualization research, development and education.

By Brendan O'Hallarn
ODU University Relations

Researchers at ODU's VMASC Put Their Multidisciplinary Expertise to Work to Help Protect Hampton Roads from Hurricanes

It's hurricane season, and East Coast residents, including those in Hampton Roads, are checking weather forecasts and maps produced by the National Hurricane Center and The Weather Channel, keeping a wary eye on the potential for storms to form in the Atlantic.

It only takes one significant storm - a Hurricane Katrina on the Gulf Coast, or a Hurricane Isabel in Hampton Roads - to place citizens at immediate risk and disrupt life dramatically into the future.

As the lowest-lying major population center on the Eastern Seaboard (and second only to New Orleans in the United States), Hampton Roads has the potential to suffer devastating damage and loss of life from a severe weather event.

So researchers at Old Dominion University's Virginia Modeling, Analysis and Simulation Center (VMASC) have put their multidisciplinary expertise to work to provide insight that can help anticipate and manage the impact of severe storm events.

The research involves encouraging threatened citizens to evacuate, identifying who might stay behind in the event of a major storm, and addresses how to most efficiently evacuate Hampton Roads and the best way to protect and help vulnerable populations recover after a major weather event.

VMASC Executive Director John Sokolowski said the research - which involves separate teams of M&S researchers collaborating with colleagues in government, industry and academia - reflects how VMASC's mission has evolved.

"These are real-world issues, which modeling and simulation can help address in a multidisciplinary fashion," Sokolowski said. "Not only can these simulations be a tool for decision-making bodies locally and nationally, but they also reflect our commitment to modeling and simulation as a discipline."

The newest project is known as HEED, the Hurricane Evacuation Encouragement Demonstrator. Barry Ezell, chief scientist at VMASC, received a $50,000 grant from the Virginia Department of Emergency Management (VDEM) to aid and encourage evacuations.

A major problem for first responders in weather events is citizens who disregard mandatory evacuation orders. HEED is designed to graphically spotlight the risks of staying behind when a hurricane is bearing down.

A user of the model enters their ZIP code and the projected category of the storm. HEED instantly produces a graphic representation of the estimated damage to their home.

"It's a very innovative approach, graphically demonstrating just how dangerous it would be if someone stayed in their home during a major weather event," Ezell said.

According to Joshua Behr and Rafael Diaz, research associate professors at VMASC, hurricanes do not affect everyone equally. Some populations and neighborhoods exhibit more vulnerability to injury from storm surge and wind damage because of proximity to rising water, the age of housing stock and roofing materials. Other populations have more extensive financial and social networks that allow them to better prepare for and manage the outcome of a storm event.

In the past 14 months, Behr and Diaz have conducted extensive interviews of Hampton Roads households to show which neighborhoods are most likely to contain medically fragile, vulnerable and at-risk populations.

The interviews, conducted through ODU's Social Science Research Center, go far beyond simply identifying the communities that are most at risk due to the immediate effects of wind and storm surge. The researchers have developed a multidimensional metric of vulnerability that includes physical, medical, networking and psychosocial aspects of vulnerability, both during the event itself and in the post-event recovery period. These data are being used to compile a set of maps illustrating the most medically fragile and vulnerable populations in Hampton Roads, right down to the neighborhood level.

The interviewing and mapping efforts have also led to the creation of a new theory about what might motivate a citizen to ignore a mandatory evacuation order, known as "Tethering Theory."

Behr said those that have the means and ability to evacuate the region in anticipation of a storm don't always do so, and often those that, on the surface, appear to lack the means and ability to evacuate, in fact do so. To better understand why this is the case, the researchers hypothesize that social networks and a sense of obligation or professional commitment 'tether' individuals to weather a storm locally.

According to Behr, residents are tethered to the region for various reasons, including a sense of obligation to a family member who may be medically fragile and who is dependent on an informal network of family members. Residents may also be tethered due to a sense of pride in their property, or a fundamental distrust of government (and its evacuation orders).

"The behavioral choice of what to do in the face of an impending storm is much more complex than simply whether or not the individual has transportation. There are many motivating factors for defying an evacuation order," Behr said.

The VMASC information will be available to local emergency planners and state agencies like VDEM, so that they can create tailored evacuation messages that may pierce through residents' predisposition to stay.

If the majority of the region's citizens do decide to evacuate in advance of a hurricane, VMASC researchers are wrestling with one more issue: How do residents logistically leave the area via the existing road infrastructure, which features numerous choke points at bridges and tunnels?

Mike Robinson, research assistant professor and transportation research leader at VMASC, has for several years been modeling traffic patterns in Hampton Roads with senior project scientist Peter Foytik. They have presented their hurricane evacuation model for Hampton Roads to members of Congress at the Modeling and Simulation Expo in Washington, D.C.

The work is constantly being updated to incorporate new road construction and the ever-increasing number of cars on the region's roads. An evacuation for a Category 2 storm or higher would take more than 24 hours, but that time could be reduced if eastbound lanes of I-64 were reversed.

Robinson said the evacuation model uses the assumption that everyone in the affected area will leave, which other VMASC research demonstrates isn't likely to occur. However, it also emphasizes how important it is for residents to make a plan. "This is a very complex undertaking," he said.

transportation

Transportation researchers seek ways to increase individual and group mobility and safety through the use of modeling and simulation techniques. Research topics include several aspects of transportation, including traffic modeling, transportation network planning, behavioral influences and constraints, aviation safety, maritime operations, logistics and distribution, and training. VMASC researchers work closely with Old Dominion University's Transportation Research Institute, Maritime Institute, and Ship Maintenance, Operations, and Repair Institute as well as other leading experts to maximize the strength of project teams. The Transportation Laboratory at VMASC provides meeting space, dedicated graduate researcher computer use, and leading transportation simulation software. The Transportation team brings ground-breaking research and development and the innovative use of application of existing transportation simulation software to solve problems.

Transportation planning in the United States is required as a condition to receive federal transportation funds for large urban areas. Even in smaller areas, providing adequate transportation means is a significant concern. Transportation planning is inherently difficult because of the number of variables that must be considered when making decisions on how to spend available funds. Combining data on land use, population growth, and employment patterns into meaningful assessments of future requirements requires sophisticated modeling techniques.

Researchers at Virginia Modeling, Analysis and Simulation Center (VMASC) are developing and employing transportation models that will aid in making these predictions. Using state-of-the-art modeling software and proven transportation analysis methods, we have been developing models of large regional transportation systems that include private vehicle patterns, public transportation utilization, and cargo. These models can be used to conduct "what if" analyses on the impact of future changes.

Core areas of M&S tramsportation research include Modeling of large-scale networks, Dynamic traffic assignment, Microscopic simulation modeling, Crash data analysis, Vehicular ad-hoc networks, Freight system modeling, Sustainable Transportation, Value pricing, Intelligent Transportation Systems, and Psychological underpinnings of dangerous driving habits.

LEAD

Mike Robinson leads VMASC's research in transportation and evacuation modeling. Dr. Robinson is currently leading a study of suggested transportation construction projects for the Hampton Roads region, forecasting the different alternative's effectiveness at reducing the congestion issues currently experienced as well as those anticipated in the year 2034. He also leads a study of the proposed toll road connecting Hampton Roads with the Richmond-Petersburg area along the existing US 460 corridor. The particular focus of this study is the proposed road's impact on freight movement. Previous research includes the Commonwealth of Virginia-funded project to model the evacuation of the Hampton Roads region, studies for the Virginia Department of Transportation, and as the transportation modeling and simulation leader for a US Department of Labor Economic Development Assistance grant to spur the economy of southeastern Virginia. Robinson is a U.S. Naval Academy graduate who also holds a Master's degree in physics from the Naval Postgraduate School in Monterey, California. He completed his Ph.D. in Modeling and Simulation at ODU. Other research interests include decision modeling and emergency planning and decision-making.

