



**CO L O R A D O**

**Department of  
Higher Education**

## REPORT ON THE IMPLEMENTATION OF SB 18-086

DECEMBER 1, 2023

## Overview

C.R.S. 24-33.5-1905 (4) directs the Department of Higher Education (DHE, the Department) to prepare a report detailing progress made towards critical state cybersecurity goals at institutions of higher education that received an appropriation through SB 18-086. Specifically, the report must include, at a minimum:

1. The number of faculty or adjunct faculty hired at each institution of higher education as a result of the funding;
2. The number of student internships created with the funding at each institution of higher education;
3. The number of degrees or certificates that have been awarded at each institution of higher education in connection with the funding;
4. The number of scholarships awarded at each institution in connection with the funding;
5. The number of presentations and seminars given on cybersecurity by each institution of higher education; and
6. The amount of all other money that has been raised to match the state investment, which may include tuition, fees, federal funds, and industry donations.

Six governing boards were awarded funding in the 2021-22 fiscal year. The following report summarizes their spending.

## Key Findings

Fiscal Year 2022-23 was the fifth year in which funding was awarded to support cybersecurity and distributed ledger technology activities at institutions. Despite the lingering impact of the COVID-19 pandemic on campus operations, institutions remained committed to offering cybersecurity activities and programming to both students and their communities. As of Fiscal Year 2022-23, most of the programs have expended their total allocation amounts.

**Table 1** shows SB 18-086 appropriation, actual expenditures, required scholarship award total, and actual scholarships awarded by Governing Board for Fiscal Year 2022-2023.

	SB 18-086 Appropriation	Total Amount Expended	SB 18-086 Scholarship Requirement	Total Amount Spent on Scholarships
Colorado Mesa University	\$300,000	\$226,130	\$30,000	\$31,900
Metropolitan State University of Denver	\$300,000	\$291,146	\$30,000	\$28,500
Western State Colorado University	\$200,000	\$323,185	\$20,000	\$35,000
Colorado State University System	\$1,200,000	\$1,054,525	\$180,000	\$1,166,083
University of Colorado System	\$2,800,000	\$2,800,000	\$560,000	\$1,251,901
Colorado Community College System	\$300,000	\$300,000	\$30,000	\$30,000

**Table 2** summarizes activities funded by SB 18-086 funding for Fiscal Year 2022-2023.

	Faculty and Adjuncts Hired	Internships Created	Degrees and Certificates Awarded	Scholarships Awarded	Presentations and Seminars Given	Amount of Other Funding Raised
Colorado Mesa University	0	12	13	17	8	\$0
Metropolitan State University of Denver	4	11	66	22	2	\$119,708
Western Colorado University	.91	11	5	14	12	\$130,913
Colorado State University System	7	93	144	106	90	\$2,828,194
University of Colorado System	3	18	98	133	280	\$21,964,796
Colorado Community College System	3	19	82	12	0	\$0

### Full Institutional Responses

Institutions used the funds received to support a wide range of public-facing activities, such as hosting summer camps, presenting at conferences, and offering trainings for community members. Institutions also raised significant additional funds to support their work in the cybersecurity realm. For additional details on institutional activities and funds raised, each institution’s full response has been included in the subsequent pages. In some cases, responses have been edited for formatting and grammar but are otherwise unchanged from the institutional submission.

## COLORADO MESA UNIVERSITY

SB 18-086 Appropriation Expenditure Report	
<b>Governing Board Name</b>	Colorado Mesa University
Total SB 18-086 Appropriation	
Actual Amount Spent on Scholarships	\$ 21,000
Total number of scholarships awarded	17
Required Allotted Amount Earmarked for Scholarships	
<b>At or above allotted amount of scholarship earmark</b>	Yes
Number of faculty/adjuncts hired as a result of funding	
	0.00
Number of student internships created	
	12
Number of degrees/certificates awarded in connection with SB 086 funding	
	13
Number of presentations/seminars given on cybersecurity	
	8
<b>Amount of all other money raised to match state investment</b>	0
Total Amount Expended	
	\$ 215,515
<b>Please discuss any additional ways in which SB 086 money was spent, which may not be captured in lines 6-9 and fundraising efforts as reported in FY21 and any other information you would like to be included in the report.</b>	
<p>Student research interns at the Cybersecurity Center have published 4 peer-reviewed research articles with 1 more currently under review. Student interns at the Center have also set up a server and network, which they are now using for big-data and machine learning research in cybersecurity. 36 students have declared for the Cybersecurity Professional Certificate or Minor. 2 graduates of the program have entered graduate programs in cybersecurity. Of the graduates to date, 100% have taken jobs in the field. Lastly, funding has supported 2 CMU faculty to travel to the National Center of Academic Excellence in Cybersecurity Symposium, participate in faculty development, and attend continuous education workshops.</p>	

## METROPOLITAN STATE UNIVERSITY

SB 18-086 Appropriation Expenditure Report		
<b>Governing Board Name</b>	Metropolitan State University of Denver	
Total SB 18-086 Appropriation	\$	300,000
Actual Amount Spent on Scholarships	\$	33,000
Total number of scholarships awarded	22	
Required Allotted Amount Earmarked for Scholarships	\$	30,000
<b>At or above allotted amount of scholarship earmark</b>	Yes	
Number of faculty/adjuncts hired as a result of funding	4.0	
Number of student internships created	11	
Number of degrees/certificates awarded in connection with SB 086 funding	66	
Number of presentations/seminars given on cybersecurity	2	
<b>Amount of all other money raised to match state investment</b>	119,708.04	
Total Amount Expended	\$	294,638
<b>Please discuss any additional ways in which SB 086 money was spent, which may not be captured in lines 6-9 and fundraising efforts as reported in FY22 and any other information you would like to be included in the report.</b>		
<b>The department continued funding a Cybersecurity Program Manager, a full-time Cybersecurity specialist in Dept. of Computer Information Systems, and the Director of the Cybersecurity Center, as well as scholarships for undergraduate students with the SB 18-086 monies.</b>		

**Metropolitan State University of Denver  
Cybersecurity-SB 18-086 Spending Summary  
September 2023**

- **The Bachelor of Science Degree in Cyber Security**  
 The Bachelor of Science Degree in Cyber Security has continued to see growth in enrollment since it began Fall 2018. At the end of the 2022-2023 academic year, the program had 430 majors. Of those 430, 144 were senior status. During the spring of 2022, the BS in Cybersecurity earned the National Center of Academic Excellence in Cyber Defense by the National Security Agency (NSA). The Master of Science in Cybersecurity (CYBM) has also seen growth since it began in 2019 with 15 students. At the end of AY 2022-2023, there were 35 students enrolled in the program.
- **Faculty and Staff**  
 The department continued funding a full-time Cybersecurity specialist faculty in Computer Information Systems and a Cybersecurity Program Manager with SB 18-086 monies. In addition, we partially fund the Director of the

Cybersecurity Center. The SB 18-086 monies are also used to fund several of the adjunct faculty who teach courses in the Cybersecurity program. The funding provides adjunct pay for about 3-5 faculty a semester, but the programs cover the other 8 to 11 faculty who teach the 18 different Cybersecurity undergraduate courses each Fall, Spring, and Summer. Across the three departments, nine full-time faculty teach courses in the Cybersecurity programs.

SB 18-086 monies have not been used to directly fund academic research, but the faculty have continued to engage in academic scholarship around cybersecurity. We have used funding from the CYBM program to help offset some of the professional development costs for faculty. Below are a few examples of academic scholarship produced by the faculty:

- Fustos, J. Cybersecurity Certificate Selection Process: A Data Envelopment Analysis Approach. Published in February 15, 2023. 2023 *SEDSI CONFERENCE* – presentation and proceedings
- Lambert, W. B., Fustos, J. & Moreno, A. (2023). Cybersecurity Certificate Selection Process: A Data Envelopment Analysis Approach. *Journal of Applied Business and Economics*. <https://doi.org/10.33423/jabe.v25i3>.
- Li, L. “Cybersecurity Education: An Interdisciplinary Approach.” *International Police Executive Symposium*, 31<sup>st</sup> Annual Meeting, August 2022.
- Zhu, W. “Converting Upper-Division Undergraduate Computer Science Courses Online: Challenges, Student Performance, and Student Perceptions” *Frontiers in Education* 2022, Uppsala, Sweden, October 8-11, 2022. Data collected from Computer and Network Security course.

- **Scholarship**

MSU-Denver created a scholarship in Fall of 2018 and has allocated 10% of the annual SB 18-086 awards to be distributed for scholarships. In FY 23, \$33,000 was awarded to 22 students in the amount of \$1500 per student.

- **Other areas and institutional matches**

The three departments fund a majority of part-time and full-time faculty who teach courses in the Cybersecurity Degree Program. The CYBM fund is also used to pay adjunct faculty who teach in the MS program or conference attendance. For FY 23, the CYBM program paid \$4,000 in professional development funds for faculty. The College of Health and Human Sciences also provided personnel support in the amount of \$1,020.00 for FY23.

Additionally, the Department of Criminal Justice and Criminology and the CYBM program fund paid \$6,300 to sponsor a table at the Women in Cybersecurity Conference hosted in Denver in March 2023. Three faculty and four students were able to attend the conference because of the sponsorship.

