VMASC ANNUAL REPORT 2016

VMASC Executive Director
John Sokolowski, Ph.D.
1030 University Blvd., Suffolk, VA 23435
jsokolow@odu.edu, 757-686-6232
www.vmasc.odu.edu
# Table of Contents

Message from the Executive Director........2  
News and Events.....................................4  
Message from the VMASC Board of Advisors.............................20  
VMASC Awards..................................22  
VMASC Scholarly Work.........................23  
  Journal Articles.........................23  
  Book Chapters.........................28  
  Conference Proceedings and  
    Presentations....................28  
VMASC Special Contributions............31  
VMASC Industry Association............34  
Industry Acknowledgements..........35
Message from the VMASC Executive Director

In our last annual report I outlined a couple of new research initiatives that we were putting in place. These initiatives were big data and cyber security. I would like to update you on the implementation of those initiatives. As always these complement our work in the military, homeland security, medical, and transportation areas. The area of big data cuts across almost all of our other research thrusts. Because of the global reach of these areas, large amounts of data must be collected and analyzed as part of model development. Our investment in this area is clearly paying off since we have been able to leverage this expertise in several funded research projects cutting across several areas. It is clear that this capability will continue to grow over the next several years.

In the area of cyber security we have made a strategic hire of a well-funded faculty member with significant expertise in this area. We are now part of three cyber security centers of excellence, all with different foci in the broad expanse of this area. The university is also making cyber security a main thrust and VMASC will be the center of this effort supporting various laboratory needs and faculty collaboration. We will not only focus on government support in this area but will also address cyber research supporting the commercial sector to include health care and manufacturing.

We added an additional focus area near the end of this year. That area is criminal justice. The area of criminology has key components that affect our homeland security and cyber efforts. Having expertise in this area will clearly add some needed emphasis to this area that must be accounted for when trying to capture the behavior in each of these areas. Even outside of these areas there are opportunities to apply modeling and simulation to many criminal theories to provide insight into criminal behavior that only M&S can take on.

We have also had a busy year with our transportation and infrastructure resiliency modeling efforts. We developed a micro traffic simulation for the City of Virginia Beach. It was likely the second largest micro traffic simulation ever built. It provided the City with a detailed traffic model of the entire city that included all vehicles, primary roads and intersections, and all signal light timing. It provides them the capability to do all types of traffic and urban planning analysis with a validated simulation that can provide accurate insight on traffic behavior in response to many different scenarios.

On the resiliency side our researchers have played a significant role in using modeling and simulation to characterize the impact of recurring flooding on the Hampton Roads region. We have shown its impact across many areas such as health care, housing, and
employment. The federal government has recognized our efforts in this area as critical to their assessment process.

As you can see we have had another busy and successful year. We will continue to grow the areas pointed out above and also look for new opportunities in which to show the value of modeling and simulation.

John Sokolowski

VMASC Executive Director
VMASC Summer 3D Modeling, Unity Game Development and Robotics Camps

In 2015 and 2016, VMASC experienced another successful summer under the instruction of Research Professor, Dr. Yiannis Papelis, Sr. Project Scientist's Hector Garcia and Menion Croll, along with returning game camp interns Caleb Ralph, Joshua Ralph, Samantha Henry and Brian Perry. VMASC continues to develop new and interesting ways to expose technology to campers in support of STEM education.

This year we provided six, one week long camps in Robotics, 3D Modeling, 3D Modeling with Printing and Unity Game Development. Computer literacy and STEM (Science, Technology, Engineering, and Math) are at the forefront of today's educational initiatives. Both have the potential of making individuals, young and old, participants of the ongoing technological revolution by opening the doors to entrepreneurship and well-paid job opportunities. The increased presence of social media, mobile applications, and mobile devices have made computing ubiquitous and computer programming a desirable and sought-after skill that can be applied in any field where computers are used. STEM has been and will be the driving force behind ocean and space exploration, advanced manufacturing, robotics, biotechnology, and transportation to mention a few. STEM education is also considered crucial as reported by the National Science Foundation's National Science Board in 2007.

One approach to increasing K-12 exposure to STEM principles and applications is through modeling and simulation (M&S). M&S provides the means to capture a real or imaginary system in a computer and ask questions about that system. M&S helps develop the ability to: 1) meaningfully simplify a complex problem; 2) capture the
problem in a model; 3) describe the model in a computer language; 4) collect meaningful input data; 5) execute the model over time; 6) obtain and analyze results; and 7) make inferences about a potential solution to the problem. Further, models and simulations expose students to mathematics, logic, probability and statistics as well as help develop critical problem solving and analytical skills.

We at VMASC believe that one of the best ways to demonstrate our commitment to advancing the discipline and practice of modeling and simulation is by extending our reach to enrich the education of our youngest minds. We undertake this valuable task by engaging with educators in our community and by providing students with hands-on programs and multiple specialized experiences throughout the year.