Project Scientists: Pete Foytik, Craig Jordan

RESEARCH

2011-2012 Research Awards

Investigation of New Equilibrium Assignment Methods for the VDOT Transportation Demand Model, Virginia Department of Transportation, Period of Performance 8/9/11-1/10/13, Total Funding $199,989, Mike Robinson - co-principal investigator.

Unmet Data Needs of Transportation Planners, Virginia Department of Transportation, Period of Performance 8/1/11 – 5/1/13, Total Funding $94,408, Mike Robinson - co-principal investigator.

Trans-LIVE (Transportation for Livability by Integrating Vehicles and the Environment), Tier 1 University Transportation Center, U.S. Department of Transportation, Period of Performance 1/21/11 – 9/30/13, Total Funding $600,000, Mike Robinson - co-principal investigator.

HAMPTON ROADS HURRICANE EVACUATION SIMULATION
- Virginia Department of Emergency Management

VMASC created a dynamic traffic simulation to assess the effectiveness of the Virginia Hurricane Evacuation Plan. VMASC efforts contributed to the on-going Hurricane Restudy and work being completed by the Virginia Transportation Research Council, the U.S. Army Corps of Engineers, and commercial consultants. Using a mesoscopic transportation simulation, evacuations for hurricane strengths one through four can be simulated with each simulated 3-day evacuation requiring less than 15 minutes. In a major advance over previous studies, the model specifically considered the effects of accidents and incidents with almost 200 accidents and 1400 incidents simulated in any single scenario using 4 levels of event frequencies and durations. The final product allows visual analysis of evacuations with a variety of population response rates, participation levels, and storm strengths.

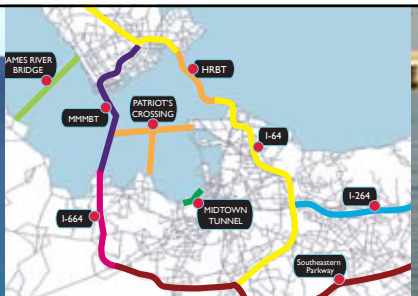
HAMPTON ROADS TRANSPORTATION ALTERNATIVES (PHASE 1 & 2)
- Virginia General Assembly Hampton Roads Transportation Subcommittee

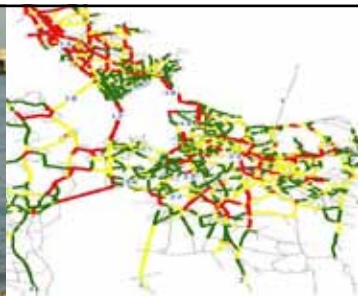
VMASC used traffic simulations for to analyze the effectiveness of various transportation network alternatives being considered to alleviate traffic congestion in the Hampton Roads region of southeastern Virginia, especially recurring congestion at the Hampton Roads Bridge/Tunnel, the region's major bottleneck. VMASC used commercial transportation software to conduct the analysis, including macro-, micro, and mesoscopic models. A freight/cargo model was also used to allow assessing the impact of large truck traffic on congestion. The VMASC model was tested against existing transportation conditions and the projected forward to the year 2030 using population projections provided by local government. The analysis included assessing the ability of new roadways to reduce congestion caused by both high volume and projected accidents and incidents.

HAMPTON ROADS-CRATER MULTIMODAL TRANSPORTATION AND DISTRIBUTION STUDY
- U.S. Department of Transportation

Using advanced modeling & simulation techniques, VMASC research will forecast the impact of a proposed limited access toll road paralleling an existing highway on freight movement and traffic patterns.

2012 PROJECTS
- Analysis of Volume Delay Functions in Travel Demand Models
- Climate Change/Sea Level Rise Decision-Support Model





medicine & healthcare

The medical and healthcare modeling and simulation applied research area has identified four areas in which we have expertise, specifically, the use of M&S for training, treatment, disease modeling and management of healthcare systems. This applied research area consists of researchers from VMASC and ODU, other universities and national health care systems. Our researchers have identified problems areas impacting medicine and health care where modeling and simulation can and should be implemented.

LEAD

Andrea Parodi leads VMASC's Medical & Health Care applied research area. Dr. Parodi earned a BA in Psychology, with minors in sociology, philosophy and theology at College of Mt. St. Vincent on the Hudson and her Baccalaureate nursing education was concluded at Pace University in Westchester, New York. She earned a Master of Science in Nursing (MSN) at Vanderbilt University, specializing in Medical-Surgical and Critical Care Nursing. In 1985, Dr Parodi was commissioned as an Ensign in the United States Navy Nurse Corps while an Assistant Professor of Baccalaureate Nursing at Austin Peay State University, Clarksville, TN. Her active duty Navy experiences include serving as Head Nurse for the Intensive Care units in Pensacola, Florida; Guantanamo Bay, Cuba; and the USNS MERCY; and was the Critical Care Educator and Researcher at Naval Medical Center, San Diego. In 1997, Dr.Parodi completed a Doctor of Science degree (DSN) at the University of Alabama at Birmingham, with dual specializations in Health Policy Analysis and Higher Education Leadership. She completed a doctoral Health Policy residency working in the office of United States Senator Daniel Inouye of Hawaii in Washington, DC.

Prior to Dr. Parodi's retirement from the Navy in 2011, she was Head of Nursing Research, Naval Medical Center Portsmouth, VA and was the Program Manager for Field Medical Technologies at Naval Health Research Center (NHRC) in San Diego, CA. As Program Manager of a multi–million dollar Code, her work focused on the testing and development of technology capabilities to support the Navy/Marine Corps mission while optimizing systems for war fighter care and outcomes. Over a long and diversified career, she has specialized in strategizing solutions for patient-care delivery systems and operational care delivery spanning civilian, military, and homeland defense. Her research includes serving as Principal Investigator, Construction and Deployment Project Manger, and Training Coordinator of the Shipboard Surgical System (SSS); serving as Principal Investigator in collaboration with Dr. Mark Lovell, University of Pittsburgh Medical Center, on the use of IMPACT®, a computer-based neuro-cognitive assessment tool. This team established the baseline scores for assessing mild traumatic brain injury in a military population and published a chapter related to the management of mTBI in Operative Techniques in Sports Medicine and Establishing Military Baseline Scores of neurocognitive functioning using the ImPACT Assessment Tool in Military Medicine.

As the primary author on a number of technical papers, one such paper assessed the capabilities for quarantine/isolation of persons aboard an aircraft carrier exposed to a highly virulent air borne viral disease. Later, in 2012, she would be the principal author of the Navy's developing doctrine for shipboard quarantine and isolation processes and responses at sea.

Dr. Parodi is currently the Principal Investigator on three funded activities, published "Theoretically-Driven Infrastructure for Supporting Healthcare Teams Training at a Military Treatment Facility" with her research associate, T.R. Turner this year in the journal of Military Medicine. She is also affiliated with numerous professional organizations.

Project Scientists: Dr. Bridget Glles, Robert Turner

RESEARCH

2011-2012 Research Awards

Shipboard Isolation Simulator Training Tool, Subcontract to DDL Omni, Period of Performance 09/26/11 – 09/12/12, $138,922. PI: Andi Parodi, DSN, Co-PI: Bridget Giles, Ph.D.