- **Graduate or Certificates:**

During FY 23, 40 undergraduate students completed their BS in Cybersecurity, and 15 students completed their MS in Cybersecurity. There were also 11 students who completed the STEMPath certificate program. The Cybersecurity Center continues to partner with MSU Denver’s Classroom to Career Hub to provide students opportunities to complete Cybersecurity certifications through the Cybersecurity Certification Club (C3). During FY 23, 13 students earned CompTIA ITF+ and 4 students earned CompTIA A+ certifications. The Cybersecurity

Center is also providing experience for students via the Public Infrastructure Security Cyber Education System (PISCES).

- **Amount of matching monies, including tuition, fees, federal funds, and industry donations:**  
The total amount of matching monies for FY 23 is \$119,708.04. The program continues to partner with MindSpark to provide STEMPATH Cybersecurity Certificates to K-12 teachers. During FY 23, the program received \$70,708.04 in tuition monies for the STEMPATH Certificates. The Cybersecurity Center received \$49,000 from external partners to support C3 certification initiatives, which allows students to go through a semester-long preparation program and test for certain industry certifications.

## WESTERN COLORADO UNIVERSITY

SB 18-086 Appropriation Expenditure Report		
<b>Governing Board Name</b>	Western Colorado University	
Total SB 18-086 Appropriation	\$	200,000
Actual Amount Spent on Scholarships	\$	42,000
Total number of scholarships awarded	14	
Required Allotted Amount Earmarked for Scholarships	\$	20,000
<b>At or above allotted amount of scholarship earmark</b>	Yes	
Number of faculty/adjuncts hired as a result of funding	.91 FTE (\$108,751)	
Number of student interships created	11	
Number of degrees/certificates awarded in connection with SB 086 funding	5	
Number of presentations/seminars given on cybersecurity	12	
<b>Amount of all other money raised to match state investment</b>	\$	130,913
Total Amount Expended	Western Colorado University	\$ 326,670
<b>Please discuss any additional ways in which SB 086 money was spent, which may not be captured in lines 6-9 and fundraising efforts as reported in FY23 and any other information you would like to be included in the report.</b>		
<p><b>While the cyber funding created important opportunities for formal faculty development and supporting faculty salaries associated with the informational security emphases, it has been increasingly matched by institutional resources to hire and retain faculty in the field. In addition, working with financial aid and program faculty has increased scholarship opportunities for students interested in entering the information security workforce. Finally, the networking of cybersecurity faculty across the state has been beneficial for Western and all programs ability to meet these workforce needs.</b></p>		



## COLORADO STATE UNIVERSITY SYSTEM

SB 18-086 Appropriation Expenditure Report	
<b>Governing Board Name</b>	Colorado State University System
Total SB 18-086 Appropriation	
Actual Amount Spent on Scholarships	\$ 669,269
Total number of scholarships awarded	106
Required Allotted Amount Earmarked for Scholarships	
<b>At or above allotted amount of scholarship earmark</b>	Yes
Number of faculty/adjucts hired as a result of funding	7
Number of student interships created	93
Number of degrees/certificates awarded in connection with SB 086 funding	144
Number of presentations/seminars given on cybersecurity	90
<b>Amount of all other money raised to match state investment</b>	2828194
Total Amount Expended	\$ 1,200,000
<p><b>Please discuss any additional ways in which SB 086 money was spent, which may not be captured in lines 6-9 and fundraising efforts as reported in FY21 and any other information you would like to be included in the report.</b></p>	
<p><b>Information provide in Figure 1.</b></p>	

Figure 1.



# Colorado State University System



SB 18-086 Report, CSUS Sept. 2023					
	FY 19	FY 20	FY 21	FY22	FY 23*
Total SB 18-086 Appropriation	\$1,200,000	\$1,200,000	\$729,412	\$1,200,000	\$1,200,000
Actual Amount Spent on Scholarships	\$122,435	\$306,050	\$286,005	\$1,166,083	\$669,269
Total Number of Scholarships Awarded	45	141	118	237	106
Allotted Amount Earmarked for Scholarships	\$180,000	\$180,000	\$108,000	\$180,000	\$180,000
<b>At or above allotted scholarship earmark</b>	No	Yes	Yes	Yes	Yes
<b>Other accomplishments</b>					
Number of faculty/adjuncts hired...	2	32	9	22	7
Number of student internships	71	129	118	198	93
Number of degrees/certificates/course completions	28	303	371	1,061	144
No. presentations/seminars on cybersecurity	83	143	15	123	90
Amount of all other matching money raised	\$50,000	\$7,700,000	\$3,249,816	\$5,231,369	\$2,828,194
<ul style="list-style-type: none"> <li>• More than one hundred and eighty (180) faculty/interns hired under the grant.</li> <li>• More than 500 student participants have graduated, virtually all have jobs in IT w/ IT Security prominent.</li> <li>• The CSU System invested \$79,810 for computers at Sturms, serving over 200 students in ITSec courses.</li> </ul>					

\* FY 23 Expenditures from the Grant \$1,054,525

## UNIVERSITY OF COLORADO SYSTEM

SB 18-086 Appropriation Expenditure Report		
<b>Governing Board Name</b>	University of Colorado System	
Total SB 18-086 Appropriation	\$	2,800,000
Actual Amount Spent on Scholarships	\$	910,000
Total number of scholarships awarded		133
Required Allotted Amount Earmarked for Scholarships	\$	560,000
<b>At or above allotted amount of scholarship earmark</b>		Yes
Number of faculty/adjuncts hired as a result of funding		3
Number of student internships created		18
Number of degrees/certificates awarded in connection with SB 086 funding		98
Number of presentations/seminars given on cybersecurity		280
<b>Amount of all other money raised to match state investment</b>		\$21,964,796
Total Amount Expended	\$	2,800,000
<b>Please discuss any additional ways in which SB 086 money was spent, which may not be captured in lines 6-9 and fundraising efforts as reported in FY23 and any other information you would like to be included in the report.</b>		
<b>See below for additional information</b>		

# University of Colorado, Colorado Springs (UCCS)

## Cybersecurity Initiative (CSI)

### FY23 Annual Report

September 1, 2023



Approved:

*Nancy Marchand-Martella*

**Dr. Nancy Marchand-Martella Provost**

University of Colorado, Colorado Springs

1420 Austin Bluffs Parkway

Colorado Springs, CO 80918

**Executive Summary**

On May 30<sup>th</sup>, 2018, former Governor Hickenlooper signed Senate Bill (SB) 18-086 granting UCCS \$2.8 million annually for workforce development, research and development, and support to law enforcement enhancing cybersecurity for the State and the Nation. In May 2021, the bill was extended for another three-year term. This document provides a consolidated report of FY 2023 CSI expenditures as required by SB18-086.

Altogether, UCCS in partnership with the National Cybersecurity Center (NCC) spent all of the FY 2023 State appropriation, \$2,800,000 shown in Figure 1. Additionally, nearly \$ 23M in grants and additional funds were awarded to, and obtained by, UCCS, NCC and Space ISAC. These are also reported in Figure 1.

Figure 1: SB18-086 Reporting Criteria

SB 18-086 Appropriation Expenditure Report	
<b>Governing Board Name</b>	University of Colorado System
Total SB 18-086 Appropriation	\$ 2,800,000
Actual Amount Spent on Scholarships	\$910,000
Total number of scholarships awarded	133
Required Allotted Amount Earmarked for Scholarships	\$ 560,000
<b>At or above allotted amount of scholarship earmark</b>	Yes
Number of faculty/adjuncts hired as a result of funding	3
Number of student internships created	18
Number of degrees/certificates awarded in connection with SB 086 funding	98
Number of presentations/seminars given on cybersecurity	280
<b>Amount of all other money raised to match state investment</b>	\$21,964,796
Total Amount Expended	\$ 2,800,000
<b>Please discuss any additional ways in which SB 086 money was spent, which may not be captured in lines 6-9 and fundraising efforts as reported in FY23 and any other information you would like to be included in the report.</b>	

In addition to SB18-086 reporting criteria, the impact of the state's investment in the Colorado cybersecurity ecosystem including academic and community programs, industry outreach and partnership and filling workforce needs cannot be understated. These efforts are critical to Colorado's support expanding and strengthening the UCCS ties with Space Force and Space Command in Colorado and to continue being a national leader in public and private sector activities related to cybersecurity. The following narrative provides more detail on the comprehensive impact these funds have had on UCCS efforts to engage, support, and grow cybersecurity in Colorado and beyond.

Together, UCCS and NCC are continuing along the path of exponentially expanding the cybersecurity ecosystem with initiatives, programs, research, and partnerships that are paying large dividends by enhancing cybersecurity for Colorado and the Nation. Both UCCS and NCC are grateful to the Colorado Legislature and Governor for giving us this opportunity.



