

Cybersecurity at ODU

Offering traditional undergraduate and graduate degrees in Computer Science, Computer Engineering, Information Technology, and Modeling, Simulation & Visualization, Old Dominion University (ODU) is located in the southeastern Virginia city of Norfolk, in the region named for the largest natural deep-water harbor on earth, Hampton Roads. Hampton Roads is strategically located in the heart of the mid-Atlantic and has a convenient and accessible transportation infrastructure that provides multiple options for moving goods between national and international markets. Norfolk is also home to the Naval Station Norfolk, the world's largest naval station, supporting 75 ships and 134 aircraft alongside 14 piers and 11 aircraft hangars.



Within the region, ODU serves the professional educational needs of, among others, the:

- Port of Virginia - the fastest growing port on the east coast with a vibrant and economically robust maritime industry;
- Two major railroads;
- One hundred and sixty four international business representing 28 countries;
- Numerous federal facilities including the aforementioned Naval Station Norfolk as well as Langley Air Force Base and the NASA Langley Research Center.

This significant infrastructure represents a mosaic of assets and makes Hampton Roads particularly vulnerable to malicious cyber-attacks. ODU is an ideal and strategic candidate for the designation of NSA Center of Academic Excellence (CAE) in Cyber Operations and is poised to train the next generation of Cybersecurity professionals. Faculty from four colleges (Arts & Letters, Sciences, Engineering and Business) and the Virginia Modeling, Simulation and Analysis Center (VMASC) possess significant expertise in Cybersecurity education and research (see faculty biographies document).

We offer a variety of options for individuals to learn about cybersecurity. These include:

- a. Twenty-one separate undergraduate courses related to the topic.
- b. Eight graduate courses focusing on cybersecurity
- c. An interdisciplinary undergraduate major in cybersecurity offered through the College of Arts & Letters Interdisciplinary Studies Program
- d. An undergraduate major in Computer Science with an emphasis in cybersecurity offered through the College of Sciences Department of Computer Science
- e. An interdisciplinary minor in cybersecurity for undergraduates
- f. An on-line, graduate certificate in cybersecurity through the College of Sciences Department of Computer Science and ODU Distance Learning
- g. An advanced engineering graduate certificate in cyber systems security from the Batten College of Engineering & Technology
- h. Regular seminars offered by the Center for Cyber Security Education and Research
- i. A Cyber Security Student Association
- j. NSA/NSF-sponsored Generation Cyber summer camps for middle and high school students

ODU has developed a solid research infrastructure in the area of cybersecurity. At the university level, we created the Center for Cyber Security Education and Research in March 2015. This center, housed in the Office of Academic Affairs, works towards meeting the following objectives:

- Promote awareness about cybersecurity, cyber forensics and cyber operations from an interdisciplinary framework;
- Coordinate interdisciplinary academic programming related to cybersecurity;
- Expand the pipeline for a cybersecurity workforce through focused education programs for a diverse group of learners;
- Facilitate a collaborative approach for responding to cybersecurity issues;
- Provide training and research to the military with a specific focus on topics related to homeland security and infrastructure needs;
- Serve as a clearinghouse for cybersecurity academic programming, research, training, and prevention tools;
- Facilitate the interdisciplinary collaboration of faculty from across the university to attract funding and to address real-world problems through innovative and cutting edge research

The focus of our cybersecurity efforts can be categorized under four different themes that separate our initiative from others. These themes include:

- An *interdisciplinary framework* for understanding issues related to cybersecurity. No single academic unit or researcher can address cybersecurity on their own. A collaborative and holistic model better meets societal needs.
- A *translational framework* emphasizes the need to conduct research that informs practice and policy. With the creation of the College of Continuing Education and Professional Development, ODU is in a position to more seamlessly provide up-to-date research to consumers in a meaningful way.
- A focus on *preventing cybercrime* by pulling together expertise from social scientists, computer scientists, and engineers results in practical information.
- A focus on *resilience* informs businesses and companies how to respond to cyber attacks in a way that minimizes the harm from those security breaches. In particular, our researchers examine how to keep computer systems working while a breach is ongoing.

ODU's current assets in the area of cyber security provide a solid foundation for expanding our efforts. These assets include the following:

- Twenty-six faculty members who work in the area of cybersecurity, including ODU's newest experts, Dr. Hongyi Wu (Batten Chair of Cybersecurity and Director of the Center for Cybersecurity Education and Research) and Dr. Sachin Shetty (Professor of Modeling, Simulation and Visualization Engineering). Together with their colleagues, they teach about the topic, conduct research on topics related to cybersecurity, and have offered a variety of consulting services related to the topic. (See Appendix A).
- Eight graduate students are currently working in a network security lab.