Our camps continue to exceed our expectations by increased enrollment each year. Due to requests for camp participation, we now offer two Unity Game Camps and new this year was 3D Modeling with Printing. Each camper took home a 3D modeling printer along with cartridges to design and create their own personal models. Our Robotics camp continues to bring the best and brightest new minds into the world of electronics. Each camper builds robot models utilizing computer software, electrical components and attachments created by 3D model printing. These robots go home with each student to enhance and build upon the knowledge gained while at camp.

Engineering Early Advantage Program - EEAP
Research Assistant Professor’s, Dr. Andrew Collins and Dr. Jose Padilla, Sr. Project Scientist, Peter Foytik supported The ODU’s Engineering Early Advantage Program for Women (eEAPw). This program consists of 4 weeks of academic and career enhancing activities in a unique engineering setting.

This summer, the 15 participants worked at the Virginia Modeling, Analysis and Simulation Center (VMASC) as well as the ODU Department of Modeling, Simulation and Visualization Engineering. In addition to the project-based learning at VMASC and the MSVE Department, participants met with faculty administrators and current ODU Engineering students to learn more about life on campus. An important component of the program is the opportunity to see engineering in action by field trips to and visits from area engineering organizations.

On the first day of Summer STEAM Encryption class, VMASC Research Assistant Professor, Dr. Andrew Collins shared that he typically taught graduate student. He stated, “I’ll just have to treat you like them.” The Summer STEAM students sat right up and ready for the challenge. Dr. Collins went on to explain that students would be exposed to a wide range of code-breaking applied learning scenarios.

There are many students in the Commonwealth who do not flourish in a “regular” classroom, but who discover their academic and social footing among peers in intensive, immersive summer enrichment programs. Each year VMASC continues to support their initiative and provide subject matter experts in their field to help them with their program.
Modeling Religion Conference

The Modeling Religion Project (MRP) First Consultation Conference brought together members of the Institute for the Bio-Cultural Study of Religion (ICBSR), the Virginia Modeling, Analysis and Simulation Center (VMASC), and consultants in Modeling and Simulation (M&S) and the scientific study of religion (SSR). The objective of the conference was to explore the current and future role of M&S in supporting the scientific study of religion and the creation of a Complex Learner Agent Simulation Platform (CLASP) tool that allows users to test theories of religion. The conference identified and advanced the theoretical, technical, and strategic challenges of CLASP. Numerous use cases, capability requirements, tool constraints, architecture challenges, validation challenges, as well as specific challenges dealing with the creation of agent-based models for CLASP were identified during the conference. A documentary film on the use of M&S to support the SSR accompanies this project. As such, part of the conference activities included generating ideas for the film and recording interviews with the consultants and team members. All of the information gained throughout the conference supports the design of the CLASP architecture and focuses on the manner in which users will be able to meaningfully specify feature of religion using CLASP.

VMASC Facility Tour and Technology Showcase

Parents, teachers and students of grades 8th – 12th interested or engaged in Science, Technology, Engineering and Mathematics (STEM) were encouraged to take part in our fall facility tour and technology showcase on October 29, 2015. It was a great opportunity for youth and young adults to learn more about the discipline of Modeling & Simulation (M&S) and how it is being applied across diverse career fields and industries.

Thomas Reese welcoming the students

Our researchers and staff provided tours throughout the facility touching on areas such as Transportation, Medical and Healthcare, Medical Tools development, CLOUD computing, Analytics and Pedestrian Modeling. Students were provided the opportunity for hands on interaction along
with driving a flight and driving simulator. Some were also offered the chance to perform medical care to medical simulation manikin’s and augmented patient simulators.

**V. Andrea Parodi** provided hands-on medical demonstration with military manikin simulator.

Students were provided a hands-on demonstration of the Augmented Patient Simulator provided by ODU’s Department of Modeling & Simulation.

**Dr. Joshua Behr** provided the students with a presentation on Sea Level Rise and Severe Storm Vulnerability.

Ph.D. student, **Hamdi Kavak** provided presentation on CLOUDES: Rethinking How We Learn, Build and Play with Simulation.

Students were able to test their driving skills with a Hands-on Driving Simulator.

**Dr. Erika Frydenlund** provided a presentation on Pedestrian Modeling.
This STEM outreach will be a yearly activity scheduled each October. By stimulating young minds, we hope to build future modelers and simulators in Hampton Roads.

In attendance for this event were approximately 400 students interested in STEM education from area schools in Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, Suffolk, Virginia Beach, and as far away as Kill Devil Hills, NC.

