“Enhancing the Preparation of Next-generation Cyber Professionals”

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Department of Integrated Information Technology
College of Engineering and Computing
University of South Carolina

Cyber Talent Management Workshop and Discussion
October 26, 2021 - Columbia, SC
USC Team

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(ROTC, Walker Institute Main Project Coordinator)

1LT Ebony Penton  
(ROTC Command)

MAJ Christina Knight  
(Former ROTC Command, Co-PI)

Dr. Robert Cox  
(Faculty, Cyber Intelligence)

MAJ Jason Porter  
(Former ROTC Command)

Dr. John Gerdes  
(College of Engr. and Comp.)

Anthony Dillon  
(Internships)
Elie Kfoury  
(Graduate Student)

Jose Gomez  
(Graduate Student)

Ali AlSabeh  
(Graduate Student)

Shahrin Sharif  
(Graduate Student)
Project Overview

- **Project title:** “Enhancing the Preparation of Next-generation Cyber Professionals”
- **Funding agency:** Office of Naval Research
- **Period:** July 22, 2020 – May 31, 2022

“U.S. Air Force’s cyber warfare operations is only 46 percent filled”

“The Pentagon is hoping to hire 8,300 cyber positions starting this year (2018)”

Project Overview

• Goals:

1. Develop a minor in Cybersecurity Operations, aligned with the Cyber Intelligence program.
2. Establish an Undergraduate Research Program in Applied Cybersecurity.
3. Deploy virtual equipment pods on a virtual platform, accessible over the Internet, to support and facilitate research and teaching activities from anywhere, without compromising hands-on experiences.
4. Establish meetings among industry, government, high schools, and higher-education institutions to enhance cybersecurity preparation.
Project Overview

- **Goals:**
  1. Develop a minor in Cybersecurity Operations, aligned with the Cyber Intelligence program. Status: minor in Cybersecurity Operations is now offered, starting Fall 2021.

[Image of Cybersecurity Operations, Minor degree requirements]

https://tinyurl.com/4mbj3z4k
Project Overview

• Goals:
  1. Develop a minor in Cybersecurity Operations, aligned with the Cyber Intelligence program. Status: Cyber Intelligence major includes courses of the Cybersecurity Operations minor.

Cyber Intelligence Major
Cyber Intelligence expands the cyber world beyond code and technology. Our degree prepares you to master all sides of cybersecurity challenges — political, psychological, and global.

https://tinyurl.com/4x566mpu
Project Overview

- **Goals:**
  2. Establish an Undergraduate Research Program in Applied Cybersecurity.

<table>
<thead>
<tr>
<th>Cadet</th>
<th>Branch</th>
<th>Name</th>
<th>Semester</th>
<th>Project</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Navy</td>
<td>Christian S</td>
<td>Spring 2021</td>
<td>Application ID</td>
</tr>
<tr>
<td>2</td>
<td>Army</td>
<td>Brendan C</td>
<td>Fall 2020</td>
<td>Protection against Bruteforce Attacks with NGFW</td>
</tr>
<tr>
<td>3</td>
<td>Army</td>
<td>Jack S</td>
<td>Fall 2020</td>
<td>Mitigating Routing Hijacking Attacks</td>
</tr>
<tr>
<td>4</td>
<td>Army</td>
<td>Matthew D</td>
<td>Fall 2020</td>
<td>Mitigating Routing Hijacking Attacks</td>
</tr>
<tr>
<td>5</td>
<td>Army</td>
<td>Chris N</td>
<td>Fall 2020</td>
<td>Protection against Reconnaissance and Scan Attacks</td>
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<tr>
<td>6</td>
<td>Army</td>
<td>Jack S</td>
<td>Spring 2021</td>
<td>Policy-based Forwarding</td>
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<tr>
<td>7</td>
<td>Army</td>
<td>Matthew D</td>
<td>Spring 2021</td>
<td>Policy-based Forwarding</td>
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<tr>
<td>8</td>
<td>None</td>
<td>Keegan S</td>
<td>Fall 2020</td>
<td>An open-source library for computer networks and cybersecurity</td>
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<tr>
<td>9</td>
<td>None</td>
<td>Dakota M</td>
<td>Fall 2020</td>
<td>Distributed Denial of Service (DDoS) Protection with Next Generation Firewalls (NGFWs)</td>
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<tr>
<td>10</td>
<td>None</td>
<td>Lauren W</td>
<td>Fall 2020</td>
<td>Protection against Bruteforce Attacks with NGFW</td>
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<tr>
<td>11</td>
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<td>Josue H</td>
<td>Fall 2020</td>
<td>Site to site VPN with NGFW</td>
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<tr>
<td>12</td>
<td>None</td>
<td>Brian N</td>
<td>Fall 2020</td>
<td>Distributed Denial of Service (DDoS) Protection with Next Generation Firewalls (NGFWs)</td>
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</table>
## Project Overview

### Goals:

2. Establish an Undergraduate Research Program in Applied Cybersecurity.

Status: the program has been established. It supports between 10-12 students per semester ($4K).