- We are in the process of purchasing cybersecurity software that assists in teaching cybersecurity courses. Information is available online at <http://www.netdevgroup.com/products/>.
- In 2013, the Batten College of Engineering and Technology developed the Cyber Security, Communications, and Networking Innovation Lab. Working closely with researchers from VMASC, the mission of this lab is to use research to improve the security of cognitive radio networks, wireless communications, and wireless networking.

Programmatically, ODU has much to offer the region in the area of cyber security. Here is a summary of the potential benefits:

- Our programs are providing a pipeline of future employees who will be able to work in cybersecurity positions. Having a strong cadre of cybersecurity employees will make the region more attractive to future employers.
- Through programs developed by our College of Continuing Education and Professional Development, the university will be able to meet the current and changing needs of the workforce. Because changes occur rapidly in the information technology field, we will be able to develop continuing education programming that is up-to-date and responsive to technological changes.
- Research by faculty members at ODU will provide information that can directly translate into practice. This research will help to identify prevention and intervention strategies.
- By translating the research into practice, and collaborating with businesses and government agencies, we will ensure more secure computer networks. Enhancing the security of cyber systems reduces unnecessary costs to businesses/agencies and allows those entities to focus on their specific goals and tasks.

For our cybersecurity efforts to be most successful, we must partner with various stakeholders. . In 2016, ODU led the establishment of the ***Hampton Roads Cybersecurity Education, Workforce and Economic Development Alliance (HRCyber)***. HRCyber is a partnership between educational institutions, government agencies, non-profit organizations, and private employers focused on developing educational pathways from high school through community college to four year institutions and continued professional development. The mission of HRCyber is to facilitate a capable and fully trained cybersecurity workforce for the Hampton Roads region.

The planned goals and activities for the HRCyber alliance include the following:

- Coordinate educational pathways among public high schools (Virginia Beach City Public School District/Advanced Technology Center, and Newport News City Public Schools), community colleges -- Tidewater Community College (TCC) and Thomas Nelson Community College (TNCC) -- and four year institutions (ODU and the College of William and Mary)
- Gather, organize and make available information from the regional workforce about the knowledge and skills needed in cybersecurity programs using the NICE-identified knowledge, skills, and abilities framework and revise curricula where needed.
- Coordinate academic programming among educational institutions and workforce to insure relevance and linkages to the NICE Framework.

- Strengthen the cybersecurity capabilities of the regional workforce which includes a large complex of military bases, joint forces, federal facilities, and defense-related businesses, as well as healthcare companies.

ODU's plan for the future of cybersecurity programming includes the following:

- Expanding our research infrastructure and promoting collaborative projects
- Developing new continuing education courses responsive the industry needs
- Developing additional for credit certificates in areas of cyber physical security, information system security, and cyber ethics and law
- Developing a Master's program to expand the pipeline for the information security workforce.

Appendix A. ODU Cybersecurity Expertise Guide (updated on August 26, 2016)

Name Email Website	College/Department	Expertise
Brunelle, Janet jbrunell@odu.edu	Sciences/Computer Science	LaRC: Software reliability, Fault-tolerant software, Artificial intelligence ODU: Investigation of new teaching techniques and technologies
Chernikov, Andrey achernik@odu.edu http://www.cs.odu.edu/~achernik/	Sciences/Computer Science	Image analysis in medical and bio-material modeling and simulation. Parallel computational geometry with a focus on quality mesh generation. High-performance scientific computing.
Ezell, Barry bezell@odu.edu http://www.vmasc.odu.edu/ezell.html	Chief Scientist, VA Modeling, Analysis and Simulation Center	Risk analysis expertise in terrorism risk, critical infrastructure, and industrial control systems; President of Security Analysis and Risk Management Association
Flanagan, David dflanagan@odu.edu http://www.vmasc.odu.edu/flanagan.html	Project Scientist	Cyber risk to industrial control systems in the surface transportation sector (DHS).
Gheorghe, Adrian AGheorgh@odu.edu https://www.odu.edu/directory/people/a/agheorgh	Engineering/Batten Chair of Systems Engineering	Risk and vulnerability assessment for complex systems, risk assessment transportation of dangerous goods.
Graham, Roderick S. rgraham@odu.edu http://roderickgraham.com/	Arts&Letters/Sociology & Criminal Justice	Social implications of various information and communication technologies (ICTs) including the Internet and mobile phones. How these technologies increase or decrease inequality between economic classes, racial groups, and nations.
He, Wu WHe@odu.edu https://www.odu.edu/directory/people/w/whe#profiletab=3	Business/Information Technology & Decision Science	Cyber security, social media, data mining
Madan, Bharat B. bmadan@odu.edu http://eng.odu.edu/msve/directory/fs/madan.shtml	Engineering/Modeling, Simulation and Visualization Engineering	Cyber security and attack tolerant cyber systems, elliptic curve cryptography, big data analytics for cyber situation awareness