NAVAIR MSIM Course

In cooperation with the ODU Modeling, Simulation, Visualization and Engineering Department, Research Associate Professor, Dr. Saikou Diallo continues to provide course instruction to 20 professionals from NAVAIR seeking a certification in Modeling and Simulation. The students learned the basics of M&S and completed a class project in which they developed, built and analyzed a simulation from start to finish.

Board of Advisors Annual Meeting

At this year’s Annual Board of Advisor’s (BoA) meeting, the board presented ODU’s Modeling, Simulation, Visualization and Engineering Department (MSVE) with funding in the amount of $18,500 in support of undergraduate and graduate student scholarships, course text books and support for the annual Capstone Conference.

Additionally, the BoA voted to establish an endowment account in support the MSVE department and provided MSVE Department Chair, Dr. Rick McKenzie with a check in the amount of $50,000.
Concluding the annual meeting, Vice Chair, Mr. Johnny Garcia, SimIS facilitated the election process for three vacant seats currently held by Stephen Parker, Jason Bewley and Frank Munoz. The nominations for replacement members were nominated and accepted. Those new members are Jan Ward, Northrop Grumman, John Carl, BAH and Rob Lisle, Huntington Ingalls Industries.

---

**Modeling & Simulation Engineering**
**ABET Accredited**

The Bachelor of Science in Modeling and Simulation Engineering is now an ABET Accredited Program! This undergraduate program is the first in the nation in modeling and simulation to be established and accredited.

---

**MODSIM World Conference and Expo 2016**

This year the ModSim World Conference and Expo was held April 26 – 28, 2016 in Virginia Beach, VA. This years focus was “Empowering User Communities with Modeling and Simulation.” The VMASC Industry Association (VIA) along with VMASC sponsored the event to include the opening banquet, entrepenuer competition and contributing sponsor. Each year the modsim conference brings together participants all across the globe to discuss real world problems and solutions.
VMASC Hires Faculty Researcher in Cyber-Security

Dr. Sachin Shetty joins the VMASC research team in July 2016 as the second faculty member to be hired as part of the Center for Cybersecurity Education and Research at ODU. Dr. Shetty is a Ph.D. graduate of Old Dominion (2007). He will hold a joint appointment as an associate professor in ODU's Virginia Modeling and Simulation Center (VMASC) and the Department of Modeling, Simulation, and Visualization Engineering (MSVE).

Shetty was an associate professor of electrical and computer engineering at Tennessee State University. He also served as an engineer with the Expeditionary Electronic Warfare Systems Division, Naval Surface Warfare Center, in Crane, Ind. Previously, 2007-2008, and taught electrical and computer engineering at ODU.

ODU Modeling & Simulation Researcher Looks for Clues in Big Data

For a decade Dr. Ross Gore has looked in the world of big data for answers to society's complex problems. Sometimes, the data come from surprising sources. The most recent paper he co-wrote looked at the relationship between Twitter content and the rates of obesity across the United States.

To Dr. Gore, it's a challenge, taking giant public data sources and analyzing them in new and creative ways, hoping for breakthroughs in how government policies can be shaped or tweaked to benefit society.

Since 2014, Dr. Gore has been a research assistant professor at Old Dominion's Virginia Modeling, Analysis and Simulation Center (VMASC). Working with professors who specialize in completely different disciplines has helped him discover new research applications.

With Dr. Saikou Diallo and Dr. Jose Padilla, VMASC research assistant professors, Gore recently published the paper exploring the relationship between Twitter content and geographic differences in obesity rates. Dr. Gore also was part of a team of researchers to win an award from the Bill and Melinda Gates Foundation in 2015 for using
data to aid development in the West African country of Senegal.

"The main connection is modeling," Gore said. "But if I have a question about vulnerability, I can go talk to Josh (Behr, research associate professor). If I have a question about transportation, I can talk to Mike (Robinson, research associate professor). And they're just down the hall. It really opens up the possibility of questions to answer."

---

Research, Cooperation, a Vision for Combatting Rising Seas

Hampton Roads’ changing climate holds enormous implications. These changes have the potential to fundamentally alter our physical landscape, economy, national readiness and quality of life. Responding to a changing climate is daunting, but we are making headway. There is reason for optimism.

Old Dominion University has long produced cutting-edge research that advances the science of oceanography, climatology and geophysics. But the university is also at the forefront in deepening our understanding of the social, economic and health impacts of these changes and has articulated an approach to building resiliency. For example, we have combined the physical modeling of storm impacts with the economic health and well-being of vulnerable populations.

The approach emerging from ODU emphasizes the intersection of the physical, engineering and social sciences by recognizing that Hampton Roads is a “system of systems”—not only critical infrastructure like transportation, communications and water, but also critical social, economic and health systems. Through investment in mitigation and adaptation strategies, we can toughen these critical systems and, in turn, strengthen our region’s resilience.

We must stay focused on the primary fronts.

