Commonwealth Cyber Initiative

Coastal Virginia

Coastal Virginia Center for Cyber Innovation

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3rd Quarter Project Report
January 2021 – March 2021

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Commonwealth Cyber Initiative

The Commonwealth Cyber Initiative CoVA CCI Node Quarterly Update for 3rd Quarter, Fiscal Year 21

General

COVA CCI focus during the 3rd Quarter of FY 21 was on continuing the five funded cybersecurity research projects, initiating selected CCI Collaboration Research projects and supporting spring 2021 activities

1. COVA CCI academic institutions were awarded approximately $5.65 million dollars in 10 different cybersecurity grants from government and private industry,
2. Researchers continue to work on the five previously funded cybersecurity research projects.
3. Awarded five (5) projects under the CCI Collaboration Research RFP for a total of $994,850 in partnership with ODU, W&M, VCU, UVA, VT, GMU.
4. COVA CCI supported nine (9) graduate assistants, during spring 2021, with experiential learning opportunities by supporting various COVA CCI activities at partner institutions. Six of these students are supporting cybersecurity businesses.
5. Continued to work with the Virginia Space Grant Consortium on the Cybersecurity Internship program to place cybersecurity students from across the region into internship opportunities. To date eleven have been placed as interns with these organizations; Grey Gecko (x3), Arks Enterprises (x2), AScIS (x2), MI Technical Solutions, IntellecTechs, Jenlyn, and Peregrine Technical Solutions.
6. Developed a regional network of over 90 researchers, faculty, and business partners working for eight colleges/universities and 20+ businesses
7. Continued the construction of the Cyber Innovation Park located on the main campus of Old Dominion University. This center will house COVA CCI and the ODU School of Cybersecurity. Completion is anticipated by May 2021
8. Invested $708,000 to develop a shared collaborative research computing environment (COVA SHARE). COVA SHARE will support the growing cybersecurity programs, academic and research collaboration opportunities, and industry partnerships; lay the foundation to support 5G testbed data collection and provide secure storage and transfer between connected Node members and to the CCI Hub for analysis and other collaboration.
9. Completed the design and launched the COVA CCI website – www.covacci.org

Update on the Seven Requirements

1. External Research Grants Attracted to Support the Work of CCI

Narrative: COVA CCI researchers continue to apply for and receive grants from January and March 2021, approximately $5.65 million in research grants were awarded to COVA CCI researchers. Each of these grants has a PI or Co-PI affiliated with or received funding directly from COVA CCI and/or CCI for their research.

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Figure 1: External Research Grants

External Research Grants Attracted to Support the Work of CCI			
Project Title	Sponsor	Award Organization	Amount
CAREER: Memory-Efficient, Heterogeneity-Aware and Robust Architecture for Federated Intelligence on Edge Devices	NSF	ODU	$470,023
ODU GENCyber JROTC Students and Teachers Interactive Learning	NSA	ODU	$125,000
Preparing Future Cybersecurity LeADERS through Community College Partnerships and Applied Learning Experience	NSF	ODU	$3,906,604
Advancements in low-latency, resilient and energy-efficient 5G networks for smart warehouse	DoD	ODU/VMASC	$850,000*
Cyber Risk and Resilience Analytics	Frontier Technology, Inc	ODU/VMASC	$106,000
Efficient Checkpointing on Heterogeneous Architectures	DoE	W&M	$19,270
Virtual Hearings in Agency Adjudication	Administrative Conference of the United States	W&M	$28,000
Collaborative Research: Context-aware Freezing of Gait mitigation in the real-world setting	National Institute of Health	W&M	$83,978
Enabling Efficient Sharing of Emerging GPUs	Google	W&M	$60,000
		Total	**$5,648,875**

* This is the ODU portion of the total grant awarded in the amount of $13 million dollars.

2. **Research Grants Awarded from the Funds Contained in HB30**

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Narrative: COVA CCI is providing funding under the research category for several initiatives.