Gretchen Bliss  
Director for Cybersecurity Programs  
[gbliss@uccs.edu](mailto:gbliss@uccs.edu) (719) 351-4910  
University of Colorado, Colorado Springs  
1420 Austin Bluffs Parkway  
Colorado Springs, CO 80918



# University of Colorado Colorado Springs

UCCS has leveraged SB-086/CSI \$2,800,00 in 2022-2023 from the JBC to achieve the following under the broad legislation requirements:

## **Scholarship Amount – \$910,000**

- 67 College of Engineering and Applied Science (EAS) students were awarded cybersecurity scholarships totaling \$363,000
- 31 College of Business (COB) students were awarded cybersecurity scholarships totaling \$130,000
- 4 College of Letters, Arts and Sciences (LAS) students were awarded cybersecurity scholarships totaling \$10,000
- College of Public Service (COPS) students were awarded cybersecurity scholarships totaling \$20,000
- College of Education (COE) students were awarded 20 cybersecurity scholarships totaling \$20,000
- COB and EAS provided Sec+ certification scholarships for 24 students totaling \$27,000
- The National Cybersecurity Center (NCC), based on additional funds leveraged as a result of state money, offered academic and non-academic scholarships for adults and K12 in FY 2023 for a total of \$340,000.

## **Total Students Scholarships Awarded –499**

- 15 graduate and 53 undergraduate Engineering and Applied Sciences (EAS) cybersecurity students
- 6 graduate and 25 undergraduate College of Business (CoB) cybersecurity students
- 4 Letters, Arts and Sciences (LAS) cybersecurity students
- 10 College of Public Service (COPS) cybersecurity students
- 20 College of Education (COE) cybersecurity students
- 65 Middle School students (in addition to the 30 students funded by a NSA grant) attended two no cost (covered by CSI funds) week long cybersecurity camps at UCCS Summer 2023
- The NCC provided cybersecurity training to 301 academic and non-academic participants.

## **Faculty Hires – 1 new**

- **College of Engineering and Applied Science (EAS) - 3 Ongoing faculty**
  - In addition to the previously hired Endowed Gallogly cybersecurity chair in 2021, EAS hired a cybersecurity instructor, Dr. Serena Sullivan in 2022. EAS still employs 2 faculty and 1 instructor with this funding - cybersecurity areas of focus for these faculty include cybersecurity operations and security in intelligent transportation and privacy and anonymous networks.
- **Cybersecurity Program Office –4 ongoing staff**
  - Continues to employ the Director of Cybersecurity Programs with this funding, as well as a cybersecurity grant manager, a marketing and outreach position (.4 time), and an HR/Budget deputy position (0.75).
- **College of Business – 1 ongoing faculty, 1 new position pending hire**

- Employs 2 tenure track faculty, one with this funding and one instructor of cybersecurity with department funding. The Couger Endowed Chair tenure track faculty position in Information Systems focused on Cybersecurity Management is newly appointed.
- The NCC – 24 ongoing staff

### **Student Internships Created – 18**

- **UCCS cybersecurity students** obtained 4 (4 EAS, 0 COB) cybersecurity internships in 2022-2023
- **UCCS EAS Blockchain research project** supports 2 part-time interns and directly executes the legislative SB18-086 requirement to conduct research and development on encryption and data integrity techniques
- The NCC hosted 10 cybersecurity student internships
- The Space ISAC hosted 2 cybersecurity college interns for Summer 2023, fellows that conducted strategic planning and evaluation of the cybersecurity threat intelligence platform

### **Degrees and Certificates Awarded – 666**

In addition to the degrees and certificates awarded below, UCCS Engineering and Applied Science College and Cybersecurity Program Office obtained from the National Security Agency (NSA) redesignation of their Cybersecurity Master of Engineering cybersecurity degree program as a Center of Academic Excellence (CAE) in cybersecurity.

- **UCCS EAS/COB degrees – 51 graduated**
  1. Bachelor's degree in Innovation (BISC-BI, BUBI/CYSM) – Graduated 2022-2023 21 (0 COB, 21 EAS); Enrolled 84 (COB 7, EAS 77)
  2. Bachelor of Science Cybersecurity (CSCI-BS/CYBS) – Graduated 2022-2023 3; Enrolled 40
  3. Bachelor of Arts Cybersecurity (CSCI-BA/CYBA) - Graduated 2022-2023 1; Enrolled 35
  4. BS in Business Emphasis Area in Cybersecurity Management (BUBS-BS, BUBI-BI, CYSM-CERU)CoB – Graduated 2022-2023 7; Enrolled 51
  5. Master's Degree in Computer Science EAS – Graduated 2022-2023 6; Enrolled 46
  6. Master's Degree in Cybersecurity EAS (MAEG-MENG) - Graduated 2022-2023 5; Enrolled 18
  7. MBA Emphasis in Cybersecurity Management CoB (MBAD-MBA, MBAE-MBA, MBAO-MBA) – Graduated 2022-2023 7; Enrolled 22
  8. Doctor of Philosophy Degree EAS (ENGR-PHD Security, SECR-PHD)– Graduated 2022-2023 1; Enrolled 43
  9. Doctor of Business Administration in Cybersecurity Management CoB (EDBA-DBA)– 2022-2023 0; Enrolled 17
  10. Bachelor of Arts Interdisciplinary Studies Cybersecurity (INST-BA)-Graduated 2022-2023 0; Enrolled 1
- **UCCS certificates – 42**
  - Network System Security EAS – Graduated 2022-2023 0; Enrolled 0 (students self-report; none reported)
  - Undergraduate Applied Cybersecurity Certificate EAS – 2022-2023 0; Enrolled 0 (students self-report; non reported)
  - Graduate Certificate in Cybersecurity Management CoB (CYSM-CRG, CYSM-CERU)– Graduated 2022-2023 21; Enrolled 21
  - Undergraduate Certificate in Cybersecurity Management CoB - graduated 2022-2023 21; Enrolled 21 (students self-report; non reported)



- Graduate Certificate in National Security (GNSI-CERG)-Graduated 2022-2023 0;  
Enrolled 27
- As part of a STEM grant UCCS has awarded scholarships to 24 students for Security + industry certification courses in Summer 2022, 11 of the 24 obtained certifications.
- **The College of Letters, Arts and Sciences**
  - Students in the College of Letters, Arts & Sciences have been exploring the intersection of cybersecurity and degrees in LAS such as philosophy, mathematics, and sociology and currently offer two undergraduate degrees.
    - Interdisciplinary Studies with an Emphasis on Cybersecurity, BA
    - Technical Communication and Information Design, BA
- **The College of Public Service**
  - Criminal Justice, (CRJU-BA) - Cyber Crime & Cybersecurity Track Option – Graduated 2022-2023 0; Enrolled 17
- **NCC – 573 certificates**
  - Three NCC cybersecurity non-credit programs were offered during this past FY. 573 of the students and adults who completed the cybersecurity courses earned nationally recognized certifications in areas such as IT Fundamentals and Security+
    - NCC Student Alliance (NCCSA) in Cybersecurity (CTSO) – 570 participants (570 students, 80% 457 achieved certification)
    - Cybersecurity training – Adults – 166 participants (166 adults, 70% 116 achieved certification)
  - Cyber camps – 160 participants
- The NCC, based on additional funds leveraged as a result of state money, was able to increase Adult Education Initiative offerings to include CySA+ and Network +and was approved to be on the Colorado Eligible Training Provider List (EPTL). Additional funding was received from Space ISAC, Daniel’s Fund, El Pomar, Cielo, Alan Paller, Crown Jewels, Pisces, National Science Foundation (NSF), Small Business Association (SBA) Cyber for small businesses, AAF, Range Force and Northrop Grumman.

**Additional Funds:**

- **UCCS**
  - UCCS was awarded funding from NSF for DoD Scholarship for Service (SFS) program- 7 cybersecurity students (2 PhD, 3 MS and 2 Undergraduate) – \$455,404 for AY 2022-2023 (\$1,438,636 cumulative since Fall 2019), Sang-Yoon Chang

**Seminars, Publications and Presentations on Cybersecurity – 300**

- **UCCS Cybersecurity Distinguished Lecture Series: 14**
  - Hosted 14 Distinguished Lectures by world-renowned scientists, with attendees primarily from UCCS students and faculty. The speakers also interacted with UCCS students and faculty intensively after the lecture.
    - Major General Bradley Pyburn (USCYBERCOM), 09/13/2022
    - Dr. Lisa Zhang (UCLA), 10/19/2022
    - Dr. Hernan Londono (Dell), 11/16/2022
    - Dr. Alexander Kott (Army Research Lab), 12/07/2022