LIVES and Simulation Lab, Sponsoring Agency, Eastern Virginia Medical School (EVMS), Period of Performance 01/01/12 – 12/31/12, $50,000. PI: Andi Parodi, DSN, Co-PI: Saikou Diallo, Ph.D, Yiannis Papelis, Ph.D, Mark Scerbo, Ph.D.

Pre-Deployment Nursing Skills Training, TATRC, Period of Performance 05/01/12 – 04/30/14, $1,999,893. PI: Andi Parodi, DSN, Co-PIs: Yiannis Papelis, Ph.D, Bridget Giles, Ph.D, Sr. Project Scientist, Hector Garcia, Research Scientist, Robert Turner.

A THEORETICALLY DRIVEN INVESTIGATION OF THE EFFICACY OF AN IMMERSIVE INTERACTIVE AVATAR-RICH VIRTUAL ENVIRONMENT IN PRE-DEPLOYMENT NURSING KNOWLEDGE AND TEAMWORK SKILLS TRAINING

The innovative program will use a combination of biometric measures of learner engagement to optimize the software development phase, in turn maximizing the learners' experience. Content will present scenario-based performance training targeting clinical information and concepts of critical thinking. This two-year effort will culminate in the creation of a highly interactive software program that will link clinical training with TeamSTEPPS, a patient safety program designed by the DOD and AHRQ to inextricably link content to practice.

PHYSICIAN TRAINING IN BEDSIDE ULTRASONOGRAPHY IN CLINICAL MEDICINE

EVMS and VMASC partnered in the development of a simulation tool to train clinicians in the use of diagnostic ultrasound as an integral part of bedside physical examination. Portable bedside ultrasound devices have revolutionized the practice of medicine, and they are utilized across many specialties of medicine, such as anesthesiology, cardiology, emergency medicine, gastroenterology, obstetrics and gynecology, neurology, ophthalmology, and urology. To fully exploit this capability, students must receive increased and pathology-specific training to facilitate cognitive and mechanical proficiency. Physician Training in Bedside Ultrasonography for Clinical Medicine advances the current standards of ultrasonography education through immersive simulation training that includes a comprehensive library of pathology images which the students must extract, recognize, and discuss as part of integrating advanced ultrasound principles for patient care.

PHYSICIAN TRAINING IN PATIENT BLOOD MANAGEMENT

VMASC partnered with Englewood Hospital and Medical Center in the development of a web-based simulation training tool that teaches optimal blood management practices for patients undergoing surgery. The importance of this research stems from the mounting evidence of issues surrounding blood transfusion practice. These include the potential negative impact on patient safety and outcomes, the increasing cost to acquire and transfuse blood, and the limited supply of blood products. The Physician Training in Patient Blood Management Tool trains physicians, e.g. anesthesiologists and surgeons, whose practice involves transfusion decision-making and who might benefit from a deeper knowledge of patient blood management practices via an expedient training mechanism.

OBESITY EPIDEMIC SIMULATION TOOL

The main goal of VMASC's Obesity Epidemic Simulation Tool research is to determine the systemic conditions under which the rise in the obesity-related patient population of an area will exceed the clinical carrying capacity of that area. This requires identifying and analyzing the inputs, structure, and outputs of the system. It is also necessary to analyze how the components that make up the inputs and the structure - environment, population, and medical infrastructure - interact with each other to affect the outputs.




VIRTUAL environments

Intelligent agents are entities, or actors, that exhibit rudimentary intelligence by observing their surrounding environment and then acting according to various goals. Intelligent agents utilize perception to asses the environment and exhibit goal-directed behavior when pursuing their goals. Agent-based-modeling is a technique that employs interacting intelligent agents to model a system. Research has shown that even relatively simple agent models will yield aggregate complex behaviors while interacting with each other and with their environment. When the complexity of individual agents is increased, it is possible to create models of systems whose complexity far exceeds the capabilities of traditional modeling techniques.

Intelligent agents can be purely virtual or physical. A purely virtual agent operates completely within a virtual environment. Perception is implemented in software by creating interrogations of the virtual environment that reflect physical (i.e., line of sight) as well as cognitive constraints (i.e., cognitive overload). Acting is implemented in software by using traditional continuous system modeling approaches to simulate a physical system whose excitation is provided by the agent (i.e., steering input to a car model), or by directly setting the values of virtual parameters. A physical agent operates in the actual world. Perception is implemented by utilizing sensors such as cameras and lasers that provide information about the surrounding environment to the agent model. Acting is implemented through actuators that directly interact with the environment. Examples of physical agents include unmanned aerial or ground vehicles, and autonomous robots.

Research in the area is focused on the techniques associated with developing both virtual and physical intelligent agents, including modeling approaches for developing the virtual environments within which virtual agents operate. Domain specific knowledge is incorporated into both the agent and the environment, yielding highly complex yet realistic simulations that can be used for exploration of new concepts and system approaches. The cluster involves four focus areas, as follows.

LEAD

Dr. Yiannis Papelis is a Research Professor at Old Dominion University's Virginia Modeling Analysis & Simulation Center (VMASC). Before joining ODU, Dr. Papelis spent a year as visiting faculty at UCF, during which time he got involved in the DUC project. Before UCF, Dr. Papelis was the Chief Technical Officer at the National Advanced Driving Simulator at the Univ. of Iowa, where he conducted traffic safety research and worked extensively on agent based modeling of traffic, virtual environment modeling 3D visualization, and operator-in-the-loop simulator.

Dr. Papelis has led numerous research projects related to transportation safety using human-in-the-loop simulation, and has been active in various national and international committees. Yiannis Papelis earned a BSEE (with honors) from Southern Illinois University in 1988, a MSEE from Purdue University in 1989 and a Ph.D. degree in Electrical & Computer Engineering from the University of Iowa in 1993. He has been involved in research on immersive virtual environments used primarily in ground vehicle simulations. Dr. Papelis is currently conducting research on autonomous agent modeling issues as applied to a wide range of topics, including simulation of critical infrastructure components, realistic simulation of crowds and control of autonomous ground and aerial vehicles.

Project Scientists: Menion Croll, Hector Garcia

RESEARCH

2011-2012 Research Awards

Navigation System and Modeling & Simulation, WR Systems, Period of Performance 05/17/12 – 04/15/13, Total Funding $250,000. PI: Yiannis Papelis, Ph.D., Roland Mielke, Ph.D., James Leathrum, Ph.D., Sr. Project Scientist, Menion Croll.

Air Ground Next Generation Concepts, National Institute of Aerospace (NIA), Period of Performance 05/01/12 – 08/31/12, Total Funding $32,894. PI: Yiannis Papelis, Ph.D., Sr. Project Scientist, Menion Croll.

VIRTUAL INTELLIGENT AGENTS

Research concentrates on domain-specific virtual intelligent agents. Unlike general agent based modeling research, this focus area is concerned with use of intelligent agents for simulating specific domains that pose unique modeling challenges. As a result, a lot of the research is interdisciplinary in nature as it involves domain specific expertise. Specific areas include agents used for simulating airborne and ground aircraft traffic around large airports (class B airspace), agent cognitive models utilizing psychological foundations for simulating crowds, driver models for agents used in microscopic traffic simulation, and lastly, agents representing infrastructure elements (power, water, communications) used for simulating interdependencies in critical infrastructure systems.

PHYSICAL INTELLIGENT AGENTS

This area focuses on research in managing physical perception and task-level planning of agent activities. Typical applications include unmanned aerial and ground vehicles. The research tries to address issues such as collision avoidance, path planning and cooperative intelligent agents.