Continue to mitigate storm-related risks, meaning that we must make less severe the immediate- and mid-term consequences of larger storm events. Our coastal region historically is subject to tropical storms, Nor’easters and hurricanes. Localities and the state have increased their investments in emergency operations centers and other critical infrastructure, as well as planning and exercising response, logistics and communications.

Continue to take adaptive measures. Last year, the General Assembly directed Hampton Roads localities to incorporate in their comprehensive planning processes strategies to combat sea-level rise and recurrent flooding. Comprehensive planning efforts include measures to halt development in certain low-lying areas, protection of other areas through storm water improvements or coastal barriers, and greater efforts to increase elevations and flood-proof homes.

Work toward longer-term, enhanced resilience. Resilience is the ability of our systems, on the whole, to withstand and
recovery from a shock inflicted by a hazard, as well as the ability of the region to evolve and adapt with a changing environment.

Enhanced resilience is more than hardening critical infrastructure and exercising emergency response and recovery efforts. It includes establishing a vision to re-shape the community and redefine land use in ways that will make the region more livable.

Adopting such a vision can help guide recovery efforts. Resilience is more than maintaining or rebuilding on the same footprints. It’s striving for an environment built to last, incorporating venues that enhance livability, sustainability and quality of life.

Beginning with small gatherings of scientists, citizens and community and government leaders, efforts to build regional resilience have garnered federal attention. The White House’s support for the intergovernmental coordinating project that brought together federal, state and local agencies within the region — and the region’s recent successful response to the National Disaster Resiliency Competition, which drew more than $120 million in part to support infrastructure and solutions in Norfolk’s Chesterfield Heights — are good illustrations.

The region’s efforts thus far exhibit what is best about America: a belief that we can tackle any problem, an ability to engage and harness our collective ingenuity and an unyielding optimism for the future. Are we better off today than we were a decade ago? Clearly, there is a heightened level of awareness, concrete evidence of local and regional efforts to incorporate sea level rise into planning and the beginning of an alignment of resources to address adaptation.

Much work remains to be done, but many indicators suggest we are heading in the right direction.

---

**Undergraduate Research and Scholarship (PURS)**

**Social Justice & Transportation Equity**

The Office of Research and the Honors College awarded VMASC Research Assistant Professor, Dr. Erika Frydenlund as one of the first recipients of the Program for Undergraduate Research and Scholarship (PURS).

VMASC is seeking to develop a new area of expertise in transportation equity, building on its successful research in vulnerable communities and evacuations, led by Dr. Joshua Behr and Dr. Rafael Diaz, and transportation planning and evacuation led by Dr. Mike Robinson. Transportation equity research intersects both of these fields, as well as aspects of Urban Studies, Women’s Studies, Political Science, and Sociology more broadly. The confluence of these topic areas to answer questions about transportation access embodies the multidisciplinary research goals of ODU and promotes deeply scholar-activist work. Through this new initiative at VMASC, an undergraduate researcher was given the opportunity to work with a research faculty member through the Program for
Undergraduate Research and Scholarship (PURS) grant. Carrie Parsons, a Women’s Studies and Public Service double-major gained experience with a broad range of qualitative and quantitative research methodologies, bridging the traditional quantitative/qualitative divide. Parsons expanded her research skills by contributing to conference presentations and journal publications. Her work with VMASC faculty has provided a foundation on which to further the new transportation equity research track.

VMASC Researchers hired to analyze effectiveness of Department of Homeland Security Risk Assessment Tools

A program designed by researchers at Old Dominion University's Virginia Modeling, Analysis and Simulation Center (VMASC) will be deployed to analyze the cost effectiveness of billions of dollars of U.S. Department of Homeland Security (DHS) programs that mitigate terrorism risk.

Dr. Barry Ezell, VMASC chief scientist, is the principal investigator on a 12-month $250,000 grant, which will allow DHS to determine which of its substantial investments in keeping America safe have worked the best. The team members include Ross Gore, research assistant professor, and David Flanagan, project scientist.

"For 10 years, Homeland Security has conducted terrorism risk assessments," he said. "What is needed is a way to determine how well programs are mitigating terrorism risk from a cost effectiveness perspective."

Using as a foundation the Terrorism Risk Assessment Simulation (TRASIM) program developed by VMASC last year, the grant will support the creation of a decision-support system known as MONA (Mitigation Optimization & Net Assessment), which will allow DHS and its partners to map the success and failure of its programs across the spectrum.

Ezell likened the process to a financial planner showing a client how each investment of a portfolio is performing. "We can then separate the programs that are working very well with those that are under-performing from a cost-benefit analysis," he said.

In a time of budgetary pressures for all federal agencies, that will help them determine the most efficient ways of shoring up areas where the United States has vulnerabilities, post-9/11.