1) COVA CCI is providing funding through the **COVA CCI Cybersecurity Research and Innovation Funding program**. This program supports diverse and inclusive CPSS research efforts, with a focus on the intersection of artificial intelligence (AI), cybersecurity, and CPS technologies applied to maritime, transportation, and defense sectors. Five projects were approved in April 2020 for a total of $679,429. These projects will be completed in May 2021. See Figure 2: COVA CCI funded research grants.

2) COVA CCI is funding **Cybersecurity Curriculum Development projects** that are focused on identifying gaps in existing curricula and the development of strategies to fill these gaps. Two projects were funded in Q3 2020 for a total of $20,000. An additional five projects were approved in Q1 2021 for a total of $60,000. See Figure 3: COVA CCI curriculum development projects.

3) COVA CCI has supported two iterations of a **Cybersecurity Undergraduate Research Program – Spring 2020 and Fall 2020**. This program leverages the strength of research-extensive institutions to support active research participation by undergraduate students in the area of cybersecurity. Students will have opportunities to explore a variety of cutting-edge research topics, including but not limited to: Blockchain Security, Cyber Law & Policies, Human Behavior Security, Online Scams, Mobile Protection, Secure Digital Printing, Secure Internet of Things, Secure Machine Learning, Social Engineering, and Wireless Security.

4) COVA CCI awarded five (5) projects totaling approximately $1 million dollars, as part of the CCI led **Cybersecurity Collaboration Research project**. The funding projects are listed below.

- A Systematic Evaluation of Smart City Security and Privacy—PI A. Nadkarni/W&M; Co-PI Y. Tian/UVA
- Backdoor Detection and Mitigation in Deep Neural Networks—H. Wu /ODU; Co-PIs J. Cho /VT; L. Armistead /Peregrine; C. Xin /ODU; J. Li/ODU; R. Ning /ODU
- DeepPOSE: Securing Transportation systems from GPS Spoofing Attacks—PI C. Xin, /ODU; Co-PIs Y. Zhao/VCU; K. Kefauver /GCAPS; D. Zhao /ODU
- Secure and Privacy Preserving 5G Network for Connected Vehicles—S. Shetty /ODU; Co-PIs C. Shen /UVA; D. Wijesekera/GMU; K. Zeng /GMU; T. Le\/ODU; J. Reed /VT
- Virginia State Investments in Port of Virginia: A Simulation-based Framework for Identifying, Assessing, and Mitigating Systemic Cybersecurity at the Operational Technology Layer—R. Diaz /ODU; Co-PI H. Shen /UVA

See this article for more details - cci-funds-22-cybersecurity-grants.
See Figure 5: COVA CCI led Cybersecurity Collaboration Research Projects.

5) **CCI Arts and Design Collaboration Project.** The Arts and Design Collaboration challenges the community of researchers in the Arts and Design to reimagine and depict the results of

cybersecurity research (and in particular research that occurs in CCI) either for scientific purposes, or for creative arts practice purposes. In response to this RFP, COVA CCI was awarded two projects. See Figure 7: CCI Arts and Design Projects.

- Dr. Kevin Moberly, Old Dominion University, and his project team of Dr. Ryan Patton, VCU, Dr. Deri Draper, ODU/VMASC, Dr. Jeff Pittges, Radford, and Mr. Bobby Keener, CivilianCyber. Their project named Develop a Gamified Mobile Application for Cybersecurity Education and Assessment via a User Centered Design Process, is awarded $25,000 for their work which spans January 4, 2021 through August 31, 2021.
- Dr. Sachin Shetty and Dr. Yan Lu, both with Old Dominion University/VMASC are working with VCU as Co-PIs on their project, Moving Choreography to a New Universe: an AI-Driven Privacy Automation Approach. They were awarded $12,500 for their work.

6) CCI Experiential Learning Project. COVA CCI received two projects in response to the 2021 CCI Experiential Learning CFP.

- Dr. Sachin Shetty, ODU/VMASC and is entitled, Cybersecurity Monitoring and Assurance Training Program for Safe and Secure Port Operations. He was awarded $150,000 for this project.
- Dr. Abraham Chon, William and Mary, Cyber Risk Management and Analytics: An Interdisciplinary Approach in Experiential Learning. He was awarded $150,000 for this project. See Figure 8: CCI Experiential Learning projects.