- Dr. Joe Mozer (US SPACE FORCE), 02/09/2023
- Col Christopher Kennedy (US SPACE FORCE), 03/16/2023
- Lt Gen John Shaw (USSPACECOM), 04/14/2023
- Dr. Bill Nochols (CMU), 11/22/2022
- Dr. Rainer Bohme (University of Innsbruck, Austria), 11/29/2022
- Dr. Calvin Chan (CU Boulder), 12/06/2023
- Dr. Pavel Celeda (Masaryk University, Czech Republic), 02/01/2023
- Dr. Baek-Young Choi (University of Missouri – Kansas City), 02/21/2023
- Jan Hajny (Brno University of Technology, Czechia, EU), 02/22/2023
- Commander Stephanie Pendino (USCYBERCOM), 03/02/2023
- **College of Engineering and Applied Sciences – 42 publications and presentations**
  - **Publications - 31**
    - Thomas Hastings and **Kristen R. Walcott**. “Continuous Verification of Open-Source Components in a World of Weak Links.” In the Proceedings of the International Symposium on Software Reliability Engineering (ISSREW)- The 12th IEEE International Workshop on Software Certification (WoSoCer). Oct 2022.
    - Qi Xia, Qian Chen, and **Shouhuai Xu**. Near-Ultrasound Inaudible Trojan (NUIT): Exploit your speaker to Attack your Voice-Controllable Devices. Usenix Security’2023, to appear. This paper has been reported by UCCS Communique and 20 news media reports world-wide (see [What’s New – LCD \(xu-lab.org\)](https://www.xu-lab.org/what-s-new-lcd/)).
    - Liangde Tao, Lin Chen, Lei Xu, **Shouhuai Xu**, Zhimin Gao, Weidong Shi. Electoral manipulation via influence: probabilistic model. Auton. Agents Multi Agent Syst. 37(1): 18 (2023)
    - Deqiang Li, Shicheng Cui, Yun Li, Jia Xu, Fu Xiao, **Shouhuai Xu**. PAD: Towards Principled Adversarial Malware Detection Against Evasion Attacks. Accepted to IEEE Transactions on Dependable and Secure Computing, 2023
    - **Ekzhin Ear**, Jose L. C. Remy, and **Shouhuai Xu**. Towards Automated Cyber Range Design: Characterizing and Matching Demands to Supplies. Proc. of the 2023 IEEE International Conference on Cyber Security and Resilience (CSR’2023), accepted
    - **Shouhuai Xu**. AICA Development Challenges. Book Chapter in “Building an Artificial Intelligent Cyber-defense Agent,” to appear in 2023
    - Jin Peng, Haofei Zhang, Juan Mao, **Shouhuai Xu**. Repeated data breaches and firm value, Economics Letters, Volume 224, 2023, 111001
    - Deqiang Li, Qianmu Li, Yanfang (Fanny) Ye, **Shouhuai Xu**. Arms Race in Adversarial Malware Detection: A Survey. ACM Comput. Surv. 55(2): 15:1-15:35 (2023)
    - Mir Mehedi Ahsan Pritom and **Shouhuai Xu**. Supporting Law-Enforcement to Cope with Blacklisted Websites: Framework and Case Study. Proceedings of IEEE 2022 Conference on Communications and Network Security
    - Eric Ficke, Raymond M. Bateman, and **Shouhuai Xu**. Reducing Intrusion Alert Trees to Aid Visualization. Proc. of the 16th International Conference on Network and System Security (2022)
    - Rosana Montanez Rodriguez and **Shouhuai Xu**. Cyber Social Engineering Kill Chain. Proc. of the 2022 International Conference on Science of Cyber Security (SciSec’2022): pp 487-504

- Rosana Montanez Rodriguez, **Adham Atyabi**, and **Shouhuai Xu**. Social Engineering Attacks and Defenses in the Physical World vs. Cyberspace A Contrast Study. Book Chapter in “Cybersecurity and Cognitive Science,” 2022, pages 3-41.
- Zhen Li, Deqing Zou, **Shouhuai Xu**, Hai Jin, Yawei Zhu, Zhaoxuan Chen. SySeVR: A Framework for Using Deep Learning to Detect Software Vulnerabilities. IEEE Trans. Dependable Secur. Comput. 19(4): 2244-2258 (2022)
- Zhen Li, Deqing Zou, **Shouhuai Xu**, Zhaoxuan Chen, Yawei Zhu, Hai Jin. VulDeeLocator: A Deep Learning-Based Fine-Grained Vulnerability Detector. IEEE Trans. Dependable Secur. Comput. 19(4): 2821-2837 (2022)
- Huashan Chen, Hasan Cam, **Shouhuai Xu**. Quantifying Cybersecurity Effectiveness of Dynamic Network Diversity. IEEE Trans. Dependable Secur. Comput. 19(6): 3804-3821 (2022) [\[OBJ\]](#)
- Catherine Meadows, Sena Hounsinou, Timothy Wood, and **Gedare Bloom**. 2023. Sidecar-based Path-aware Security for Microservices. In Proceedings of the 28th ACM Symposium on Access Control Models and Technologies (SACMAT '23), May 2023.
- Farhad Mofidi, Sena Hounsinou, and **Gedare Bloom**. 2023. L-IDS: A lightweight hardware-assisted IDS for IoT (Internet of Things) systems to detect ransomware attacks. In Proceedings of the 8th ACM/IEEE Conference on Internet of Things Design and Implementation (IoTDI '23), May 2023.
- O. Ikumapayi, H. Olufowobi, J. Daily, T. Hu, I. C. Bertolotti and **G. Bloom**, "CANASTA: Controller Area Network Authentication Schedulability Timing Analysis," in IEEE Transactions on Vehicular Technology, doi: 10.1109/TVT.2023.3258746. Mar. 2023
- Vijay Banerjee, Sena Hounsinou, Habeeb Olufowobi, Monowar Hasan, and **Gedare Bloom**. “Secure Reboots for Real-Time Cyber-Physical Systems.” In Proceedings of the 4th Workshop on CPS & IoT Security and Privacy (CPSIoTSec '22), Nov. 2022.
- P. Agbaje, A. Anjum, A. Mitra, E. Oseghale, **G. Bloom**, H. Olufowobi, “Survey of Interoperability Challenges on the Internet of Vehicles,” in IEEE Transactions on Intelligent Transportation Systems, vol. 23, iss. 12, pp. 22838-22861, Aug. 2022.
- H. Lawrence, U. Ezeobi, O. Tauil, J. Nosal, O. Redwood, **Y. Zhuang, G. Bloom**, “CUPID: A Labeled Dataset with Pen testing for Evaluation of Network Intrusion Detection,” in Journal of Systems Architecture, vol. 129, Elsevier, pp. 1-12, Aug. 2022.
- J. Seaton, S. Hounsinou, **G. Bloom**, and P. N. Brown, “Competitive Information Provision Among Internet Routing Nodes,” in 2023 American Control Conference (ACC), May 2023.
- A. Duby, T. Teryl, **G. Bloom, Y. Zhuang**, “Evaluating Feature Robustness for Windows Malware Family Classification,” in 2022 International Conference on Computer Communications and Networks (ICCCN), July 2022
- Chiho Kim, **Sang-Yoon Chang**, Jonghyun Kim, Dongeun Lee, and Jinoh Kim, Automated, Reliable Zero-Day Malware Detection based on Autoencoding Architecture, IEEE Transactions on Network and Service Management (TNSM), 2023

- Hsiang-Jen Hong, **Sang-Yoon Chang**, Xiaobo Zhou, Auto-Tune: An Efficient Autonomous Multi-Path Payment Routing Algorithm for Payment Channel Networks, Elsevier Computer Networks, 2023
- Wenjun Fan, Hsiang-Jen Hong, Jinh Kim, **Simeon Wuthier**, Makiya Nakashima, **Xiaobo Zhou**, Ching-Hua Chow, and **Sang-Yoon Chang**, Lightweight and Identifier-Oblivious Engine for Cryptocurrency Networking Anomaly Detection, IEEE Transactions on Dependable and Secure Computing (TDSC), 2022
- Jinh Kim, Makiya Nakashima, Wenjun Fan, **Simeon Wuthier**, **Xiaobo Zhou**, Ikkyun Kim, and **Sang-Yoon Chang**, A Machine Learning Approach to Anomaly Detection based on Traffic Monitoring for Secure Blockchain Networking, IEEE Transactions on Network and Service Management (TNSM), 2022
- Arijet Sarker, Sanghyun Byun, Manohar Raavi, Jinh Kim, Jonghyun Kim, and **Sang-Yoon Chang**, Dynamic ID Randomization for User Privacy in Mobile Network, ETRI Journal, 2022
- Hsiang-Jen Hong, Wenjun Fan, **Simeon Wuthier**, Jinh Kim, **Edward Chow**, **Xiaobo Zhou**, and **Sang-Yoon Chang**, Robust P2P Networking Connectivity Estimation Engine for Permissionless Bitcoin Cryptocurrency, Elsevier Computer Networks, 2022
- Chiho Kim, **Sang-Yoon Chang**, Dongeun Lee, J Dongeun Lee, Jonghyun Kim, Kyungmin Park, and Jinh Kim, Reliable Detection of Location Spoofing and Variation Attacks, IEEE Access, 2023
- **Yanyan Zhuang**, Yu Yan, Lois Anne DeLong, Martin K.-C. Yeh, "Do Developer Perceptions Have Borders? Comparing C Code Responses across Continents." Accepted by Software Quality Journal.
- **Keynote, and panel and other presentations in year 2023 - 42 Presentations**
  - **Shouhuai Xu**. Cybersecurity Dynamics: A Foundation for the Science of Cybersecurity. Ohio State University, April 27, 2023
  - **Shouhuai Xu**. Cybersecurity Dynamics: A Foundation for the Science of Cybersecurity. University of Missouri Kansas City, Feb 17, 2023
  - **Shouhuai Xu**. Repeated Data Breaches and Firm Value. The 18th Annual Cybersecurity Forum on Financial Information Systems and Cybersecurity: A Public Policy Perspective. Smith School of Business and School of Public Policy, University of Maryland, Jan 11, 2023.
  - **Shouhuai Xu**. CR2M2: A Framework for Cyber Risks to Missions Management, US DoD University Consortium for Cybersecurity Research Workshop, National Defense University, Nov. 16, 2022
  - **Shouhuai Xu**. Towards Quantitative Cyber Risk Management. Curiosity Unlimited, Dec. 9, 2022
  - Mark Maldonado and **Shouhuai Xu**. Towards Detecting Log4j Attacks via Machine Learning. USCYBERCOM CyberRecon'2023. Won USCYBERCOM Analyst Award.
  - Arijet Sarker, **Simeon Wuthier**, Jinh Kim, Jonghyun Kim, and **Sang-Yoon Chang**, Version++: Cryptocurrency Blockchain Handshaking with Software Assurance, IEEE Consumer Communications & Networking Conference (CCNC), 2023, Las Vegas, NV, USA (Acceptance Rate: 37%)