"If we're paying billions of dollars for a program and it's not working the way it should, that's money that can be reallocated to other strategic needs," Ezell said.

The project will be done in four phases. To begin, VMASC scientists will survey existing tools to identify the architecture used for the MONA decision support system. The Old Dominion team will also identify stakeholders at all levels of government that will use it.

Following design and implementation of the systems required to make MONA operational, the project will conclude with
testing to ensure it provides accurate information to emergency managers at all levels of government and then training workshops to ensure personnel in these roles can use these tools to make the best risk assessment decisions.

TRASIM, the program created by VMASC scientists, aims to make terrorism risk models faster and less expensive, providing a more accessible decision-making tool.

Ezell said the creation of TRASIM is part of a strategic shift at VMASC, attempting to tailor its modeling and simulation solutions to the real needs of potential customers, in and out of government.

"It's less about writing white papers and more about creating programs that can be implemented and taken to the customer," he said. "This project (MONA) will put the data and the tools in the hands of the DHS analysts, so they can make the best decisions."

One of the world's leading research centers for computer modeling, simulation, and visualization, Old Dominion University's VMASC is dedicated to solving real-world problems through the application of modeling and simulation techniques and to developing new approaches to represent physical, social and human systems in simulation.

Strategically Grouping Individuals: The Next Stage for Agent-based Simulation

Agent-based modeling (ABM) is emerging as a major paradigm within the simulation community. Agent-based simulations have broken through to non-engineering domains, with successes that make other simulations approaches envious. Researchers have used ABM to gain insight in a surprising range of application from bacteria colonies to the foreclosure crisis. The strength of ABM is its modeling focus on the individual agents and how their behaviors effect the global system. For example, the Schelling’s classic segregation model shows us that homeowner agents with only a slight preference to have neighbors similar to themselves (homophily) will lead to citywide segregation.

The focus on heterogeneous individuals, or individual things, is a strength of ABM because it overcomes the assumptions of uniformity found in macro-simulation approaches; individuals are different and these differences have led to diverse world and society around us. Imagine a world where everyone’s favorite ice cream was strawberry or favorite color was blue. However, an ABM must consider how its agents interact, directly or indirectly, because without interaction you are just doing lots of individual-based modeling. Simplistic rules of interaction maybe appropriate when modeling bacteria or atoms but humans are more complex. They communicate with each other, trade, befriend, and form groups.
Forming groups has been an essential part of the human race from hunter-gather villages to social network websites. The reasons people join, or leave, a group can be due to a wide variety of factors, for example, homophily, popularity, or strategic benefit. A simulation that does not take into account groups could lead to erroneous results. For example, in an evacuation model, one might assume that individuals will flee from danger if possible and conclude that contraflow should be imposed on all roads; however, an individual might wish to move towards the danger to retrieve a family member from their current location, such as school or nursing home.

Traditional, Social Network Analysis (SNA) is the common approach used to study group formation in modern academia. However, the current methods used for group formation (Barabasi-Albert models or Erdos-Renyi models) focus on homophily or popularity but not strategic benefit. Some agent-based models, like Joshua Epstein’s sugarscape, included group formation but only at a simplistic level and the agents are definitely not acting strategically. The study of strategic action selection, by interacting agents, is called Game Theory.

Game Theory is a mathematical modeling approach that provides the normative strategies of agents interacting. Analysts use Game Theory to explore a variety of human interactions including prisoner interrogations, auctions, and contract negotiations. A subfield of Game Theory is Cooperative Game Theory (or n-person game theory), which explicitly looks at strategic coalition (group) formation of situations involving three or more individuals. Though Game Theory provides a method to analyze strategic group formation, it is not practical to implement because of the computational costs of solving Cooperative Game Theory are staggering.

Researchers at VMASC, led by Dr. Andrew Collins, have been looking into ways to overcome the computational limitations of Cooperative Game Theory by introducing parts of it into agent-based models. Our approach involves making iterative changes to the groups so allowing them to evolve over time. We applied the approach to a variety of different situations: coalition formation of countries, refugee movement, and, currently, terrorist group formation.

Figure 1: Netlogo output of a simplistic group formation of the world.

The key to our method is making the agents weigh the benefit of group membership against some utility criteria. For example, the researchers have used the method to model group formation in refugee movement. In this model, refugees must weigh up the benefit of safety in numbers against movement speed (as a group will move at the speed of its slowest member). If safety in numbers is extremely important, to the agents, then they will form a single large group and if speed is extremely important then they will not form groups at all (because joining a group will slow them down to the speed of the slowest agent in that group). What is interesting is the results between these two extremes where agents balance safety with speed; in this case, the agents split into large groups with each group sprouting of faster subgroups during
the simulation run. This work on refugee movement extends work undertaken by VMASC on group formation in pedestrian evacuations and will be presented at the upcoming Winter Simulation Conference.