Figure 2: COVA CCI funded research grants

Research Grants Awarded from the Funds Contained in HB30		
Project Title	Institutions	Amount
Leveraging AI and Machine Learning to Develop New CPSS and Workforce Development Solutions	Old Dominion University CivilianCyber	$150,000
Trust, Interoperability and Inclusion: A Framework for Creating Cyber-Trust in Connected Homes	William & Mary Old Dominion University	$150,000
Encouraging Positive Changes in Cyber Hygiene Behaviors and Knowledge in the Department of Defense	Old Dominion University MI Technical Solutions	$87,709
Securing IoT Devices through Power Side	William & Mary Old Dominion University	$150,000

Channel Auditing and Privacy Preserved Convolutional Neural Networks		
Explore Privacy-Preserving in Deep Image Retrieval Systems	Old Dominion University William & Mary Hampton University	$142,720
		Total: $679,429

Figure 3: COVA CCI curriculum development projects

COVA CCI curriculum development projects		
Project Title	Institutions	Amount
Q4 2020		
Fundamentals of Cybersecurity for local governments and SME leaders	William & Mary	$10,000
Implementing Blockchain Applications	Old Dominion University	$10,000
Q1 2021		
Small College Cybersecurity Curriculum Enhancement Project	Paul D. Camp Community College	$10,000
Core Legal Topics in Cybersecurity for non-lawyers	Tidewater Community, College William & Mary	$20,000
Information Literacy for Cybersecurity	Old Dominion University	$20,000
International Cyber Policy Training and Competition	Old Dominion University	$10,000
		Total: $80,000

Figure 4: COVA CCI cybersecurity undergraduate research program

COVA CCI cybersecurity undergraduate research program		
Project Title	Institutions	Amount
UG Cybersecurity Research Session 1 (4/13/20 – 7/31/20)	Christopher Newport Univ, Old Dominion University, Tidewater Community College	$30,000
UG Cybersecurity Research Session 2 (8/29/20 – 12/19/20)	Christopher Newport Univ, Old Dominion University	$15,000
		Total: $45,000

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Figure 5: COVA CCI led Cybersecurity Collaboration Research projects

Title	PI / Univ	Co-PI / Univ	Cost
Secure and Privacy Preserving 5G Network for Connected Vehicles	Sachin Shetty/ODU	Tan Le (ODU) Jeff Reed (VT) Cong Shen (UVA) Duminda Wegesekera (GMU) Kai Zend (GMU)	$200,000 ODU – $57523 VT – $35976 UVA – $35500 GMU – $71001
Backdoor Detection and Mitigation in Deep Neural Networks	Hongyi Wu/ODU	Chunsheng Xin (ODU) Jiang Li (ODU) Rui Ning (ODU) Jin-Hee Cho (VT) Leigh Armistead (Peregrine)	$184,816 ODU – $136532 VT – $48284
DeepPOSE: Securing Transportation Systems from GPS Spoofing Attack	Chunsheng Xin/ODU	Danella Zhao (ODU) Yanxiao Zhao (VCU) Kevin Kefauver (GCAPS)	$200,000 ODU – $101175 VCU – $50000 VT - 48825
A Systematic Evaluation of Smart City Security and Privacy	Adwait Nadkarni /WM	Yuan Tain (UVA)	$194,850 WM - $95460 UVA – $99390
Virginia State Investments in Port of Virginia: A simulation-based framework for identifying, assessing, and mitigating systemic cybersecurity at the operational technology layer.	Rafael Diaz/ODU	H. Shen (UVA)	$200,000 ODU –$77761 UVA –$122,239
Total			**$995,841**

Figure 6. COVA CCI Cybersecurity Collaboration Research Projects with COVA CCI as Co PI

Title	PI / Univ	Co-PI / Univ	Cost

Sensor Degradation Detection Algorithm for Automated Driving Systems,	Michelle Chaka/VT	Chunsheng Xin (ODU)	ODU - $75,000
Developing an Open Architecture Testbed and Learning-based Management for Smart Cities (OpenCity)	Sherif Adbelwahed/VCU	Murat Kuzlu	ODU - $65,000
Total			**$140,000**