- Junxian Zhao, **Xiaobo Zhou, Sang-Yoon Chang**, ChenZhong Xu, Let It Go: Relieving Garbage Collection Pain for Latency Critical Applications in Golang, ACM International Symposium on High-Performance Parallel and Distributed Computing (HPDC), 2023, Orlando, FL, USA
- Manohar Raavi, **Simeon Wuthier, Xiaobo Zhou, and Sang-Yoon Chang**, Post-Quantum QUIC Protocol in Cloud Networking, EuCNC 6G Summit, 2023, Gothenburg, Sweden
- **Sang-Yoon Chang**, Kyungmin Park, Jonghyun Kim, and Jino Kim, Towards Securing UAV Flying Base Station: Misplacement Impact Analyses on Battery and Power, ACM International Workshop on Systems and Network Telemetry and Analytics (SNTA), 2023, Orlando, FL, USA
- **Sang-Yoon Chang, Simeon Wuthier**, Jonghyun Kim, and Jino Kim, Lightweight Software Assurance for Distributed Mobile Networking, International Conference on Security and Management (SAM), 2023, Las Vegas, NV, USA
- Arijet Sarker, **Simeon Wuthier**, Jino Kim, Jonghyun Kim, and **Sang-Yoon Chang**, Version++ Protocol Demonstration for Cryptocurrency Blockchain Handshaking with Software Assurance, Demo at IEEE Consumer Communications & Networking Conference (CCNC), 2023, Las Vegas, NV, USA (Best Demo Award)
- Junxian Zhao, Aidi Pi, **Xiaobo Zhou, and Sang-Yoon Chang**, Improving Concurrent GC for Latency Critical Services in Multi-Tenant Systems, ACM/IFIP/USENIX International Middleware Conference (MIDDLEWARE), Quebec City, Canada
- Wenjun Fan, **Simeon Wuthier**, Hsiang-Jen Hong, **Xiaobo Zhou, Yan Bai, and Sang-Yoon Chang**, The Security Investigation of Ban Score and Misbehavior Tracking in Bitcoin Network, IEEE International Conference on Distributed Computing Systems (ICDCS), 2022, Bologna, Italy (Acceptance rate: 19.9% - 114 out of 573)
- **Simeon Wuthier**, Pranav Chandramouli, **Xiaobo Zhou, and Sang-Yoon Chang**, Greedy Networking in Cryptocurrency Blockchain, IFIP International Conference on ICT Systems Security and Privacy Protection (IFIP SEC), 2022, Copenhagen, Denmark (Acceptance rate: 23.6% - 30 out of 127)
- **Yaroslav Balytskyi**, Manohar Raavi, Yevgen Kotukh, Gennady Khalimov, and **Sang-Yoon Chang**, PT-Symmetric Bayesian Parameter Estimation on a Superconducting Quantum Processor, IEEE International Conference on Communications (ICC), 2022, Seoul, South Korea (Acceptance rate: 40%)
- Hsiang-Jen Hon, **Sang-Yoon Chang**, and **Xiaobo Zhou**, Auto-Tune: Efficient Autonomous Routing for Payment Channel Networks, IEEE Conference on Local Computer Networks (LCN), 2022, Florida, USA (Acceptance rate: 30%)
- Manohar Raavi, **Simeon Wuthier**, Pranav Chandramouli, **Xiaobo Zhou, and Sang-Yoon Chang**, QUIC Protocol with Post-Quantum Authentication, Information Security Conference (ISC), 2022, Bali, Indonesia
- Kelei Zhang, **Simeon Wuthier, Kay Yoon, and Sang-Yoon Chang**, Designing and Using Capture The Flag for Coordination and Interaction in Engineering Education, IEEE Global Engineering Education Conference (EDUCON), 2022, Tunis, Tunisia

- Wenjun Fan, Subham Kumar, **Sang-Yoon Chang**, A blockchain-based Retribution Mechanism for Collaborative Intrusion Detection, Silicon Valley Cybersecurity Conference (SVCC), 2022, Virtual
- Nikhil Sai Kanuri, **Sang-Yoon Chang**, Younghee Park, Jonghyun Kim, and Jino Kim, Impact of Location Spoofing Attacks on Performance Prediction in Mobile Networks, Silicon Valley Cybersecurity Conference (SVCC), 2022, Virtual
- Kathryn Hines, Manohar Raavi, John-Michael Villeneuve, **Simeon Wuthier**, Javier Moreno-Colin, **Yan Bai**, and **Sang-Yoon Chang**, Post-Quantum Cipher Power Analysis in Lightweight Devices, Poster at ACM Conference on Security and Privacy in Wireless and Mobile Networks (WiSec), 2022, San Antonio, Texas, USA
- Theo Gamboni-Diehl, **Simeon Wuthier**, Jino Kim, Jonghyun Kim, and **Sang-Yoon Chang**, Lightweight Code Assurance Proof for Wireless Software, Poster at ACM Conference on Security and Privacy in Wireless and Mobile Networks (WiSec), 2022, San Antonio, Texas, USA
- **Sang-Yoon Chang**, Jino Kim, and Jonghyun Kim, Flying Base Station Control: Transmission Power, Bandwidth Rate, and Mobility, US Korea Conference (UKC), 2022, Arlington, VA, USA
- **Sang-Yoon Chang**, Jino Kim, and Jonghyun Kim, Dynamic and Diverse Trust in Permissionless, Zero-Trust, or Perimeterless Networking, US Korea Conference (UKC), 2022, Arlington, VA, USA
- **Sang-Yoon Chang**, Global Cybersecurity Forum (GCF), Cryptographic Engineering Panel, Nov 2022 (Funded with registration, airfare, and accommodation)
- **Sang-Yoon Chang**, Sungkyunkwan University Cybersecurity Seminar, 5G/6G Security, Oct 2022 (funded with honorarium)
- **Kora Gwartney**, Ekzhin Ear, Jose Remy, Samuel Olegba, Graeme Slack, and **Shouhuai Xu**. TEMPS: A Framework for Quantifying Cyber Operations Success against Adversarial Threats. USAFA (US Air Force Academy) Research Conference'2023
- Brandon Collins, **Shouhuai Xu**, and **Philip Brown**. Towards Creating a New Cybersecurity Game Theory: Gaps and Potential Bridges. USAFA Research Conference'2023
- Ekzhin Ear and **Shouhuai Xu**. TEMPS: A Framework for Quantifying Cyber Operations Success against Adversarial Threats. RSA Conference'2023
- E. Ear and **S. Xu**. CyberRACE: A Framework for Cyber Range Automation to Support Cybersecurity Education. Colorado State Capitol Science Day, Jan 2023
- Brandon Collins, **Shouhuai Xu**, and **Philip Brown**. Towards Creating a New Cybersecurity Game Theory: Gaps and Potential Bridges. USAFA Research Conference'2023
- **Kora Gwartney**, Ekzhin Ear, Jose Remy, Samuel Olegba, Graeme Slack, and **Shouhuai Xu**. TEMPS: A Framework for Quantifying Cyber Operations Success against Adversarial Threats. USAFA Research Conference'2023
- Rosana Rodriguez, Theodore Longtchi, **Kora Gwartney**, Ekzhin Ear, David P. Azari, Christopher P. Kelley, and **Shouhuai Xu**. Quantifying Psychological Sophistication of Malicious Emails. USAFA Research Confernece'2023