VIRTUAL ENVIRONMENTS

This focus area concentrates on the construction of virtual environments. Simulation realism is highly correlated to the complexity and fidelity of the virtual environment. Both geo-specific and geo-typical environments are considered, although each approach requires different techniques. To support real-time execution, specialized databases containing correlated data must be derived from a variety of sources that include GIS data, synthetic representations and inference.

IMMERSIVE SIMULATIONS

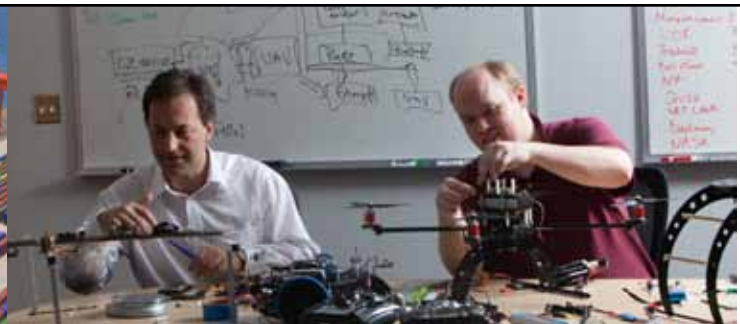
This focus area address simulations that involve a human as part of the simulated environment, and the challenges associated with agent development when such agents must interact with humans. Typical examples include driving and flight simulators, whose virtual environment include autonomous agents (i.e., other drivers or pilots). Other related examples include immersive games and training systems. Topics of interest include immersive virtual environment visualization techniques, real-time simulation techniques, realistic hardware interfaces, control loading systems and cueing subsystems.

AIRPORTS: AN AGENT-BASED END-TO-END CLASS B TERMINAL AREA OPERATIONS SIMULATION TOOL

The goal of this project is to facilitate understanding of integrated end-to-end class B terminal area operations and their coupled interactions, including airport-level exploration of proposed operational procedures. The project combines capabilities of existing airborne traffic generation tools and event-based airport simulation tools to provide a unified fast-time and real-time simulation capability that supports capacity-constrained terminal airspace operations, runway operations, and surface and gate operations. Extensive 3D visualization capabilities are also supported to provide immersive applications.

AUTOMATED TEXTURE SYNTHESIS FROM MULTI-SPECTRAL SATELLITE IMAGERY

This project is investigating the feasibility of enhancing existing low resolution/low density visual databases by using synthetic high resolution textures for terrain and newly created geometry that is based on GIS line data. High resolution terrain imagery is increasingly becoming available, however, there are significant areas for which such imagery is not available. One such application investigated in this project is for transportation planning applications, where planned developments can be visualized in real-time by specifying core parameters such as road elevation and curve radius while instantaneously observing the effect of such changes on the final design.



SOCIAL sciences

VMASC social scientists work closely with traditional methods of modeling such as statistical modeling - a method for the discovery and interpretation of patterns in large numbers of events; formal modeling - a method that provides a rigorous analytic specification of the choices actors can make and how those choices interact to produce outcomes, and agent-based modeling, a method allowing for the observation of aggregate behaviors that emerge from the interactions of large numbers of autonomous actors. VMASC's Social Sciences research facilitates research opportunities between M&S researchers at VMASC and liberal arts faculty as a way to enhance social sciences traditional modeling and analysis capacity. This is done by integrating modeling, simulation, and visualization as a tool to expand and communicate qualitative data.

Engaging modeling and simulation into an empirical analysis allows one to better understand the "what happened" and to explore the "what if." Social Scientists are integral to solving complex problems as more and more emphasis is being placed on modeling qualitative analysis alongside the quantitative data. This is important to fully grasp the history, culture, politics, economics, and social mores of a society. To do this, one must integrate various applications of modeling, simulation, and visualization into the research as a way to expand and communicate the qualitative analysis of the subject area and provide a much denser schematic for the model.

LEAD

John Sokolowski is the Executive Director of the Virginia Modeling, Analysis and Simulation Center and Associate Professor of Modeling, Simulation, and Visualization Engineering, both at Old Dominion University. He has been with the Center since 2001 and previously served as its Director of Research. He holds a Bachelor of Science in Computer Science from Purdue University, a Master of Engineering Management from Old Dominion University (ODU), and a Ph.D. in Engineering with a Concentration in Modeling and Simulation also from ODU. His research interests include human behavior modeling, decision system modeling, multiagent system simulation, and modeling and simulation representation of social systems. He has published four books on modeling and simulation and is the author of numerous journal articles and conference papers. He is a member of the Society for Modeling and Simulation International, American Association of Artificial Intelligence, Association of Computing Machinery, Phi Kappa Phi, and Phi Beta Kappa.

Prior to joining VMASC he served twenty-seven years in the U.S. Navy as a submarine officer, retiring at the rank of Captain. During his years in the military, Dr. Sokolowski served on four submarines including Executive Officer of USS Hammerhead (SSN663), Norfolk, VA and Commanding Officer of USS Benjamin Franklin (SSBN 640), Charleston, SC He also served as Head, Modeling and Simulation Division, Joint Warfighting Center (JWFC), U.S. Joint Forces Command. At JWFC, he led the U.S. military's most advanced simulation group in support of worldwide joint training. His responsibilities included design and management of complex simulation architectures and oversight of three major Department of Defense simulation programs.

Catherine Banks is Research Associate Professor at the Virginia Modeling, Analysis, and Simulation Center (VMASC) at Old Dominion University. Dr. Banks received her Ph.D. in International Studies at Old Dominion University in Norfolk, Virginia. She is currently working on the development of a medical immersive simulation training tool for a specific application and a simulation program to analyze the impact of the obesity epidemic on the medical community.

Her research also includes modeling states and their varied histories of revolution and insurgency, political economy and state volatility, and human behavior/ human modeling with applications in both the social sciences and the health sciences. Dr. Banks is the co-editor of *Principles of Modeling and Simulation: A Multidisciplinary Approach* published in 2009; co-author of *Modeling and Simulation for Analyzing Global Events* published in 2009; co-editor of *Modeling and Simulation Fundamentals: Theoretical Underpinnings and Practical Domains* published in 2010; and co-editor of *Modeling and Simulation for Medical and Health Sciences* published in 2011.

Project Scientist: Will Richards

RESEARCH

2011-2012 Research Awards

National Center for Collaborative Medical Modeling & Simulation (NCCMMS), Sponsoring Agency – Commonwealth of Virginia via Old Dominion University, Period of Performance 09/01/11 – 06/30/12, Total Funding $250,000. PI: John Sokolowski, Ph.D., Sr. Project Scientist's Menion Croll and Hector Garcia.

Support to IID & DSD, Sponsoring Agency – Joint Coalition Warfighting (JCW), Period of Performance 10/13/11 – 09/30/12, Total Funding $364,746. PI: John Sokolowski, Ph.D., Program Manager, Joseph Grosel, Senior Program Manager, Charlie Triplett.

Support to CCDD, Sponsoring Agency – Joint Coalition Warfighting (JCW), Period of Performance 10/13/11 – 09/30/12, Total Funding $190,221. PI: John Sokolowski, Ph.D., Senior Program Manager, Joseph Grosel.

Joint Staff J7 Subject Matter Expert Support, Sponsoring Agency – Joint Coalition Warfighting (JCW), Period of Performance 03/22/12 – 09/30/12, Total Funding $104,709. PI: John Sokolowski, Ph.D., Program Manager, David "Oscar" Meyr.

