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Innovation Pilot of HBCU Apprenticeship Cohorts

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Apprenticeship Implementation Solutions, Inc.

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Designing and Launching Secure Software Development Degree Apprenticeships Partnering with Historically Black Colleges and Universities

Dr. Diana Elliott
Urban Institute

Girish Seshagiri
Apprenticeship Implementation Solutions, Inc.

Dr. Nikunja Swain
South Carolina State University

Goal

Transform Lives!

One HBCU Degree Apprenticeship Cohort

At a time

The Cybersecurity Crisis – Skills Shortage

Total Job Openings	
Cybersecurity Related	Software Development
597,767	**1,429,932**
Top Job Titles	**Top Skills Requested**
Cybersecurity Analyst	Java
Cybersecurity Consultant	Software Development
Cybersecurity Manager	SQL
Software Developer	Software Engineering
Systems Engineer	JavaScript

https://www.cyberseek.org/heatmap.html

The Cybersecurity Crisis – Lack of Diversity

A disproportionately high number of white males work in cyber

Gender/Racial Minorities	% in Cybersecurity Workforce
Female	14
Black	9
Asian	8
Hispanic	4

The point o[illegible] organization **leverages the value of diversity to make outcomes better**. I don't want to take a 25-year-old female of color and have her act like a middle-aged white male. I want them both to bring their experiences, thought processes, and skills to the problem at hand.

"How To Address The Lack Of Diversity In Cybersecurity", Taavi Must, Forbes, April 23, 2021

Transforming Lives With SC HBCU Registered Degree Apprenticeship Cohorts

"As Is"	"To Be"
Up to **40%** students never complete a degree	Degree Apprenticeship cohorts boast a completion rate of **90 %** or higher
On average, college graduates take three to six months to find employment	Apprentices guaranteed employment (subject to availability) upon graduation
Majority of college graduates are unemployed or underemployed in jobs that do not require a bachelor's degree	A majority of apprentices earn wages commensurate with the skills they attain
$40,904 — the average balance for borrowers of student loans	Earned wages offset student loans to a large extent

Talent Finance Initiative - A Public-Private Approach, US Chamber of Commerce Foundation