- Mark Maldonado and **Shouhuai Xu**. Towards Detecting Log4j Attacks via Machine Learning. USAFA Research Conference'2023
- Antonia Feffer and **Shouhuai Xu**. Exploring Physical Layer Security Approaches for Securing Optical Satellite Communications. USAFA Research Conference'2023
- Mark Maldonado and **Shouhuai Xu**. Towards Detecting Log4j Attacks via Machine Learning. USCYBERCOM CyberRecon'2023
- **Kora Gwartney**, Ekzhin Ear, Jose Remy, Samuel Oglegba, Graeme Slack, and **Shouhuai Xu**. TEMPS: A Framework for Quantifying Cyber Operations Success against Adversarial Threats. USCYBERCOM CyberRecon'2023
- E. Ear and **S. Xu**. CyberRACE: A Framework for Cyber Range Automation to Support Cybersecurity Education. UCCS Mountain Lions Research Day, Nov. 2022
- **Yanyan Zhuang**. "Do Developer Perceptions Have Borders? Comparing C Code Responses across Continents", Committee for Research and Creative Work (CRCW) presentation, May 2023.
- **Yanyan Zhuang**. "Understanding Code: Misconception and Reverse Engineering", Cybersecurity Research Exchange, March 2023.
- **Yanyan Zhuang**. "Secure Software Systems Lab Research Introduction", UCCS-USAFA-UTSA-Cyber-and-Space Research Summit, December 2022.
- **College of Business( COB) – 14 Publications**
  - **Publications - 1**
    - **Terri Johnson Akse**, Jerry Sellers and Bruce Chesly. International Astronautical Congress in Paris 2022 (Cyber in the Space Domain). And we have an abstract that was accepted to the IAC for 2023 in Baku.
- **Scholarship for Service students (SFS) – 13 publications**
  - Arijet Sarker, **Simeon Wuthier**, Jino Kim, Jonghyun Kim, and **Sang-Yoon Chang**, Version++: Cryptocurrency Blockchain Handshaking with Software Assurance, IEEE Consumer Communications & Networking Conference (CCNC), 2023, Las Vegas, NV, USA
  - Manohar Raavi, **Simeon Wuthier**, **Xiaobo Zhou**, and **Sang-Yoon Chang**, Post-Quantum QUIC Protocol in Cloud Networking, EuCNC 6G Summit, 2023, Gothenburg, Sweden
  - **Sang-Yoon Chang**, **Simeon Wuthier**, Jonghyun Kim, and Jino Kim, Lightweight Software Assurance for Distributed Mobile Networking, International Conference on Security and Management (SAM), 2023, Las Vegas, NV, USA
  - Arijet Sarker, **Simeon Wuthier**, Jino Kim, Jonghyun Kim, and **Sang-Yoon Chang**, Version++ Protocol Demonstration for Cryptocurrency Blockchain Handshaking with Software Assurance, Demo at IEEE Consumer Communications & Networking Conference (CCNC), 2023, Las Vegas, NV, USA (Best Demo Award)
  - Kathryn Hines, Manohar Raavi, John-Michael Villeneuve, **Simeon Wuthier**, Javier Moreno-Colin, **Yan Bai**, and **Sang-Yoon Chang**, Post-Quantum Cipher Power Analysis in Lightweight Devices, Poster at ACM Conference on Security and Privacy in Wireless and Mobile Networks (WiSec), 2022, San Antonio, Texas, USA
  - Wenjun Fan, Hsiang-Jen Hong, Jino Kim, **Simeon Wuthier**, Makiya Nakashima, **Xiaobo Zhou**, Ching-Hua Chow, and **Sang-Yoon Chang**, Lightweight and Identifier-

- Oblivious Engine for Cryptocurrency Networking Anomaly Detection, IEEE Transactions on Dependable and Secure Computing (TDSC), 2022
- Wenjun Fan, **Simeon Wuthier**, Hsiang-Jen Hong, **Xiaobo Zhou**, **Yan Bai**, and **Sang-Yoon Chang**, The Security Investigation of Ban Score and Misbehavior Tracking in Bitcoin Network, IEEE International Conference on Distributed Computing Systems (ICDCS), 2022, Bologna, Italy
- Jinoh Kim, Makiya Nakashima, Wenjun Fan, **Simeon Wuthier**, **Xiaobo Zhou**, Ikkyun Kim, and **Sang-Yoon Chang**, A Machine Learning Approach to Anomaly Detection based on Traffic Monitoring for Secure Blockchain Networking, IEEE Transactions on Network and Service Management (TNSM), 2022
- Hsiang-Jen Hong, Wenjun Fan, **Simeon Wuthier**, Jinoh Kim, **Edward Chow**, **Xiaobo Zhou**, and **Sang-Yoon Chang**, Robust P2P Networking Connectivity Estimation Engine for Permissionless Bitcoin Cryptocurrency, Elsevier Computer Networks, 2022
- **Simeon Wuthier**, Pranav Chandramouli, **Xiaobo Zhou**, and **Sang-Yoon Chang**, Greedy Networking in Cryptocurrency Blockchain, IFIP International Conference on ICT Systems Security and Privacy Protection (IFIP SEC), 2022, Copenhagen, Denmark
- Manohar Raavi, **Simeon Wuthier**, Pranav Chandramouli, **Xiaobo Zhou**, and **Sang-Yoon Chang**, QUIC Protocol with Post-Quantum Authentication, Information Security Conference (ISC), 2022, Bali, Indonesia
- Kelei Zhang, **Simeon Wuthier**, **Kay Yoon**, and **Sang-Yoon Chang**, Designing and Using Capture The Flag for Coordination and Interaction in Engineering Education, IEEE Global Engineering Education Conference (EDUCON), 2022, Tunis, Tunisia
- **Sang-Yoon Chang**, **Kay Yoon**, **Simeon Wuthier**, and Kelei Zhang, Capture the Flag for Team Construction in Cybersecurity, arXiv, 2022
- **Cybersecurity Program Office (CPO) – 140 presentations**
  - Presentations were given to ISSA, AFCEA (Armed Forces Communications & Electronics Association), SBDC, 10 corporate partners, Space ISAC membership, CS Rocks K-12 conference, Cyber First Fridays, Colorado Springs K-12 school superintendents, CUS All girls Cyber camp, Women Cybersecurity (WiCyS (Women in CyberSecurity)) events at 3 CU campuses, UCCS Cybersecurity Career Panels, NSA Centers of Academic Excellence, Cyber Education, CAE Community Symposium, Cybersecurity Across Disciplines and many other local, national, and international partners.
- **College of Public Service (COPS) -3 publications**
  - **COPS Publications 3**
    - Quintana, K., Sutton Chubb, C., **Olson, D.**, **Kosloski, A.**, (2023) *I.T. Can't Fix That: Cybersecurity as an Interdisciplinary Approach to Criminal Justice Curriculum* (under review).
    - **Stutey, D. (COE)**, Rogalla, K., Jaime, M., Burr, B., **Wehrman, J.**, **Tapia-Fuselier, J.**, **Stark, C.**, & Denzler, N. (in progress). Pet therapy interventions with multiply marginalized youth in a therapeutic youth mentorship program.
    - **Stutey, D. (COE)**, Enkler, K., Solis, A., Severn, K., **Stark, C.** & **Wehrman, J.** (under review). Campus Connections: Photo elicitation with at-risk youth, *Journal of Multicultural Counseling and Development*.



- **Guest Lecture Series in Cybercrime and Cybersecurity - 1**
  - Developed a Freshman Course called “Cybersecurity: Fact, Fun and Fiction” co-taught by CoB, COPS and CPO
- **National Cybersecurity Center (NCC) – 31 presentations**
  - 7 Cyber for Government Leaders presentations,
  - 10 presentations by Thomas Russell to K12 students at NCC,
  - 4 presentations by NCC staff to visiting international delegations,
  - 6 presentations to visiting VIPs (including Colorado Thirty Group), "lunch and learn" by Micki Cockrille (500 downloads of NCC podcast).
  - 1 Ecosystem-wide presentation to Lamborn and Hickenlooper.
  - Kim Crider presented at America's Future Series on "The Obstacles to Dual Use Innovation".
  - Harry Raduege led Fireside Chat on "Protecting Critical Space Infrastructure"
  - NCC sponsored DEFCON youth "social engineering" village
- **Space ISAC- 25 presentations**
  - Based on a combination of state and additional funds, attended, and presented at national and international conferences including Space Symposium, CYSAT, CyberLEO, Space Industrial Conference/SSIB Workshops, Small Sat and more.

**Matching/additional grants – \$20,637,651**

- **Cybersecurity Program Office - \$ 4,613,785**
  - **New grants \$439,159**
    - **National Security Agency (NSA) – \$159,062.21**, GenCyber Combination Teacher/Student Camp GenCyber Teacher Grant, 2024-2026, Gretchen Bliss, Joshua Alcorn, Terri Johnson Akse
    - **National Science Foundation – \$180,097 of \$100,000,000– NSF Engines Development Award for 2023 – 2025**, Gretchen Bliss, Dr. Xu, and other community partners
    - **ZEV Workforce Development Grant - \$100,000**, Gedare Bloom, Gretchen Bliss
  - **Ongoing Grants - \$261,894.72**
    - **NSA \$112,214.58**, GenCyber Student Camp 2022 – 2024, Gretchen Bliss, Josh Alcorn
    - **NSA \$149,680.14**, GenCyber Teacher Camp 2022 – 2024, Gretchen Bliss, Josh Alcorn
  - **Completed in FY 2023 - \$3,912,731.10**
    - **NSA \$ 103,272.55**, GenCyber Introduction Teacher Camp 2020 – 2022, Gretchen Bliss, Josh Alcorn
    - **NSA \$106,564.55**, GenCyber Advanced Teacher Camp 2020 – 2022, Gretchen Bliss, Josh Alcorn
    - **NSA - \$349,907**, CAE Northwest Hub 2021-2023, Gretchen Bliss
    - **NSA - \$3,352,987**, Faculty Development 2020-2023, Gretchen Bliss, Terri Johnson Akse
- **UCCS Engineering/Cybersecurity Grants – \$12,286,866**
  - **New grants \$2,579,023**
    - **VICEROY \$1,999,567**, Cyber Ranger Forge: A University of Colorado System Virtual Institute for Cyber Range and Research based Advanced Training of ROTC Cadets for