J7 Subject Matter Expert Support, Sponsoring Agency – Joint Coalition Warfighting (JCW), Period of Performance 03/22/12 – 09/30/12, Total Funding $146,317. PI: John Sokolowski, Ph.D., Program Manager, David "Oscar" Meyr.

J7 Subject Matter Expert Support, Sponsoring Agency – Joint Coalition Warfighting (JCW), Period of Performance 02/21/12 – 02/20/13, Total Funding $252,121. PI: John Sokolowski, Ph.D., Program Manager, David "Oscar" Meyr.

Support to Joint Coalition Warfighting, Sponsoring Agency – Joint Coalition Warfighting (JCW), Period of Performance 02/05/12 – 02/04/13, Total Funding $317,334. PI: John Sokolowski, Ph.D., Sr. Faculty/Program/Project Analyst, Robert "Bob" Kean.

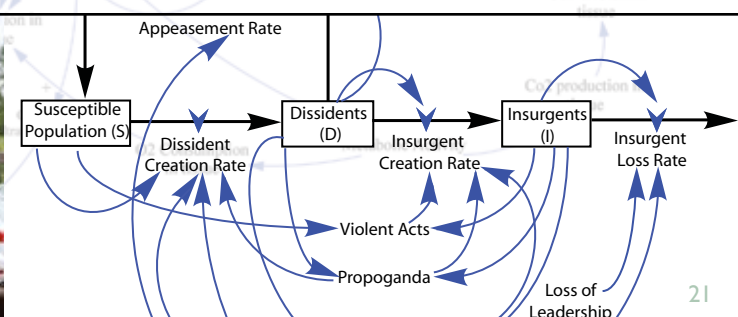
Intergovernmental Personnel Agreement (IPA), Sponsoring Agency – MSCO, Period of Performance 07/01/11 – 06/30/12, Total Funding $204,128.

Intergovernmental Personnel Agreement (IPA), Sponsoring Agency – MSCO, Period of Performance 11/01/11 – 10/31/12, Total Funding 179,048.

Intergovernmental Personnel Agreement (IPA), Sponsoring Agency – MSCO, Period of Performance 01/02/12 – 01/01/13, Total Funding $171,903.

Intergovernmental Personnel Agreement (IPA), Sponsoring Agency – Joint Staff, Period of Performance 08/01/11 – 07/31/12, Total Funding $121,555.

Intergovernmental Personnel Agreement (IPA), Sponsoring Agency – MSCO, Period of Performance 02/27/12 – 02/26/13, Total Funding $204,866.



interoperability

The M&S Interoperability applied research area focuses on the development and application of theories and methodologies in order to solve interoperability problems that cut across M&S domains. The track works closely with professionals in industry, government and academia in order to apply theoretical findings into products that reach a wide user base.

The ability to connect heterogeneous systems remains a great challenge whether we are dealing with legacy systems or integrating new solutions into existing capabilities. This is especially true in Modeling and Simulation (M&S) because every model is a purposeful simplification of reality that addresses a given problem and interoperating M&S solutions requires solving issues ranging from the technical connectivity of simulations to the conceptual composition of models.

VMASC's Modeling and Simulation Interoperability (MSI) group is comprised of three full time research professors and four graduate students working to develop theories, methodologies and tools for Modeling and Simulation (M&S) in the areas of Conceptual Modeling, Composability, Interoperability, Simulation Computability, and Verification and Validation (V&V). We depart from the premise that by studying these areas, we can facilitate the practitioners' use of M&S by providing a solid foundation for the development of new tools and applications.

LEAD

Saikou Y. Diallo is a Research Assistant Professor at VMASC. He received his M.S. in Modeling & Simulation (2006) and his Ph.D. in M&S (2010) from ODU. His research focuses on the theory of interoperability as it relates to Model-based Data Engineering and Web Services for M&S applications. Mr. Diallo has authored or co-authored over fifty publications including a number of awarded papers and articles in conferences, journals and book chapters. He participates in a number of Modeling and Simulation related organizations and conferences and is currently the co-chair of the Coalition Battle Management Language drafting group, an M&S IEEE standard development group. Dr. Diallo has studied the concepts of interoperability of simulations and composability of models for the last six years. He developed a formal theory of interoperability and is currently extending it using Model Theory. He is currently conducting research into the design of infrastructures to integrate command and control systems (C2) with simulations or robotics. He is VMASC's lead researcher in CBMS (Coalition Battle Management Services), an expert in Modeling and Simulation, and lead of the M&S Interoperability group at VMASC.

Jose J. Padilla is a Research Assistant Professor at VMASC. Dr. Padilla has studied the concept of understanding for the last four years and how the concept applies to areas such as Modeling and Simulation (M&S), Systems Science, and complexity. He is currently conducting research into how the concept of understanding can be used in the process of conceptual modeling and in the creation of autopoietic agents. His work in problem formulation with the National Centers for System of Systems Engineering provided insight into the role of humans in the perceived complexity of organizations. Dr. Padilla is part of the M&S Interoperability Group at VMASC researching in the areas of Human Social Culture Behavior (HSCB) modeling and conceptual modeling.

Andreas Tolk is a Professor of Engineering Management and Systems Engineering at Old Dominion University and a VMASC affiliate researcher for the past 10 years. Dr. Tolk support defense organization with modeling and simulation expertise since 1991. His work focuses on challenges of interoperability and composability of independently developed simulation solutions in support of common training, analyses, testing, or support of operations. He was a member of the international expert groups that wrote the NATO Modeling and Simulation Master Plan (1996) and the NATO Code of Best practice for Command and Control Assessment (2002). He was pivotal in the development of Model-based Data Engineering (MBDE) and the Levels of Conceptual Interoperability Model (LCIM). His work on simulation interoperability has been awarded multiple times by best paper awards and only recently by the first Technical Merit Award by the international Simulation Interoperability Standard Organization (SISO). Dr. Tolk contributed to several textbooks on agent-directed simulation and intelligence-based systems engineering, and organized panels on Human Social Cultural Behavior (HSCB) modeling challenges.

Students: Hamdi Kavak, Olcay Sahin, Chris Lynch

RESEARCH

VMASC plays a leadership role in M&S standardization bodies such as SISO. Over the last decade, the VMASC-MSI group has been at the forefront of developing a standard battle management language (BML) that will enable the interoperability of C4I devices with M&S systems. The group has supported several joint (JCW/JOSE) and coalition (NATO) efforts that implemented and tested BML over the last ten years. BML is an active and ongoing effort within the MSI group with the support of the Coalition Warfare Program (CWP) and the Joint Coalition Warfighting Center (JCWC) (former JFCOM).

CURRENT RESEARCH INVOLVES:

- Developing formal specifications of Modeling and Simulation, Interoperability, Conceptual Modeling, and Validation & Verification.
- Creating a Human Social Culture Behavior (HSCB) environment for the support of decision-making under short- and long-term emergency and urban-planning scenarios. As a use case, we want to assist local leaders to make long-terms decisions about sea-level rise in the Hampton Roads, VA area.
- Supporting the development and implementation of a set of web services that facilitate the interoperability of coalition C4I and M&S systems in a distributed environment (Coalition Battle Management Services – CBMS).

THEORETICAL CONTRIBUTIONS

- A mathematical model of interoperability that formally explains interoperability and its practical implication to existing standards and methods;
- A general theory of understanding that considers the level of interoperability between models by reconciling the worldviews embedded within each model;
- A mathematical model that captures the commander's intent in an executable form and thus improves human-to-machine interoperability for combat simulations.