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<tbody>
<tr>
<td>13</td>
<td>None</td>
<td>Kyle R</td>
<td>Fall 2020</td>
<td>Protection against Reconnaissance and Scan Attacks</td>
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<tr>
<td>14</td>
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<td>Ryan T</td>
<td>Fall 2020</td>
<td>IPsec VPN with Routers</td>
</tr>
<tr>
<td>15</td>
<td>None</td>
<td>Nathan B</td>
<td>Fall 2020</td>
<td>Site to site VPN with NGFWs</td>
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<tr>
<td>16</td>
<td>None</td>
<td>Bryson L</td>
<td>Spring 2021</td>
<td>External Dynamic List</td>
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<tr>
<td>17</td>
<td>None</td>
<td>Ryan T</td>
<td>Spring 2021</td>
<td>IPsec VPN with Next Generation Firewalls</td>
</tr>
<tr>
<td>18</td>
<td>None</td>
<td>Brad W</td>
<td>Spring 2021</td>
<td>Application ID</td>
</tr>
<tr>
<td>19</td>
<td>None</td>
<td>Zach F</td>
<td>Spring 2021</td>
<td>External Dynamic List</td>
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<td>20</td>
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<td>Nathan L</td>
<td>Spring 2021</td>
<td>Geoblocking</td>
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<td>21</td>
<td>None</td>
<td>Ty L</td>
<td>Spring 2021</td>
<td>Geoblocking</td>
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<td>22</td>
<td>Army</td>
<td>Tucker B</td>
<td>Fall 2021</td>
<td>Preventing Attacks on UDP / UDP abuses</td>
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<td>23</td>
<td>None</td>
<td>Collins K</td>
<td>Fall 2021</td>
<td>Preventing Attacks on UDP / UDP abuses</td>
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<tbody>
<tr>
<td>24</td>
<td>Air Force</td>
<td>Jeremy G</td>
<td>Fall 2021</td>
<td>Protecting Networks Against BGP Hijacking</td>
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<tr>
<td>25</td>
<td>None</td>
<td>Hannah G</td>
<td>Fall 2021</td>
<td>Protecting Networks Against BGP Hijacking</td>
</tr>
<tr>
<td>26</td>
<td>None</td>
<td>Cameron M</td>
<td>Fall 2021</td>
<td>Understanding TCP SYN Attacks</td>
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<tr>
<td>27</td>
<td>None</td>
<td>Jesse L</td>
<td>Fall 2021</td>
<td>Understanding TCP SYN Attacks</td>
</tr>
</tbody>
</table>
Project Overview

- **Goals:**

2. Establish an Undergraduate Research Program in Applied Cybersecurity.
   Status: the program has been established. It supports between 10-12 students per semester.

 ROTC cadets and veterans

- Chris (ROTC)
- Jack (ROTC)
- Brendan (ROTC)
- Matt (ROTC)
- Christian (ROTC)
- Ryan (Navy)
Project Overview

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2. Establish an Undergraduate Research Program in Applied Cybersecurity.
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Tucker (ROTC)

Jeremy (Air Force)

ROTC cadets and veterans
Project Overview

- Goals:

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Dakota
CS, IT, CI students

Keegan

Brian

Brad

Bryson

Ty
Project Overview

- Goals:

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CS, IT, CI students

Josue

Zach

Nate

Nathan

Kyle

Lauren
Project Overview

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Cameron

CS, IT, CI students

Jesse

Hannah

Collins
Project Overview

• Goals:

2. Establish an Undergraduate Research Program in Applied Cybersecurity.

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Jack, ROTC

“During my semesters conducting research under ONR, I learned many valuable skills that would help me improve my chances at becoming a Cyber Operations Officer in the United States Army. The skills I learned during this period carried over into internships with 3rd Special Forces Group Cyber Effects Cell, as well as the Army Cyber Institute at West Point. Understanding the vulnerabilities with routing protocols greatly improved my value as a member of a research team examining malware and phishing attacks...”

Currently senior student, employed with UofSC’s IT and at the 359th Theater Tactical Signal Brigade, Headquarters Company.

Brad, IT student

“I learned vital cybersecurity skills, such as creating policies with Application Identification rules, generating traffic to ensure security policies are operating appropriately, and reading logs to understand where traffic is traversing the network. The skills I learned during my ONR project were very similar to those skills needed to become part of the Networking/Perimeter team at Savanna River National Laboratory (SRNL), which protects the internal network... My managers [at SRNL internship] were very pleased with my knowledge and experience with next generation firewalls. As a result of my experience with ONR and previous internship at SRNL I was offered a full-time position contingent upon my graduation in May 2022”.