We intend this research to bridge the gap between ABM and Game Theory. By introducing strategic group formation into agent-based modeling, we are providing a method to increase the resolution of ABM for modeling humans that will, hopefully, lead to better fidelity simulations. To find out more about ABM or Game Theory, please contact ajcollin@odu.edu.

MS&V Student Capstone Conference 2016

The Capstone Conference features students in Modeling and Simulation (M&S) undergraduate & graduate degree programs and fields from many colleges or universities. Students present their research to an audience of fellow students, faculty, judges, and other distinguished guests. For the students, these presentations afford them the opportunity to impart their innovative research to members of the M&S community from academic, industry, and government backgrounds. The MS&V Student Capstone Conference offered eight presentation tracks this year. Each track had two awards: best paper and the best presentation. The overall winner of the conference will be honored with the Gene Newman award!

As with each year, West Point Academy supports their cadets attending and presenting at the conference. This year, their students were the proud recipients of Best Paper in their Track.

In Memory

Mr. Eugene Gray Newman passed away September 8, 2013, but his legacy and dedication to modeling and simulation lives on through our annual Student Capstone Conference.

This year John Shull was awarded the Gene Newman Award for Excellence in Modeling & Simulation.
Innovation continues at the Virginia Modeling, Analysis and Simulation Center (VMASC) at Old Dominion University. The center, which brings cutting-edge modeling and simulation approaches to complex challenges facing governments and private industries, has recently completed a number of successful projects, including Microscopic Transportation Models created for the cities of Portsmouth and Virginia Beach. The center also recently lent its expertise in big data analytics to help identify underserved stroke and heart attack risk zones in the country of Senegal.

One of the world’s leading research centers for computer modeling, simulation, and visualization, VMASC has been operating through ODU since 1997. “VMASC’s goal has always been to provide critical and cost-effective decision support options for leaders at every level,” said Thomas Reese, Director of Business Development. “We are proud of the role VMASC has played in supporting the well-being of our communities and look forward to continuing to partner with businesses and governments in Hampton Roads and beyond in this mission.”

VMASC welcomes G2-OPS to their Industry Association in 2016.

G2-OPS is a small business with big capabilities in model-based systems engineering (MBSE), cybersecurity architectural analysis and strategic consulting. Government clients depend on them to satisfy requirements – or to analyze them and make new recommendations – for projects of all kinds and sizes. Clients trust G2 Ops to provide cost-effective solutions to current challenges while giving the tools to model, protect, maintain, grow and optimize organizations and its critical infrastructures.

Mr. Bratislav Cvijetic-BaTo is a graphic artist who has developed 3D Graphics and...
Animations for games for over ten years. BaTo has a BFA in Illustration from UNCC and an MFA in Animation from SCAD. He began his employment with VMASC in June 2016 as a Senior Project Scientist, where he develops graphics and animations for different projects. Prior to joining VMASC BaTo has worked as a Research Associate for Creative Gaming and Simulation Lab. BaTo was responsible for developing the graphics for the “VNurse”, a 4.2-million-dollar project. He has also produced graphics for iOcean, iAstro, iChem apps and several students’ thesis apps and games. He has also been actively involved with workshops, thesis committee responsibilities and other means of contributions. Currently, he is working on a comic book and teaching an advance studio problems class at night.

---

**Dr. Caitlin Cornelius** is a criminologist with very broad research interests, who uses modeling and simulation to help better understand the causes of crime. Prior to joining VMASC as a postdoctoral research associate, Caitlin taught at ODU as an adjunct in the department of Sociology and Criminal Justice. While completing her PhD in Criminology, she taught classes on criminal law and procedure, violence against women, and crime within the military community. Her dissertation examines the sociocultural causes of sexual assault in the United States Navy. Dr. Cornelius also holds a MA in Criminal Justice from the University of Toledo and a BA in Political Science from Salisbury University. Her current research interests include the continued examination of the causes of sexual violence, and exploring new applications of modeling and simulation to various crime topics.
VMASC Board of Advisor Message

Josh Jackson
Vice President of Training and Simulation, SAIC
Chairman of the VMASC Board of Advisors

The VMASC Industry Association enjoys the partnership with ODU's VMASC to further the application of research and development and increase awareness of how modeling, simulation, analysis can be applied to some of our nation's most difficult challenges. This year we continued initiatives like scholarships, education support, sponsorships, and entrepreneurial contests, while expanding initiatives that increase the visibility of ODU MSVE and enhance collaborative R&D in modeling, simulation, and analysis. We also embarked on a robust strategic planning effort that is culminating in a strategy to enable the VMASC industry association to help ODU VMASC achieve its objectives while growing the local modeling and simulation industry.