Figure 7: CCI Arts and Design Projects

Title	PI / Univ	Co-PI / Univ	Cost
Develop a Gamified Mobile Application for Cybersecurity Education and Assessment via a User Centered Design Process	Kevin Moberly/ODU	Ryan Patton/VCU, Deri Draper /ODU, Jeff Pittges/Radford, Bobby Keener/ CivilianCyber.	ODU - $25,000
Moving Choreography to a New Universe: an AI-Driven Privacy Automation Approach	Kate Sicchio/VCU	Sachin Shetty/ODU Yan Lu/ODU	ODU - $12,500

Figure 8: CCI Experiential Learning Projects

Title	PI / Univ	Co-PI / Univ	Cost
Cybersecurity Monitoring and Assurance Training Program for Safe and Secure Port Operations	Sachin Shetty/ODU	Saltuk Karahan/ODU, Sarada Prasad/ODU, Jim Haug, Longwood, Darrell Carpenter, Longwood, Jennifer Maeng, UVA, Thomas Polmateer, UVA, Lessie Oliver-Clark, VSU, Wei-Bang Chen, VSU, Wookjin Choi, VSU, Rich Ceci, VIT	$150,000

Cyber Risk Management and Analytics: An Interdisciplinary Approach in Experiential Learning	Abraham/W&M		$150,000

3. **Research Faculty Recruited**

Narrative: The following research faculty were recruited and hired by the COVA CCI Node in the 1st Q 2021 and are continuing to work for CCI and other funded research projects.

- Le Thanh Tan, Old Dominion University, Ph.D., Engineering, Institut National de la Recherche Scientifique (2015).
- Rui Ning, Old Dominion University, Ph.D., Engineering, Old Dominion University (2020).
- Moeti Masiane, Norfolk State University, Ph.D., Computer Science & Applications, Virginia Tech (2020).
- Daniel Shin, William & Mary, JD, Law, William & Mary (2019) – Hired Q3 2020
- Yan Lu, Old Dominion University, Ph.D., Modeling & Simulation, Old Dominion University (2020). Hired as a match.

Additional research scientists will be funded using the 2021 Research Collaboration funds: three for Old Dominion and one for William & Mary. Job announcements are current open for these positions.

4. **Results of Entrepreneurship and Workforce Programming**

Innovation, Workforce Development and Experiential Learning Programs

Narrative: COVA CCI is supporting several programs in innovation, workforce development, and student experiential learning. These include the INNOVATE Cyber Challenge, graduate student experiential learning program, and cybersecurity internship program.

The innovation program consists of the **INNOVATE Cyber Challenge**. This program takes a cohort of 20 students from across the region and groups them into four teams. Each team is assigned a cybersecurity problem/challenge. They use design thinking to come up with unique solutions for this problem. A total of 40 students have participated in the program - 20 in the spring 2020 semester and 20 in the fall 2020 semester. The **fall 2020 INNOVATE Cyber Challenge** had 20 undergraduate students from Old Dominion University, Christopher Newport University, Norfolk State University, and Paul D. Camp Community College participated in this 11-week program from September – December 2020. Students were divided into five teams and each team was tasked with developing a final cyber-related product or solution related to the education and adoption of cyber hygiene. The projects

were called Celebrate Cyber Security!, the Net Pet, Cyber Hygiene Seminars, C.H.A.I.N., and THECyberHygienits.com. A virtual showcase was held on November 18, 2020 for the students

to pitch their solutions to a diverse group of faculty, administrators, and business contacts. A group of judges evaluated each project and selected Net Pet as the winning team for this cycle.

See this article to learn more about the program – Fall 2020 INNOVATE Cyber Challenge.