Currently senior student.
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<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
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</thead>
<tbody>
<tr>
<td>Ty</td>
<td>2nd Lt. at U. S. Marine Corps, DC</td>
</tr>
<tr>
<td>Dakota</td>
<td>Information Security Analyst at Lowe's</td>
</tr>
<tr>
<td>Lauren</td>
<td>IT Specialist, SC Department of Insurance</td>
</tr>
<tr>
<td>Josue</td>
<td>Technical Solution Specialist at IBM</td>
</tr>
<tr>
<td>Kyle</td>
<td>IT Specialist at Lowe's Companies</td>
</tr>
<tr>
<td>Nathan</td>
<td>Project Coordinator at Black Box Networks</td>
</tr>
<tr>
<td>Brad</td>
<td>IT Intern Savannah River National Lab</td>
</tr>
<tr>
<td>Zach</td>
<td>IT Intern at Blue Cross Blue Shield</td>
</tr>
<tr>
<td>Nathan</td>
<td>Technology Analyst at AIG</td>
</tr>
</tbody>
</table>
Project Overview

• **Goals:**

3. Deploy virtual equipment pods on a virtual platform, accessible over the Internet, to support and facilitate the research and teaching activities from anywhere, without compromising hands-on.

Status: private cloud for teaching and research in cyber at UofSC. Live traffic, scalable.
Project Overview

- Goals:

3. Deploy virtual equipment pods on a virtual platform, accessible over the Internet, to support and facilitate the research and teaching activities from anywhere, without compromising hands-on.

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Status: private cloud for teaching and research in cyber at UofSC. Live traffic, scalable.

Use of the virtual platform at the University of South Carolina between Oct. 1, 2020 – Sep. 30, 2021.
Project Overview

• Goals:

3. Deploy virtual equipment pods on a virtual platform, accessible over the Internet, to support and facilitate the research and teaching activities from anywhere, without compromising hands-on.

Status: we **expanded** the platform and made it available to other institutions, establishing agreements with government, high schools, and other higher-education institutions (NSF support ~$1M).

- Berkeley National Lab
- SANS institute (“girlsgocyber”)
- Multiple higher-ed institutions
- International Networks at Indiana
- Texas’ Lonestart Education and Research
- U.S. Army Cyber Center of Excellence (CCoE)
Project Overview

• Goals:

4. Establish meetings among industry, government, high schools, and higher-education institutions to enhance cybersecurity preparation.

   Status: agreements with industry partners (Cisco, Palo Alto, VMware, Intel) which provide professional tools and platforms. Also, they provide a pathway to additional certifications.

95% of the more than 345,000 job listings for Information Security Analyst request professional certification.

Project Overview

• Goals:

4. Establish meetings among industry, government, high schools, and higher-education institutions to enhance cybersecurity preparation.

Status: the program incorporates preparation for DoD’s approved baseline credentials\(^1\) for Information Assurance Technical (IAT) positions, Cybersecurity Service Provider (CSSP) Analyst, and CSSP Incident Responder.

<table>
<thead>
<tr>
<th>Course</th>
<th>IAT 1-2</th>
<th>CSSP Analyst</th>
<th>CSSP Incident Responder</th>
<th>Security Plus</th>
<th>NICE Framework Objectives</th>
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</thead>
<tbody>
<tr>
<td>Intro to Computer Security</td>
<td></td>
<td></td>
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<tr>
<td>Cybersecurity Operations</td>
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<tr>
<td>Intro to Networks</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
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</tr>
<tr>
<td>IT Security for Managers</td>
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<tr>
<td>Advanced Networks</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

NICE: National Initiative for Cybersecurity Education

\(^1\)Department of Defense (DoD) Cyber Workforce Management Program Website. [https://tinyurl.com/55t7sdnm](https://tinyurl.com/55t7sdnm)
Project Overview

• Goals:

4. Establish meetings among industry, government, high schools, and higher-education institutions to enhance cybersecurity preparation.

Status: the program incorporates preparation for DoD’s approved baseline credentials for Information Assurance Technical (IAT) positions, Cybersecurity Service Provider (CSSP) Analyst, and CSSP Incident Responder.
Project Overview

• USC’s application to NSF Cybersecurity Scholarship Program currently under review
• ~$3M project
• Activities include internships and industry-sponsored capstone projects for CI, IT, and CS students
• Other organizations
  ➢ ESnet / Berkeley National Lab
  ➢ Savannah River National Lab
  ➢ Idaho National Lab
  ➢ UCAR
  ➢ SC Department of Administration
  ➢ U.S. Army CCOE
  ➢ SC Chamber of Commerce
  ➢ Multiple private companies

- Degree specific
  - General Education and other CS requirements
  - General Education and other IT requirements
  - General Education and other CI requirements

- Cybersecurity + AI specialization
  - Palmetto Forum
  - Pre-internship (3)
  - Internship (400 hours)
  - Industry-sponsored Capstone (3)

- Professional preparation
  - IT Security for Managers (3)
  - Reinforcement Learning (3)
  - Homeland Security (3)
  - Advanced Networking (3)
  - Other cyber-courses (3-6)

  - Globalization and Security (3)
  - Cryptography (3)
  - Ethical Hacking (3)
  - Machine Learning (3)
  - Intro to Artificial Intelligence (3)

  - Intro Networks (3)
  - Intro to Comp Security (3)
  - Cybersecurity Operations (3)
  - Info. Security Principles (3)
  - Building Secure Software (3)

- Required  Elective courses