The VMASC Industry Association continued our baseline support to ODU's modeling, simulation, and visualization engineering department, which is paving the way in creating a highly talented workforce. Our scholarships supported several students seeking degrees in modeling and simulation. Our continued support to the capstone conference provided a venue for students to showcase the work they've done throughout the year. Our support to ODU's MSVE department is a very important aspect of our partnership, and we expanded it significantly this year with a $50,000 endowment that will hopefully be just seed money that will grow through other gifts to provide a solid base for

We've also expanded our efforts to create R&D partnerships between VMASC industry association companies and ODU. With ODU's renewed interest in expanding funded R&D, these kinds of collaborative R&D partnerships will generate new intellectual property and economic development. These R&D efforts also hold promise for continued diversification of local modeling, simulation, and analysis efforts to a broader set of markets. VMASC is a leader in modeling and simulation and we're fortunate to have such a national asset in this region.

Finally, we've added to the VMASC industry association membership which will allow us to focus on applications to new markets. This will give VMASC and ODU industry perspective on where big modeling, simulation, and analysis challenges exist and give the industry association valuable insights into new markets for application of R&D in which ODU and VMASC is engaged.
I'm proud of the accomplishments of the industry association and leadership of the board of advisors to further the state of research and development in modeling, simulation, and analysis. I look forward to working with ODU, VMASC Industry Association, and local business leaders to expand the role of modeling and simulation to address complex challenges in the world.

- Josh Jackson
VMASC Awards


Virtual Operating Room – National Center for Collaboration in Medical Modeling and Simulation. 01 July 2015 – 30 June 2016. PI: John Sokolowski, Ph.D., Co-PIs: Yiannis Papelis, Mark Scerbo, Ph.D.

Computational Model of Fibril Assembly – Virginia Commonwealth University. 01 August 2015 – 31 July 2020. PI: Seth Weinberg, Ph.D.


Long-Term Degradation of Critical Infrastructures – Virginia Department of Emergency Management. 01 January 2016 – 31 May 2016. PI: Mike Robinson, Ph.D., Co-PIs: Barry Ezell, Ph.D., Andrew Collins, Ph.D., and Erika Frydenlund, Ph.D.


Center of Excellence in Cyber – Year 2 – Norfolk State University. 15 April 2015 – 14 April 2020. PI: Jose Padilla, Ph.D., Co-PIs: Saikou Diallo, Ph.D., Ross Gore, Ph.D., Sr. Project Scientist: Anthony Barraco, Graduate
Research Assistants: Hamdi Kavak and Danielle Vernon-Bido.


---

**VMASC Scholarly Work**

**Journal Articles**

**Behr, Joshua G., & Rafael Diaz.** "Emergency Department Frequent Utilization for Non-Emergent Presentments: Results from a Regional Urban Trauma Center Study." *PloS one* 11.1 (2016): e0147116.


**Behr, Joshua G., Rafael Diaz, & Molly Mitchell.** "Building Resiliency in Response to Sea Level Rise and Recurrent Flooding: Comprehensive Planning in Hampton Roads."


Welsch., J.M & V. Andrea Parodi, “Inter-professional Education with Didactic TeamSTEPPS® and Medical Simulation: A Systematic Review”, *Simulation in Healthcare*.


with Agent-Based Modeling and Simulation.” Journal of Housing Research (accepted March 2016).

**Book Chapters**


**Conference Proceedings and Presentations**


Simulation Multiconference, Bergeggi, Italy, September, 21-23 2015.


Watson, G., Papelis, Y., & Hicks, K., *“Simulation-Based Environment for the Eye-Tracking Control of Tele-Operated Mobile Robots”*, *Proceedings of the Spring Simulation Conference*, April 2016, Pasadena, CA (SCS).

VMAASC Special Contributions

Joshua G. Behr, Ph.D. - Research Associate Professor
Virginia Governor’s Appointee to the Scientific and Technical Advisory Committee (STAC) for the Chesapeake Bay Program
Community Resilience Panel for National Institute of Standards and Technology
Editor, Wiley Series in Modeling and Simulation

Andrew Collins, Ph.D. - Research Assistant Professor
Treasurer, The Society for Modeling & Simulation International (SCS)
Director at Large, The Society for Modeling & Simulation International (SCS)
Editorial Board Member: Journal of Revenue & Pricing Management
Publicity Chair, 2017 Spring Simulation Conference, Virginia Beach, VA

Saikou Y. Diallo, Ph.D. - Research Associate Professor
Society of Modeling and Simulation International (SCS), Member
Simulation Interoperability Standards Organization (SISO), Member
Vice President for Conferences, Society of Modeling and Simulation International (SCS)
General Chair, Society of Modeling and Simulation International (SCS), Spring Simulation Conference 2015