Maly, Kurt kmaly@odu.edu http://www.cs.odu.edu/~maly/	Sciences/Computer Science	Digital libraries, very high-performance networks, and Internet resource access.
Mielke, Roland rmielke@odu.edu https://www.odu.edu/directory/people/r/rmielke#profiletab=3	Engineering/Modeling, Simulation and Visualization Engineering	System theory and graph applications in data flow architectures.
Mukkama, Ravi mukka@cs.odu.edu http://www.cs.odu.edu/~mukka/	Associate Dean, College of Sciences/Computer Science	Security in distributed systems
Nadeem, Tamer tnadeem@odu.edu http://www.cs.odu.edu/~nadeem/	Sciences/Computer Science	Wireless networks, mobile computin, ad-hoc and sensor networks, vehicular networks, enterprise wireless network managements, efficient cross layer designs, smart antenna protocols, peer-to-peer systems, pervasive computing, location determination systems, and social networks
Olariu, Stephan solariu@odu.edu http://www.cs.odu.edu/~olariu/olariu-bio-may-2013.pdf	Sciences/Computer Science	wireless communications and more specifically wireless sensor networks with applications to information security
Payne, Brian bpayne@odu.edu	Vice Provost for Graduate and Undergraduate Academic Programs/Sociology and Criminal Justice	Criminology with a concentration in white-collar crime and policy
Popescu, Dimitrie dpopescu@odu.edu https://www.odu.edu/directory/people/d/dpopescu	Electrical & Computer Engineering	Wireless communications: distributed optimization in wireless systems; spectrum sensing and modulation classification, multiple antenna and MIMO systems, interference avoidance/suppression and power control, OFDM and multicarrier systems, ultra wideband systems, vehicular networks. Control theory.
Ranjan, Desh dranjan@odu.edu http://www.cs.odu.edu/dranjan.shtml	Sciences/Chair, Computer Science	Algorithm design and implementation, bioinformatics and computational complexity.

Shetty, Sachin sshetty@odu.edu http://ww2.odu.edu/~sshetty/	Engineering/Modeling, Simulation and Visualization Engineering and VMASC	Intersection of computer networking, network security and machine learning.
Sokolowski, John jsokolow@odu.edu http://www.vmasc.odu.edu/sokolowski.html	Executive Director, VA Modeling, Analysis and Simulation Center	Human behavior modeling, decision system modeling, multiagent system simulation, and modeling and simulation representation of social systems.
Still, Jeremiah jstill@odu.edu http://www.psychofdesign.com/jeremiah/	Sciences/Psychology	Human Computer Interactions
Streit, Doug jstreit@odu.edu	Information Technology Services	IT security, records and PM
Weigle, Michele mweigle@cs.odu.edu http://www.cs.odu.edu/~mweigle/	Sciences/Computer Science	Web science, digital preservation, information visualization, mobile computing, wireless networks
Wittkower, D. E. dwittkow@odu.edu https://odu.academia.edu/DEWittkower	Arts & Letters/Philosophy & Religious Studies	Philosophy of technology, philosophy of digital culture, conduct of personal relationships online, phenomenology of SNS (social networking sites), business and professional ethics, theories of privacy, ethics of data use.
Wu, Harris hwu@odu.edu	Business/IT & Decision Science	Social computing, knowledge management, cloud computing, social networks, data, text and Web mining, case-based design
Wu, Hongyi (Michael) H1wu@odu.edu http://www.lions.odu.edu/~h1wu/	Batten Chair of Cybersecurity, Engineering/Electrical & Computer Engineering	Networked cyber-physical systems for security, safety, and emergency management applications, where the devices are often light-weight, with extremely limited computing power, storage space, communication bandwidth, and battery supply.
Xin, Chunsheng cxin@odu.edu	Engineering/Electrical & Computer Engineering	Cybersecurity, cognitive radio networks, wireless communications and networking, cyber-physical systems, and performance evaluation and modeling
Xu, Li lxu@odu.edu	Business/IT & Decision Science	MIS foundational theory and methodologies, business intelligence, enterprise information systems in e-commerce, ERP, and intelligent systems.
Zubair, Mohammed zubair@odu.edu http://www.cs.odu.edu/~zubair	Sciences/Computer Science	High performance computing and big data analytics. Parallel programming environments.