METHODOLOGICAL CONTRIBUTIONS

- Levels of Conceptual Interoperability Model (LCIM) which describes and prescribes the type of interoperability between systems. The LCIM has been used within DoD, DoE and DoJ.
- Model-based Data Engineering that helps practitioners integrate their legacy systems in a federation. MBDE is used within several communities and was adopted by the U.S Army Test and Evaluation Command (ATEC) as their data strategy (IPG 09-7).

APPLICATION CONTRIBUTIONS

- Leading the technical development and implementation of a set of web services that facilitate the interoperability of coalition C4I and M&S systems in a distributed environment (Coalition Battle Management Services – CBMS).
- Designing and developing the Emergency/Urban Planning Model.

CONSULTING

- On simulation interoperability projects in acquisition where current simulation standards such as HLA and DIS were used to connect simulations in order to study the cost/benefits of using M&S in the acquisition process.
- On interoperability challenges: integration of multiple architectures, Live Virtual Constructive (LVC) integration challenges, challenges in fostering interoperability and reuse.

homeland SECURITY MILITARY DEFENSE

VMASC's homeland security and military defense applied research area brings high-end tier-one technical capabilities to take on the toughest challenges facing our nation. We have the resources, the people, the equipment, the facilities, the experience, and the skills to model, simulate, analyze, and to innovatively produce visualizations that address critical decision issues and meet the needs of our customers - all under one roof. Areas of interest are in risk analysis that model terrorism, homegrown violent extremist, and natural hazards.

This M&S research area is comprised of risk analysts, operations research systems analysts, project scientists, database and software developers and GIS modelers with broad experience and customers in DoD, DHS, Virginia's Office of Commonwealth Preparedness, Virginia Department of Emergency Management, Hampton Roads Planning District commission, and federally funded research and development centers. In addition to quantitative skills, we have considerable experience in group processes, expert elicitation, facilitation, and JCIDS analytic support. For projects that require clearances, we have researchers with appropriate credentials. The homeland security and military defense applied research area looks for opportunities to partner with small companies and large companies, and entrepreneurs.

Featured capabilities in this area are: All-hazards Risk and Decision Analysis, Operations Research Systems Analysis, Database and Software Development, Capabilities-Based Assessment, M&S Standards, Insurgency and Terrorism M&S, Cyber Security, and GIS Modeling.

The research activities in this area are led by VMASC faculty members and research scientists with broad experience and a customer base in DoD, DHS, Virginia's Office of Commonwealth Preparedness, Virginia Department of Emergency Management, Hampton Roads Planning District Commission, and federally funded research and development centers.

LEAD

Barry Ezell is a retired Army officer and combat veteran with 20 years experience in military decision making, operations research and risk analysis in the DoD and DHS, with special emphasis in critical infrastructure protection, Supervisory Control Data Acquisition (SCADA) systems and weapons of mass destruction terrorism risk assessments for Chemical, Biological, Radiological, and Nuclear events. His most recent projects are as the principal investigator for Virginia's Office of Veterans Affairs & Homeland Security's Hampton Roads Full Scale Exercise and project manager for DHS Office of Risk Management and Analysis' Methodological Enhancements to the Risk Assessment Process for Informed Decision Making (RAPID). Ongoing applied research and analytic work combines advanced concepts in adversary modeling for DHS S&T and in developing risk models to inform programmatic decisions at the federal and regional levels of government.

Barry is a member of Hampton Roads Urban Areas Working Group and the Hampton Roads Critical Infrastructure Key Resources Steering Group. He has authored 30+ papers and currently serves as associate editor for Military Operations Research, editor board member for the International Journal of Critical Infrastructures Systems and Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science. He is a member of the Society for Risk Analysis, Military Operations Research Society, Institute for Operations Research and the Management Sciences, and Association of the United States Army. Barry is the recipient of Society for Risk Analysis' Best Paper in a Series, 2010 and recipient of the Distinguished Graduate Award from the Center for Risk Management of Engineering Systems, University of Virginia, 1998. Barry is married to Sarah Ritchotte and has four children: Daniel (26), Michael (21), Reagan (15), and Lucille (4). Barry served as a founding member of the board of directors for Toby's Dream Foundation where in 2010, and in its first year, raised $325K to provide Dreams to children with life threatening illnesses in Hampton Roads. Barry is also president of Salem Woods Civic Association with a community of 1088 homes, 2005-2008, 2011-present.

Project Scientists: Will Richards, Kaleen Lawsure, David Flanagan

RESEARCH

2011-2012 Research Awards

HRPDC Analytical Support – Portfolio Risk Management and Web-Enabled Database Design, Sponsoring Agency – Hampton Roads Planning District Commission (HRPDC), Period of Performance 06/01/11 – 09/30/13, Total Funding $25,000. PI: Barry Ezell, Ph.D., Project Scientists William Richards and Kaleen Lawsure.

Cyber Risk to Transportation Systems, Sponsoring Agency – Virginia Department of Emergency Management (VDEM), Period of Performance 12/01/11 – 06/30/12, Total Funding $127,149. PI: Barry Ezell, Ph.D., Co-PI: Mike Robinson, Ph.D., Project Scientist, William Richards.

Hurricane Evacuation Encouragement Demonstrator (HEED Prototype), Sponsoring Agency – Virginia Department of Emergency Management (VDEM), Period of Performance 02/01/12 -02/28/14, Total Funding $50,000. PI: Barry Ezell, Ph.D., Sr. Project Scientist, Solomon Sherfey, Project Scientist, Kaleen Lawsure.

ICS Cyber Conference, Sponsoring Agency – White Hot Security, Period of Performance 06/19/12 – 11/10/12, Total Funding $57,125. PI: Barry Ezell, Ph.D., Project Scientist David Flanagan.

HOMELAND SECURITY EXERCISE INTEGRATION

VMASC is a Commonwealth of Virginia 60,000 square feet asset - a high technology facility with world-class information technology, administrative, and facility support that includes national lambda rail, enabling 10 GB Internet connectivity, experimentation lab, as well as specialized labs for research in medical, transportation, game-based learning, virtual environments, GIS, and human factors fields. VMASC has a demonstrated capability to integrate the full range of HSEEP-compliant planning conferences, scenario development and visualization, and exercise support. VMASC researchers and analysts have years of experience in DoD wargames, DHS exercises, and decision conferences involving facilitation and group processes. We offer the full spectrum of operations and training, and understand that simulation doesn't replace live training but serves to greatly enhance it.

COST EFFECTIVE TRAINING AND EDUCATION

VMASC professors offer short courses in systems analysis, decision analysis, risk analysis, vulnerability analysis, and the management sciences. VMASC offers a unique solution for emergency management and first responders needing a centrally located facility with high-speed information technology and information system capabilities to connect local and distributed personnel to conduct training. In some cases, we can achieve a 97% cost avoidance with modeling & simulation. What VMASC provides is a more efficient, more effective, cost-driven strategy that covers the full spectrum of training needs. M&S training is safe and saves time, money, fuel, equipment and lives.

ANALYTICS AND RESULTS

Since its founding in 1998, VMASC has been the go-to organization to develop a modeling and simulation workforce in Hampton Roads, VA for DoD. In addition to training and educating a workforce, VMASC has conducted numerous studies and advanced the art of modeling and simulation. We have considerable time on the workbench solving large-scale complex issues for our customers.