Barry C. Ezell, Ph.D. - Chief Scientist, Research Associate Professor
M&S Steering Committee
All Hazards Advisory Committee
Military Operations Research Society, Member Risk Community of Practice, Member Wargaming Working Group
Associate Editor, Military Operations Research Journal
Society for Risk Analysis, Member Applied Risk Management Specialty Group

Peter B. Foytik – Sr. Project Scientist
Young Member of the Transportation Research Board Emergency Evacuation Committee

Erika F. Frydenlund, Ph.D. – Research Assistant Professor
Head of Projects, Emerging Scholars and Practitioners on Migration Issues (ESPMI) Executive Committee
Program Chair, Annual Simulation Symposium (ANSS), 2017 Spring Simulation Multi-Conference

Bridget D. Giles, Ph.D. – Research Assistant Professor
Association of Clinical Research Professionals, Certified Clinical Research Associate (CCRA)
Society for Simulation in Healthcare

Ross J. Gore, Ph.D. – Research Assistant Professor
Research Fellow at Institute for the Bio-Cultural Study of Religion (IBCSR)
Member of ODU High Performance Computing Committee
Member of Program Committee for 2016 MSVE Student Capstone Conference
Member of Program Committee for 2016 SCS Spring Simulation Conference

Yiannis E. Papelis, Ph.D. – Research Professor

Associate Editor for SIMULATION: Transactions of the Society for Modeling and Simulation International
Associate Editor for Journal of Defense Modeling & Simulation
Vice President for Publications: Society of Modeling & Simulation International

Jose J. Padilla, Ph.D. – Research Assistant Professor
Society for Modeling and Simulation International, (SCS) Member
Association for Computing Machinery, (ACM) Member
Society for Modeling and Simulation International (SCS) Annual Simulation Symposium Program Chair (2015), General Chair (2016), and Co-Chair (2017)

V. Andrea Parodi, Ph.D. - Research Associate Professor
Admissions Committee for The Tidewater Region STEAM Academy for Gifted Children
Nansemond River Preservation Alliance
Henry M. Jackson Foundation for the Advancement of Military Medicine - Guest Scientist
Sigma Theta Tau International - Honor Society of Nursing
Omicron Delta Kappa - National Leadership Honor Society
American Association of Critical Care Nurses (AACN)
Association of Military Surgeons of the United States (AMSUS) - Former Chapter Founder

President-Tennessee Valley Chapter

American Nurses Association

Society for Simulation in Healthcare

National League for Nursing

International Nursing Association for Clinical Simulation and Learning

National M & S Coalition

Co–chair of subcommittee on Education and Professional Development.

Old Dominion University Student Capstone Conference Medical/Healthcare Track Chair

National Center for the Collaboration in Medical Modeling and Simulation

National Modeling and Simulation Coalition (NMSC)

**Krzysztof J. Rechowicz, Ph.D. – Research Assistant Professor**

Member of IEEE, IEEE Engineering in Medicine and Biology Society

Member of Society for Modeling and Simulation International (SCS)

**R. Michael Robinson, Ph.D. – Research Associate Professor**

Transportation Research Board Emergency Evacuation Committee

**John A. Sokolowski, Ph.D. – Executive Director/Research Associate Professor**
Industry Acknowledgements

"The Center for Complex Operations (CCO) at National Defense University, and I personally have been working closely with Old Dominion University (ODU) for approximately three years. This growing relationship has been central and critical to our ability to provide exceptional research and support services to the Department of Defense, particularly the Office of the Secretary of Defense and the Joint Chiefs of Staff. ODU's low maintenance approach facilitates the management of contract staff and researchers permitting them - and us - to focus on the core research challenges facing the Department of Defense. Low institutional indirect cost, and high value "customer" orientation make our contractor operations seamless. At the present time we are directly supporting three Deputy Assistant Secretaries of Defense, as well as the Joint Staff J-7, with high priority research. Research topics include Defense Institution Building (for the Deputy Assistant Secretary of Defense for Security Cooperation), converging illicit networks (for the Deputy Assistant of Defense for Counter-narcotics and Global Threats), and Women, Peace, and Security (for the Deputy Assistant Secretary of Defense for Stabilization Operations). In addition using our ODU partnership we are developing innovative, teacher-friendly instructional tools for Joint Professional Military Education. The ODU team has been flexible and innovative in our joint teaming efforts."

- Michael Miklaucic

Center for Complex Operations (CCO)

National Defense University, Ft. McNair

"As a training company, being a member of VMASC not only provided us with insights into the modeling and simulation community that assisted in expanding our offerings to our customers, but also provided a point of entry into new academic institutions. Our membership with VMASC has proven invaluable in both increasing our technical capabilities and supporting the growth of our company."

- John J McNally III

Senior Vice President, Growth

Capstone Corporation