Graduate student experiential learning program. During the Spring 2021 semester, COVA CCI supported nine (9) graduate assistants with experiential learning opportunities by supporting various COVA CCI activities at partner institutions. One GRA was provided to Paul D. Camp Community College, and one GRA is assisting Christopher Newport University, to support cybersecurity classes and students. Two GRAs supported the Experiential Learning and Academic Support committees with identify all cybersecurity related classes being offered at COVA CCI partner institutions. 5 GRAs are supporting local cybersecurity businesses on current projects within these companies; Peregrine Technical Solutions (2 GRAs), CivilianCyber (2 GRAs), and MI Technical Solutions (1 GRA). The students are coming out of Norfolk State University, Old Dominion University, and the College of William and Mary

COVA CCI is partnering with the Virginia Space Grant Consortium (VSGC) to manage the **COVA CCI Cybersecurity Internship Program** using their Commonwealth STEM Industry Program (CSIIP). VSGC will leverage CSIIP to build and improve on the relationships with employers across the Commonwealth to develop internship and experiential learning opportunities. To date eleven have been placed as interns with these organizations; Grey Gecko (x3), Arks Enterprises (x2), AScIS (x2), MI Technical Solutions, IntellecTechs, Jenlyn,

and Peregrine Technical Solutions. The intern placed with Peregrine Technical Solutions, Sam Grant, is the nation's first Department of Labor Youth Registered Apprentice. He was also a keynote speaker at the 2020 NICE K-12 Education Conference.

Figure 9: Innovation/Entrepreneurship Grants awarded

Innovation / Entrepreneurship Grants Awarded		
Project Title	Institutions	Amount
INNOVATE Cyber Challenge (Spring 2020)	Christopher Newport Univ ECPI University Norfolk State University Old Dominion University Tidewater Community College William & Mary	$25,000
INNOVATE Cyber Challenge (Fall 2020)	Christopher Newport Univ Norfolk State University Old Dominion University Paul D. Camp Community College Tidewater Community College	$27,000
		Total: $52,000

Workforce Development

Figure 10: Graduate Student Experiential Learning Program

Graduate Student Experiential Learning Program		
Project Title	Institutions	Amount
Graduate Student Experiential Learning Program (Spring 2020)	Christopher Newport Univ Old Dominion University William & Mary	$15,000
Graduate Student Experiential Learning Program (Fall 2020)	Old Dominion University William & Mary	$42,000
Graduate Student Experiential Learning Program (Spring 2021)	Norfolk State University Old Dominion University William & Mary	$45,000
		Total: $112,000

Figure 11: Internship program

Internship Program		
Project Title	Institutions	Amount
Internship Program	CNU, ODU x 6, TNCC x 2, TCC, Veterans x 2	$22,000

	Total: $22,000

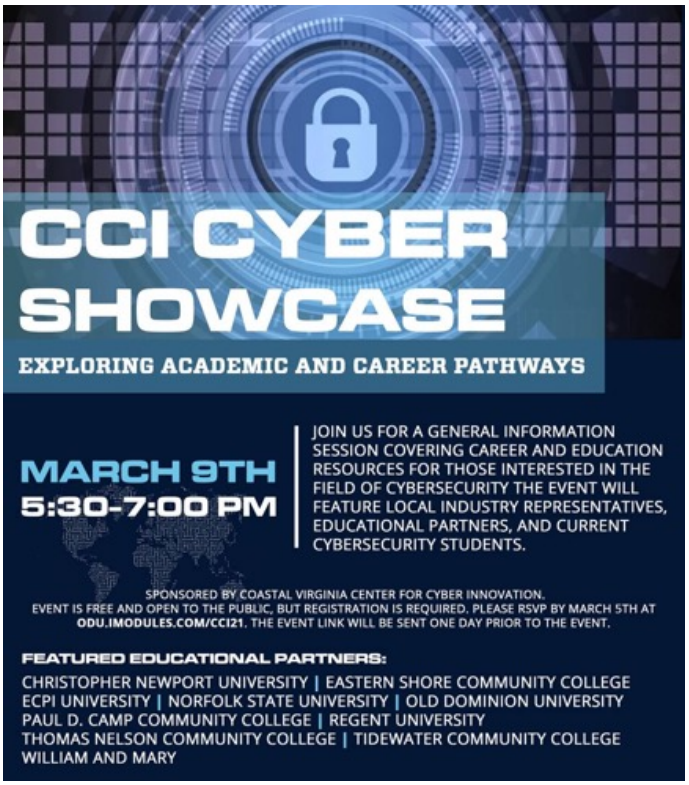
5. **Collaborative Partnerships and Projects**

CCI Cybersecurity Research Collaboration Funding

Narrative: COVA CCI is working with academic institutions from across the state on the recently awarded Cybersecurity Research Collaboration projects previously mentioned in this report. Researchers are also working business partners on potential federal funding opportunities and current research. Some of these partners include MI Technical Solutions, Peregrine Technical Solutions, CivilianCyber, and WRSystems.