VMASC is an excellent partner to small and large businesses. We have a blend of senior, mid-career and young analysts to complement and supplement a Team. Our faculty provides a competitive workbench of proven talent in each of the core areas of applied research as well as quick-turn analytic support. The results of our projects and research have been used by city mayors, the governor, businesses, and the federal government. When approved by our sponsors, VMASC results are published in journals and presented at professional conferences such as MORS, INFORMS, MODSIM World, IITSEC, and the Society for Risk Analysis.




system SCIENCES

At VMASC, the System Science applied research area supports disciplines and domains by providing specialized knowledge in advanced M&S and optimization tools that capture and process intricacies associated with complex behaviors. This research area employs simulation techniques to model, analyze, and build innovative solutions and frameworks that increase the leverage of information and knowledge used to learn and forecast complex behaviors. A large number of disciplines and domains have successfully employed M&S along with optimization tools to design, modify, or improve analyses and solutions. In most cases, researchers and analysts report substantial benefits from using these advanced methods to discover and analyze complex issues.

Four recent simulation studies developed at VMASC include:

- Using a system dynamics model to understand and project the impact of interventions for chronic disease management
- Quantifying the effects of remediation and containment policy options to mitigate the impact of sea level rise on the public health
- A simulation model for determining and forecasting ambulatory healthcare demand
- Determining the impact of extreme natural events on vulnerable populations

Advanced Operations Research and Management Sciences methods, with focus on System Dynamics, Agent-Based Simulation, Monte Carlo, Discrete-Event Simulation, Mathematical Programming, and Simulation-based Optimization models, are currently being used as core techniques to analyze and evaluate Public Health, Healthcare, Transportation & Healthcare Economics, Production & Scheduling, Services, as well as Military Decision-Making.

LEAD

Rafael Diaz graduated from Old Dominion University with a Ph.D. in Modeling and Simulation in 2007, and became a Research Assistant Professor at VMASC. He holds an M.B.A degree in financial analysis and information technology from Old Dominion University and a B.S. in Industrial Engineering from Jose Maria Vargas University, Venezuela. His publications have appeared in several prestigious peer-reviewed system science journals including Production and Operations Management, International Journal of Production Economics, and International Journal of Operations Research. His research interests include operations research, operations management, production and healthcare and public health systems, dependence modeling for stochastic simulation, and simulation-based optimization methods. He worked for six years as a process engineer and management consultant prior to his academic career.

Andrew Collins has spent the last 10 years, while conducting his Ph.D. and as an analyst for the UK's Ministry of Defence, applying analytical techniques to variety of practical operations research problems. These projects include an award-winning investigation into the foreclosure contagion effect using social networks and an philosophical investigation into the use of visualization rhetoric in simulations. Dr. Collins is currently working on shortest-path algorithms for transportation networks with driver-error. Dr. Collins is the principle investigator on a federal M&S standards governance project. Other recent research areas include entrepreneurship modeling and bio-terrorism. Mr. Collins is a member of the Hampton Roads Human Modeling Group.

Joshua G. Behr received his Ph.D. training at the University of New Orleans specializing in urban and minority politics. He has taught a variety of public policy, state government, and statistical methods courses at the University of New Orleans, Southwestern Oklahoma State University, Eastern Virginia Medical School, and Old Dominion University. His is now a research professor at VMASC. He has published on a wide range of topics including presidential approval, times series methodology, minority employment patterns, public health, and emergency department utilization as well as a recent book (SUNY Press) on political redistricting and a book chapter addressing discrete event simulation. Currently, his research interests include modeling and simulating smart grid, transportation systems, and the flow of patients within a regional healthcare system.

RESEARCH

2011-2012 Research Awards

Standards in Modeling and Simulation, Sponsoring Agency – MSCO, Period of Performance 10/01/11 – 07/31/12, Total Funding $189,311. PI: Andrew Collins, Ph.D., Co-PIs: Andreas Tolk, Ph.D., John Sokolowski, Ph.D., Saikou Diallo, Ph.D., Joshua Behr, Ph.D., Sr. Project Scientist, Solomon Sherfey, Program Manager, David "Oscar" Meyr.

Joint Urban Operations, Sponsoring Agency – Department of Defense (DoD), Period of Performance 09/29/11 – 09/28/12, Total Funding $386,218. PI: Joshua Behr, Ph.D., Program Manager, David "Oscar" Meyr.

Chronic Disease Intervention Forecasting (CDIF)

VMASC and EVMS partnered in the development of a dynamic simulation training tool that allows the user to investigate the short- and long-term financial and population health trade-offs associated with chronic disease management interventions. Measuring such known health trajectories associated with chronic conditions as diabetes, congestive heart failure, asthma, arthritis, and tobacco use, these trajectories may be altered within the CDIF tool depending on compliance with and management of a medical regimen.

Successful population-level management of chronic disease requires consideration of the complex interactions among medical, behavioral, social, and environmental elements. This tool allows the user to visualize over time the efficiencies in terms of dollars and health outcomes associated with interventions. It also teaches medical students how to visualize and assess the combined impacts of their management and treatment decisions on the group of patients they serve.

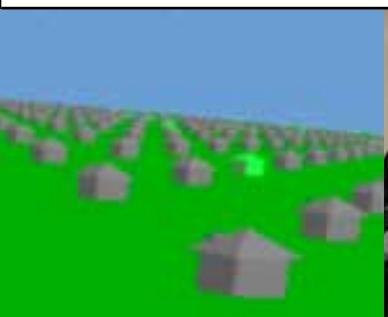
Strategic Default in the Context of a Social Network

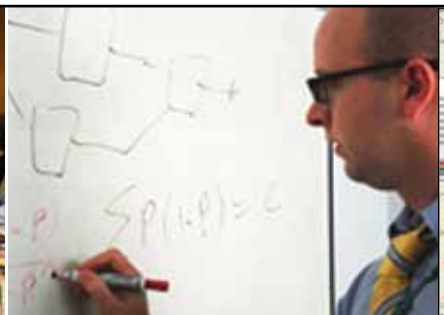
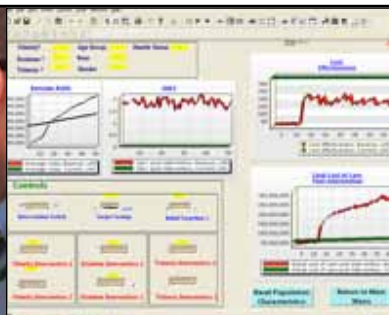
This study examines the factors that can lead to mortgage default, the role that influential members of our society play in people's decision to stop paying their mortgage and the impact on the broader housing market. The study was presented at the 2011 commonwealth of Virginia's Innovative Technology Symposium (COVITS) in Richmond on Sept. 26. It received the Governor's Technology Award for 2011 for Virginia in the category of "Cross-Boundary Collaboration in Modeling & Simulation."

The study highlights those factors that distinguish an "economic default" (caused by hardship) from "strategic default" (selected as an option by homeowners who may be underwater on their mortgage), and the methods by which an idea such as "strategic default" can be transmitted through a population by contact with individuals and through social networks. Through modeling and simulation, the authors demonstrate that defaults and foreclosures lead to lower home prices. Therefore, an epidemic of strategic defaults, initiated by advice from those who might be considered experts, can lead to the collapse of a housing market.

Modeling Community Vulnerability and Medically Fragile Populations for Natural Disaster Preparedness

This research offers a process to identify, model, and simulate medically fragile populations. The product is a metric that allows the identification and ranking of neighborhoods along the three major dimensions of vulnerability (mechanical, psycho-social, and physical/medical) involved in the individual decision to either evacuate or shelter prior to an impending natural event.