- Next Generation Cyber Operations, July 2023 – June 2026, Shouhuai Xu, Joshua Alcorn, Sang-Yoon Chang, Keith Paarporn
- **NSF** \$180,000, Regional Innovation Hub: RISE. Technical Pillar Lead 2023-2025, Shouhuai Xu
- **International Alliance for Strengthening Cybersecurity and Privacy in Healthcare** \$120,000, 2023-2028, Shouhuai Xu
- **Argonne National Laboratory** \$45,178, RTEMS Subcontract, June 2023 – August 18, 2023, Gedare Bloom
- **Colorado Department of Transportation** \$99,536, Cybersecurity Training Lab for Zero-Emission Vehicles, July 2023 – June 2024, Gedare Bloom, Gretchen Bliss
- **UCCS**, \$19,929.00, Faculty Revitalization Fellowship Program, June 2023 – May 2024, Yanyan Zhuang
- **NSA**, \$108,660, 2022 DOD Cyber Scholarship, September 2022 – December 2023, Jugal Kalita
- **ISA**, \$6,153, Cyber Risks in the Smart Home Ecosystem, June 2022 – February 2023, Shouhuai Xu
- **Ongoing Grants - \$8,187,892**
  - **NSF** \$1,029,915, CICI: SSC: Real-Time Operating System and Network Security for Scientific Middleware, October 2018 – March 2024, Gedare Bloom
  - **NSA** \$244,969, University of Colorado Colorado Springs CAE Grant August 2021 – August 2024, Gedare Bloom, Shouhuai Xu, Philip Brown
  - **NSF** \$500,000, SHF: Small: Whole-application Coordinated Parallelization Through The Optimization Of Abstraction Hierarchies, July 2019 – September 2023, Qing Yi, Shouhuai Xu
  - **NSF** \$250,472, Game Theoretic Methods for Socially Networked Multi-Agent Systems, August 2020 – July 2023, Philip Brown
  - **NSF** \$708,581, Cybersecurity hardening for scientific industrial control systems, August 2019 – September 2023, Gedare Bloom
  - **NSF** \$499,094, Assuring Cyber Security and Privacy for Human Resilience Research: Requirements, Framework, Architecture, Mechanisms and Prototype, July 2021 – June 2024, Shouhuai Xu, Yanyan Zhuang
  - **NSF** \$599,896, Career: Foundations for Real-Time System Security, July 2021 – June 2026, Gedare Bloom
  - **NSF** \$3,081,251, CyberCorps Scholarship For Service (SFS), Collaborative Research: Colorado-Washington Security Scholars Program, Aug 2019 - Jul 2024, Sang-Yoon Chang
  - **ETRI** \$440,000, Electronics and Telecommunications Research Institute or ETRI (Prime Sponsor is Institute for Information & Communication Technology or IITP from South Korea), Securing Availability and Integrity for 6G Flying Base Station Control and Communications, April 2021 – December 2024, Sang-Yoon Chang
  - **ETRI** \$210,000, Electronics and Telecommunications Research Institute or ETRI (Prime Sponsor is Institute for Information & Communication Technology or IITP from South Korea), Trust Network Model for 6G Networking Security, July 2021 – December 2024, Sang-Yoon Chang

- **CU Next**, \$300,000, Creating CU Cyber Range to Make UCCS and CU Denver a National Leader in Cybersecurity Education and Workforce Development, UCCS Co-PIs: Joshua Alcorn, Jugal Kalita, and Greg Williams. CU Denver Co-PIs: H. Jafarian, J. Murdoc, and D. Sicker, 2022-2025 Shouhuai Xu
- **UCCS Equity, Diversity, and Inclusion** \$24,080.00, Recruiting and Retaining Women in Cybersecurity, 2021 – 2024, Yanyan Zhuang, Gretchen Bliss, Katrina Rosemond
- **Committee for Research and Creative Work (CRCW)** \$7,493.00, Do Developer Perceptions Have Borders? Comparing C Code Responses across Continents, June 2020 – August 2023, Yanyan Zhuang
- **NSF** \$292,141.00, CICI: RDP: Security and Privacy Policy Enforcement for Research Data Protection, July 2019 – July 2023, Yanyan Zhuang
- **Completed in FY 2023 – \$1,519,951**
  - **NSF** \$292,141, Enforcing Security and Privacy Policies to Protect Research, August 2019- July 2022, Yanyan Zhuang
  - **NSF** \$454,823, A Framework for Enhancing the Resilience of Cyber Attack Classification and Clustering Mechanisms, January 2021 – September 2022, Shouhuai Xu
  - **NSA** \$63,774, 2021 DOD Cyber Scholarship, August 2021 – December 2022, Jugal Kalita
  - **CRDF Global**, \$75,000, Quantum-Driven Security in Emerging 5G Networking, August 2021 – September 2022, Sang-Yoon Chang
  - **Whatcom Community College** (Prime Sponsor is NSF SaTC), \$102,795, Junior Reserve Officer Training Corps (JROTC) Cyber Academy Pilot Program, May 2022 – September 2022, Sang-Yoon Chang
  - **UCCS**, \$31,418, Team Collaboration in Cybersecurity: The Development of a Skill Building Workshop, July 2021 – July 2022, Kay Yoon
  - **NSF SaTC**, \$500,000, A Framework for Enhancing the Resilience of Cyber Attack Classification and Clustering Mechanisms, October 2018 – September 2022, Shouhuai Xu
- **NCC - \$1,937,000**
  - **New grants- \$65,000**
    - **Cielo**, \$65,000, Family Success Center, July 2022-June 2023
  - **Completed in FY 2023 - \$1,872,000**
    - Based on additional funds leveraged as a result of state money, organized Workforce Development Summit with Cyber.org and National Cryptological Foundation. In partnership with Daniel’s fund and Deloitte offered quarterly Capture the Flag competitions. Leveraged state funds to obtain \$1,872,000 from multiple funding sources in FY 2022-2023
- **SPACE ISAC – \$1,800,000**
  - Membership dues valued at roughly \$ 1.8 million dollars in FY 2023.
- **CSI funded Faculty Seed Grants Projects - \$37,464.45** (Not included in “Matching/Additional Grant” total)
  - **EAS**- Reverse Engineering IoT Firmware -\$7,500, Gedare Bloom, Yanyan Zhuang
  - **EAS**- Learning to Defend: Reinforcement Learning Methods for Cyber Defense Policy -

- \$7,500, Philip Brown
- **EAS** – Characterizing and Optimizing Active Cyber Defense - \$7,500, Keith Paarporn, Shouhuai Xu
- **EAS/LAS** – Embedded Device-Based AI-Driven Raman Spectroscopy for Public Safety Applications - \$7,500, Darshika Perera, Kelly McNear
- **CoPS** – Online Participation in Illicit Economies - \$7,464.45, Kate Quintana, Anna Kosloski, Dan Olson, Caroline Chubb
- **CSI funded Research Projects - \$366,986** (Not included in “Matching/Additional Grant” total)
  - **COPS** - Public Safety Initiative (PSI) Cybersecurity Initiative Funding Request - \$95,000, Janet Van Kampen
  - **COPS** - Understanding the Social & Behavioral Role in Cybercrime & Cybersecurity - \$15,692, Anna Kosloski
  - **COE** - Enhancing Digital Leadership for Student Affairs and Higher Education Professionals - \$2,500, Patty Witkowsky, Phillip Morris, Nick Tapia-Fuselier
  - **LAS** - Developing Language and Cultural Literacy Skills to Address Strategic Diversity Needs in Cybersecurity – \$13,333, Fernando Feliu-Moggi
  - **COB** - Graduate Certificate in Space Cyber Enterprise - \$30,000, James Van Scotter
  - **EAS** - International Alliance of Trust Chains - \$10,000, Terrance Boulton
  - **Library** - O'Reilly for Higher Education Subscription - \$8,463, Joel Tonyan, Rhonda Glazier
  - **EAS** - Student Empowerment in Cybersecurity - \$24,000, Sue McClernan
  - **EAS** - Creating and Holding UCCS Distinguished Lecture Series in Cybersecurity - \$10,000, Shouhuai Xu
  - **EAS** - Creating a Cybersecurity Metrics Framework to Enable Quantitative Decision-Making - \$50,000, Shouhuai Xu
  - **EAS and Blockframe** - PhilosBDL Blockchain Development Research Program - \$90,041, Terrance Boulton, Christopher Gorog
  - **COE** - Campus Connections: Cultivating Social and Emotional Wellness in At-Promise Youth through Digital Citizenship - \$17,907, Joe Wehrman, Cortny Stark, Diane Stutey
- **In addition to the University specific requirements, UCCS has undertaken significant work on legislation specific technical requirements:**
  - **Public Safety Initiative (PSI)** (within the College of Public Service (COPS))– In support of SB 18-086 Section 4 24-33.5-1904 paragraph 2f, “Support state and federal law enforcement agencies with their responsibilities for investigating and collecting information related to cyber-based criminal and national security threats” continued to facilitate professional development education and training for 32 area law enforcement agencies across Colorado.
    - 55 Digital Forensic Investigators received cybercrime training, and three agencies received hardware and software to enhance their cybercrime investigative abilities.
    - PSI Support to Law Enforcement (LE) delivered **\$125,172** in cybercrime training and equipment to 28 area LE agencies, sponsoring 13 cybercrime investigation courses for 55 law enforcement Investigators. Most of the LE agencies that received support are also members of the Colorado Internet Crimes Against Children (ICAC) Task Force. The ICAC Task Force program assists state and local law enforcement and prosecutorial agencies in developing effective, sustainable responses to online child victimization, including responses to Child Sexual Abuse Images (CSAM). The ICAC Program has increased law enforcement's capacity to

combat technology facilitated crimes against children at every level. In 2022, the Colorado ICAC Task Force conducted over 1,925 investigations and 3076 forensic exams. \*Cellebrite: Seattle PD ICAC- [https://youtu.be/F\\_pcWXohOMY](https://youtu.be/F_pcWXohOMY)