6. **Correlated Economic Outcomes (Jobs and New Business Formation)**

Commercialization and Tech Transfer Assistance Program. In fall 2020 two research teams lead by Stephen Blackmon, William & Mary, and Chunsheng Xin, Old Dominion, participated in the Innovation Commercialization Assistance Program (ICAP), hosted by George Mason University. ICAP begins with a two-week session followed by a year-long program focused on customer discovery and developing a successful business model. ICAP is funded by the Commonwealth and there is no charge to participants. Each of these teams completed the November 2020 training session and are continuing to develop their business plans as part of their commercialization efforts.



The **COVA CCI External Partnership Committee** is actively working with industry partners and K-12 school districts. On March 9, 2021, COVA CCI hosted a Cyber Showcase for high school students interested in learning about the cybersecurity programs available in the region. Over 120 attendees participated in the event.

Tracy Gregorio, President of G2OPS and the event co-organizer said, *"Our goal was to reveal to the students and parents the wide variety of career paths available in Cybersecurity. Every business and industry has a touch point with technology that needs to be protected. The careers vary from technical, law enforcement, teaching, policy development and on and on.*

Our state is investing in our future workforce through these initiatives and as a business owner, it's a privilege to participate and build our future employees."

To learn more about the showcase visit - ODU Presents at CCI Cyber Showcase

7. **Geographic Distribution of Awards from the Funds Contained in HB30**

Figure 12: Distribution of COVA CCI Allocated Funds across the node region

Distribution of Funds Across the Node Region	
Institution	Amount
Christopher Newport University	$5,000
Norfolk State University	$154,300
COVA CCI Shared Research Environment	$708,610
Old Dominion University	$1,020,247
William & Mary	$415,843
Virginia Tech	$9,000
Tidewater Community College	$10,000
Paul D. Camp Community College	$10,000
Virginia Space Grant Consortium [1]	$167,000
Christopher Newport students	$27,000
Norfolk State University students	$3,000
Old Dominion University students	$37,500
Paul D. Camp CC	$1,000
Tidewater Community College Students	$10,500
William & Mary students	$1,000
MI Technical Solutions (Sub-contract) [2]	$39,563
Civilian Cyber (Sub-contract) [2]	$92,000
Total Committed Funds	**$2,500,000**