GAME-BASED learning

Many people who are younger than 40 grew up on video and computer games and have great affections with electronic games. Even the elder generations start to like games due to the immense user interactions introduced in the latest game consoles, such as Nintendo Wii. The entertainment, challenges, and excitement provided by electronic games make them so engaging. Research has shown that games can be utilized as effective tools to motivate the learners for educational and learning purposes if designed properly.

The vision of the game-based learning applied research area at VMASC is to be an important and leading player in research and development of educational games in the United States and in the world. The research area teaches game development theories and technologies, develops educational games, and promotes the use of games for educational and training purposes. We engage with academic, government, and industry partners, provide forum and facilitation for coordination, and actively seek funding from federal, state, and local agencies as well as industries. The game-based learning research area is composed of researchers with backgrounds and expertise in computer science, computer engineering, education, psychology, art and modeling, and user interactions.

VMASC Campers Show Off Their Video Game and Robot Creations at Reception on Campus

By Brendan O'Hallarn, ODU University Relations

"This is one of the craziest things you're ever going to see," a confident Rori Domino declared.

The precocious 14-year-old Rosemont Academy student was about to unveil the video game he had created at the Intermediate Game Development Camp hosted by Old Dominion University's Virginia Modeling, Analysis and Simulation Center (VMASC).

Domino was one of 12 aspiring video game designers, plus another four campers who participated in VMASC's inaugural Robotics Camp who showed off their creations to their parents, ODU staff and faculty - and to each other - at the end of their weeklong camps.

Domino's game, a version of the popular game Tank War that features pigs trying to take over the world, played on the large screen in the auditorium of the E.V. Williams Engineering and Computational Sciences Building, as he talked the audience through the rules of the shoot-'em-up game. Each of the five-minute presentations featured ingenious twists of standard video game designs by the young scientists. Games such as Galactic Mail, Tank War and Wingman Sam had a familiar look, but each took on the personality of its young, bright creator.

Yuzhong Shen, associate professor in ODU's Department of Modeling, Simulation and Visualization, one of the instructors for the VMASC game development camp, told the audience about the growth potential of video game design as a career, with salaries averaging $90,000 per year. Also, Shen said: "Modeling and simulation has much overlap with the gaming industry."

VMASC has run the camps every summer for several years, but this is the first time that the product developed by the campers was demonstrated before an audience. This year's VMASC summer camps also included, for the first time, a robotics camp. Pre-teen and teenage students built their own robots, under the guidance of Yiannis Papelis, research professor of virtual environments at VMASC, and showed off their bells and whistles to the crowd at the reception.

"You'll notice each of the robots has their own personality," Papelis said, as the wheeled machines navigated their way around a curved course marked with black tape, taking evasive action when obstacles were placed in their way. Through the week, robotics campers learned how to use parts to build the structure, sensors to provide awareness, and motors to provide movement to the robots, which were then run through obstacle courses and mazes, all the while competing against other campers' robots.

Building the device taught each participant basic STEM skills, as well as the importance of teamwork. Demonstrations of a wide variety of VMASC's own flying robots, housed in the building's state-of-the-art robotics laboratory, were also given.

New VMASC Programs Focus on Hampton Roads Youth STEM Education

The Virginia Modeling Analysis & Simulation Center (VMASC), in partnership with the Department of STEM Education and Professional Studies in ODU's Darden College of Education and the MSVE department in the Batten College of Engineering and Technology, is currently delivering an extensive program of activities that address STEM-related in-school youth programs outlined in an RFP published by Opportunity Inc. VMASC was one of several successful bidders to receive an initial 14-month award with the potential for three subsequent program years. Portsmouth Public Schools (PPS) has endorsed the effort and has agreed to participate in the project by assisting in outreach and recruitment of eligible youth, confirming WIA eligibility, consulting on how to best operationalize program elements within the context of students' academic calendar and commitments, and assisting in delivery of certain program elements. The target audience consists of WIA-eligible students in all three high schools within the Portsmouth school district. A minimum of 40 students will be served in this initial grant year. The two main goals of the program are advancing a higher graduation rate and promoting a higher rate of securing a job or admittance to a post-secondary education institution. To reach these goals, the program will measure baseline and incremental changes in knowledge, skills and attitudes toward workplace readiness and base career knowledge.

Program lead Yiannis Papelis states, "Through on-going hands-on involvement and strategic assistance, it is the program's aim that students who participate will obtain improved workplace readiness skills and be better equipped for their educational career." VMASC faculty and staff will leverage an extensive network of industrial and government contacts to establish opportunities for summer internship and week-long job shadowing assignments at participating industry and government facilities and employers throughout the Hampton Roads region, including Lockheed Martin, Northrop Grumman, Huntington-Ingalls – Newport News Shipbuilding, NASA, and MYMIC among others.

With the assistance of Portsmouth Public Schools officials, VMASC will establish in each Portsmouth high school a seminar series that will bring speakers covering a variety of STEM career-related topics. Special emphasis will be placed on presentations that deliver actionable information on preparing for the job market, career choices and job availability. The project will also leverage prior deliverables to Opportunity Inc. (Visport) as a means of exposing students to port related careers. For several years now, VMASC has offered summer camps on game development (both introductory and intermediate), general engineering, as well as digital arts for game development. VMASC recently expanded its summer camp offering to a robotics camp in July. The project team will leverage these existing camps by reserving a certain number of slots that will be made available to students participating in the In-School Youth program.

Moreover, special project activities will be offered in the areas of robotics and other structured competitions. VMASC, with assistance from Portsmouth Public Schools science directors, will promote and support student participation in existing technology based competitions and special projects. Students enrolled in the program and who choose to participate in these competitions will receive support in terms of mentoring and technical guidance. The targeted competition is the VEX Robotics Competition, which occurs twice a year. Administrative staff will also be made available to assist participating youth in preparation of applications for admission to post-secondary education institutions, as well as preparation of scholarship and financial aid applications. To re-enforce such skills, certain program activities (i.e., camp participation) will involve an application process and will thus provide opportunity for students to practice. In addition, participating youth will be given opportunities to attend a variety of university level tours, open houses and similar functions at Old Dominion University and other academic institutions in the Hampton Roads region.

VMASC Director of Business Development Thomas Reese says of this initiative, "We are very excited to work with Opportunity Inc. in providing our youth more exposure to science fields, hands-on experiences with technology, career opportunities at major employers, and college preparation essentials. It's not only part of our mission but the right thing to do for our community."

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Catherine BANKS, Ph.D.

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"The Nigerian Insurgency: Measuring the Impact of Nefarious Acts on a Volatile Petro-State", The Montreal International Forum on Economy and Trade 2011, Montreal, Quebec, August 2011.

2011 Annual Meeting Society for the Advancement of Blood Management. Poster Presentation "Physician Simulation Training in Patient Blood Management." September 22-24, 2011, Philadelphia, PA.

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Joshua BEHR, Ph.D.

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Andrew COLLINS, Ph.D.

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Saikou DIALLO, Ph.D

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Rafael DIAZ, Ph.D.

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Barry EZELL, Ph.D

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session chair

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Jose PADILLA, Ph.D

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Yiannis PAPELIS, Ph.D

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Andrea PARODI, Ph.D.

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Mike ROBINSON, Ph.D

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John SOKOLOWSKI, Ph.D.

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Andreas TOLK, Ph.D

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special recognition

Outstanding Professional Contribution Award for the work on Interoperability and Composability by the Society for Modeling and Simulation (SCS), March 25, 2012

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