- PSI heightens awareness and expands the training and education of law enforcement personnel to prevent, investigate, and respond to cybercrimes.
  - PSI delivers cybersecurity capability and expertise in an increasingly critical area of law enforcement.
  - PSI offers insight and advice necessary to adapt and contend with a rapidly evolving cybersecurity threat.
- **UCCS funded “Blockchain Research Program in Support of Colorado Senate Bill SB18-086,”** in support of the SB18-086 section two requirements. The largest efforts were in applied development of MVP version of the components designated for public use by the State of Colorado programs, key developments include:
    - The standing up and performance testing for Project Philos™ distributed ledgers
    - The publication of the operations of the Carbon-Neutral Distributed Ledger and “The Philos Trust Algorithm: Preventing Exploitation of Distributed Trust” for peer review
    - Setting up first two Consortium Servers for International Alliance of Trust Chains (IATC) organization
    - The development of Administrative Console platform for administration of governance for the Philos™ distribute ledger platform.
      - *This has incorporated the needs and requirements to enforce programmatic governance which is modeled after the Colorado Department of Regulatory affairs and U.S. Department of Commerce. The workflow and processes enabled by this feature will allow for multiple programs to operate seamlessly as the State of Colorado needs for program adoption are identified.*
    - The continued strength of the Blockchain Development community has maintained a steady but reduced growth while many other organizations have slowed with the onset of the COVID pandemic. There has been a steady influx of participation as the registered number of members grew to over 395.
    - Engagement in the second proof-of-concept prototype was partly funded under a grant from IEEE Blockchain Transactive Energy. This prototype is supporting a local utility company in Colorado to implement transactions for renewable energy. An alpha vision of the demonstration can be found at [www.philos.us](http://www.philos.us).
    - Alliances with Colorado Office of Information Technology were expanded as demonstrations to state officials of the program capably were given and an event for state program managers to be scheduled early in 2023 FY. This has been delayed some, as the Colorado CISO position changed over just after he is beginning of the new State FY.
    - Alliances with IEEE have expanded as the principal investigator Mr. Gorog was promoted to global chair for the IEEE Digital Privacy Initiative, details can be found at [www.digitalprivacy.ieee.org](http://www.digitalprivacy.ieee.org).
    - Several speaking engagements were given over the course of the program year as for both the IEEE Blockchain Initiative, IEEE Digital Privacy Initiative, the IAPP, and the U.S. Department of Energy.
      - IEEE ISGT Conference presented on Blockchain Governance for Transactive Energy - New Orleans
      - IEEE TESC Conference presented paper “Carbon-Neutral Distributed Ledger” - [Carbon-Neutral Distributed Ledger | IEEE Conference Publication | IEEE Xplore](#)

- Conference Paper “The Philos Trust Algorithm: Preventing Exploitation of Distributed Trust” - [The Philos Trust Algorithm: Preventing Exploitation of Distributed Trust | IEEE Conference Publication | IEEE Xplore](#)
- RSA Presented IAPP panel representing Digital Privacy Initiative – San Francisco [2023 USA | RSA Conference](#)
- DOE Cybercon presented on Transactive Energy Project – Portland OR
- IEEE PES General Presentation on Governance requirements for large scale distributed ledger – Denver Colorado
- NCSL’s Cybersecurity Task Force/Privacy Work Group session on Sunday, July 31 at the Colorado Convention Center
- Monthly IEEE Digital Privacy Initiative, Meetings include 6 subgroups which meet regularly – [Past Events - IEEE Digital Privacy](#)
- **Blockchain Development Community:** Volunteer Members and Companies provided 86% of 29,470.48 hours contributed to the effort from 2017-2023. In comparison to the \$300,000 invested by the State this provides an equivalent in-kind community sponsored effort of \$ 2,799,145.36.
- **BlockFrame Incorporated:** provided in-kind sponsorship providing media outreach services, refreshments and prizes, venue cost, and professional services for weekly meetings. These in-kind services and sponsorship over a four (4) year period provided matching support of approximately \$140,000.
- **Bees Computing & Ajames Technologies:** provided in-kind sponsorship including management platforms, volunteer and community coordination support platforms and services, IT Managed Services, and web repositories. These in-kind services and sponsorship over a five (5) year period provided matching support of approximately \$60,000.
- El Pomar Institute for Innovation and Commercialization provide approximately \$60,000 of direct student funding to students working on the effort. This supplemented the State funding and helped more students get training on blockchain technology development.
- **Space ISAC** – Membership dues valued at roughly \$ 1.8 million dollars in FY 2023.
  - Maintained engagement for Space ISAC Collaborative Groups - Information Sharing Working Group (ISWG), Headquarters Task Force, Supply Chain Risk Management (SCRM) Working Group, Analyst Working Group, Space Policy Directive 5 (SPD-5) Task Force, Exercise Task Force, Space ISAC Summit Task Force, Headquarters Task Force, Cybersecurity Maturity Model Certification (CMMC) Task Force, Public Relations & Digital Strategy (PR&D) Task Force, Space Symposium Task Force, Space Threat Resource & Intelligence Knowledge Exchange (STRIKE) Task Force, Small Satellite Community of Interest, Artificial Intelligence / Machine Learning (AI/ML) Community of Interest, Zero Trust Architecture (ZTA) & Blockchain Community of Interest, Workforce Development Community of Interest, Research and Technology Community of Interest, and Cislunar Affinity Group.

## COLORADO COMMUNITY COLLEGE SYSTEM

SB 18-086 Appropriation Expenditure Report	
<b>Governing Board Name</b>	Colorado Community College System
Total SB 18-086 Appropriation	\$ 300,000
Actual Amount Spent on Scholarships	\$ 30,000
Total number of scholarships awarded (see note 1)	12
Required Allotted Amount Earmarked for Scholarships	\$ 30,000
<b>At or above allotted amount of scholarship earmark</b>	Yes
Number of faculty/adjuncts hired as a result of funding (see note 2)	3.00
Number of student internships created (see note 3)	19
Number of degrees/certificates awarded in connection with SB 086 funding (see note 4)	82
Number of presentations/seminars given on cybersecurity	0
<b>Amount of all other money raised to match state investment</b>	\$ -
Total Amount Expended	\$ 300,000
<b>Please discuss any additional ways in which SB 086 money was spent, which may not be captured in lines 6-9 and fundraising efforts as reported in FY22 and any other information you would like to be included in the report.</b>	
<p><b>Note 1:</b> Cyber Security scholarships awarded through Financial Aid focus on offering significant support that will make the most impact for Cyber Security students. Allotted scholarship monies are awarded in \$2,500 apportionments to students to create significant positive impact for awardees.</p>	
<p><b>Note 2:</b> SB 18-086 funds have been used to pay the salary and benefits for 3 full-time cyber security faculty members (2 full salaries and 1 partial salary).</p>	
<p><b>Note 3:</b> Appropriated funds have been utilized to facilitate student connections with internship sites by funding hiring events, community partner gatherings, and travel related to building community partnerships. The Cyber Security program achieved the largest cohort of internship students in academic year 2022 - 2023.</p>	
<p><b>Note 4:</b> Completers for the cybersecurity degree and certificates since the implementation of SB 18-086 appropriation funds have grown significantly. During the past academic year, the Cyber Security program had 82 total completers, 44 of which earned an Associate of Applied Science degree in Cyber Security - which represented the largest group of completers to date for the full AAS degree - while 38 were awarded certificates in Cyber Security. Full-time personnel - funded by the SB 18-086 appropriation - allowed for program capacity and quality resulting in a greater numbers of Cyber Security completers.</p>	

## **Conclusion**

Fiscal Year 2022-23 was the fifth year of additional funding for cybersecurity and distributed ledger technologies. After receiving limited funding due to the COVID pandemic, funding was fully restored for Fiscal Year 2021-22, and institutions remain committed to fully implementing the goals of the legislation.

Outside of offering scholarships to students pursuing degrees and credentials related to cybersecurity, and the hiring of faculty and staff, institutions focused funding on improving their cyber facilities and offering outreach events through cyber centers. With ongoing investment in cybersecurity and ledger technology, institutions will be well equipped to continue to invest in these programs and the students enrolled in them.

Most of the institutions have expended their allocation amounts from SB18-086 as of Fiscal Year 2022-23. While several institutions have been able to support these programs using institutional funds, not all have been able to properly fundraise. This likely will create significant challenges for those institutions who have been unable to raise institutional funds to continue to operate these programs once state appropriations are exhausted.