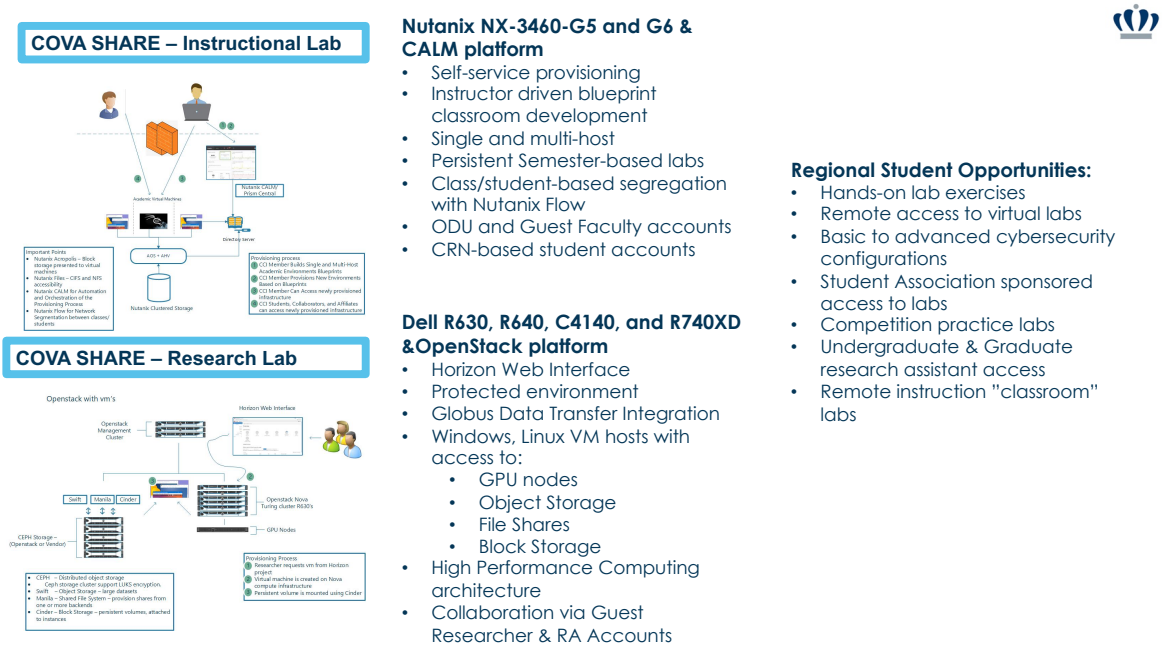
Note 1. VSGC is supporting the internship program, undergraduate cybersecurity research program, and the INNOVATE Cyber Challenge with payments to students from different institutions across the region. Funding listed for each partner institution shows the amount of support provided to students in these programs. The total amount of $167,000 includes student payments and administrative support.
Note 2. Old Dominion is working with MI Technical Solutions and Civilian Cyber as subcontractors for two different cybersecurity research projects. These are the amounts provided to the two companies and are included in the overall ODU support.

Figure 13: Distribution of 2021 CCI Collaborative Research Funds across CCI Network

Distribution of Funds Across the CCI Network	
Cross Node Collaboration Research projects (1)	
Old Dominion University	$437,991

William and Mary	$95,460
University of Virginia	$257,129
Virginia Commonwealth University	$50,000
Virginia Tech	$84,260
George Mason University	$71,001
Total	$995,841

Note 1: Funds for projects with COVA CCI PI or CO-PI.



Cyber Innovation Park and Shared Research Environment

Cyber Innovation Park is being developed on the ODU campus with an investment of $2 million dollars. It will include about 10,000 square foot space in Monarch Hall, for housing a data center, multiple research labs, teaching labs and classrooms, meeting space, faculty offices, and a student cyber incubator. Part of the space will be reconfigurable to support cybersecurity events such as cybersecurity competitions and workshops. The Cyber Innovation Park is anticipated to be finished late spring 2021. It will become home to ODU's School for Cybersecurity and COVA CCI, supporting various cybersecurity research, innovation, commercialization, and talent development efforts.

COVA CCI is investing $708,000 in a shared collaborative research computing environment, known as COVA Share, to support the growing cybersecurity programs, academic and research collaboration opportunities, and industry partnerships. Guided by the researchers in the Coastal Virginia Center for Cyber Innovation, the computing center and network investment will support the COVA Node and enable communication to the Hub and other Nodes. The environment will lay a foundation to support 5G testbed data collection, secure

storage and transfer between connected Node members and to the CCI Hub for analysis and other collaboration. It will provide access to a flexibly designed computing environment via connectivity improvements between ODU and William & Mary, and between ODU and Norfolk State University for potential collaborative efforts involving secure transfer of data between schools or secure remote access to physical or virtual hosts.

COVA CCI Node in the News

COVA CCI has been activity promoting the success of its various activities through local news sources. Below is a list of relevant news stories.

ODU News (March 26, 2021)
ODU Presents at CCI Cyber Showcase
Old Dominion University Part of Collaboration on $13 Million Department of Defense Contract

Virginian Pilot (March 9, 2021)
Opinion: ODU using real-world experience to shape higher education programs

ODU News (February 19, 2021)
ODU School of Cybersecurity and Center for High Impact Practices Receive $3.9 million NSF Grant

ODU News (February 9, 2021)
Old Dominion University Professors Awarded Nearly $1 Million in Cybersecurity-Related Grant Funding Through Coastal Virginia Center for Cyber Innovation