Work-Enhanced Learning Models Continuum

Low Enhancement

Industry speaker series
Worksite visits
Job shadowing
Employee mentorships

Moderate Enhancement

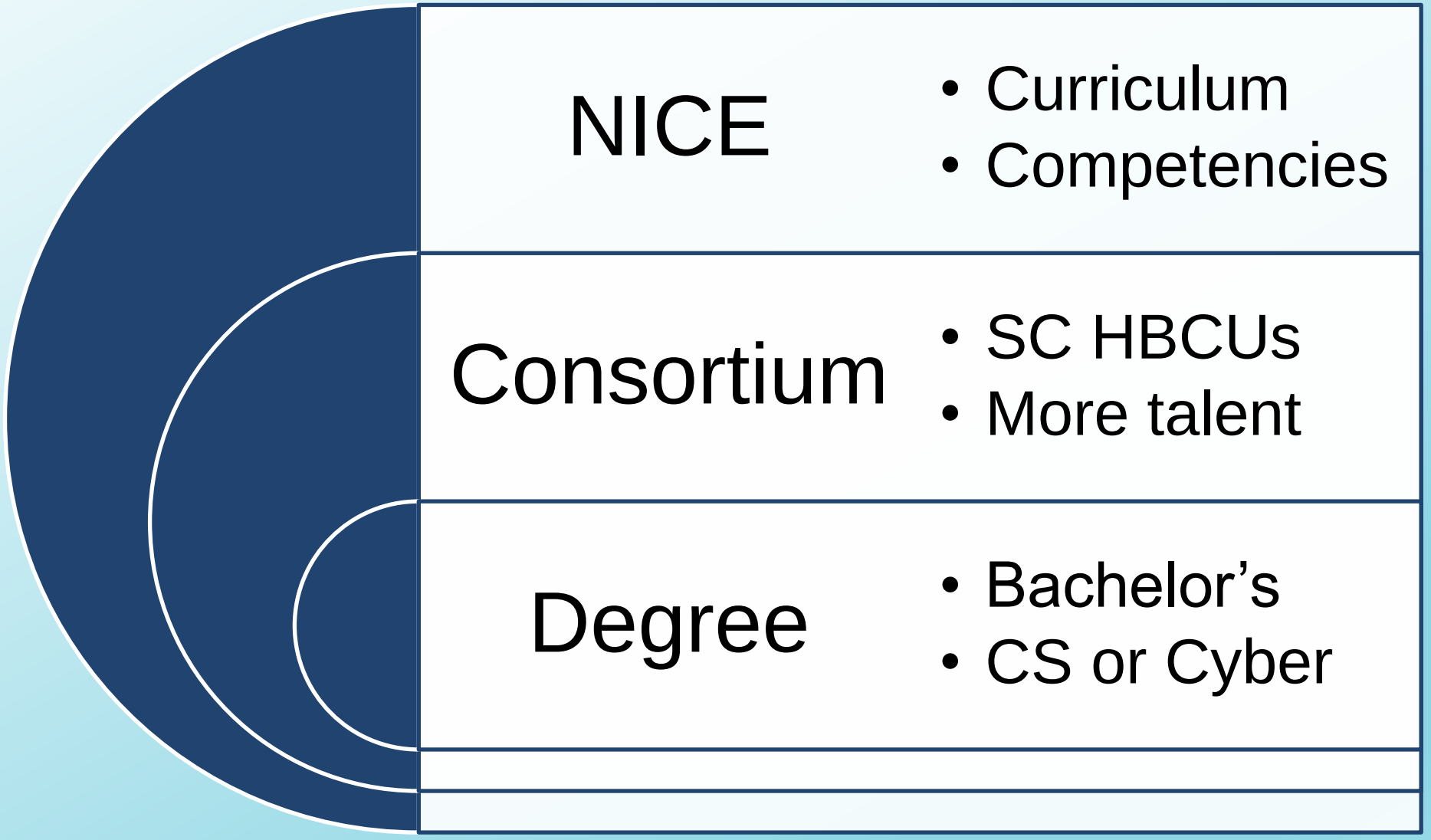
Practicums/workplace projects
Internship
Cooperative education
Senior design projects

Innovation Pilot Goal

Develop a replicable model for a degree-based software development apprenticeship program aimed at increasing diversity in the technology industry and pilot it with a consortium of HBCUs led by SCSU

- **Connect to partner employers**
- **Grow the network of participating HBCUs**
- **Provide ongoing technical assistance**
- **Address sustainability**

Program Innovations



Roles and Responsibilities

Key Role 1: Sponsor

- SCSU is the DOL Registered Apprenticeship Sponsor

Key Role 2: RTI Providers

- Consortium Schools (including SCSU)

Key Role 3: Employers

- Integer Technologies
- Robert Half International

How This Happened – Our Story

1. IT and Cybersecurity Workforce Summit – Feb 12, 2020
2. Core Group to Establish Mission “Design and Launch Degree Apprenticeship Pilot Partnering with Employers”
3. Career Pathways to HBCU Students through Degree Apprenticeships
4. SC Employer Survey to Establish Hard-to-fill IT and Cybersecurity Work Roles
5. SCSU Leadership to Map Degree Curricula to NICE Framework Competencies for Secure Software Developer Work Role
6. Created with Urban Institute Support
   - DoL Registered Apprenticeship Work Process Standard for Secure Software Developer Work Role
   - Other Artifacts for Consortium agreement, roles, and responsibilities
7. Apprenticeship Cohorts

Mapping Degree Curricula to NICE Framework – Secure Software Developer Competencies

Related Terminology

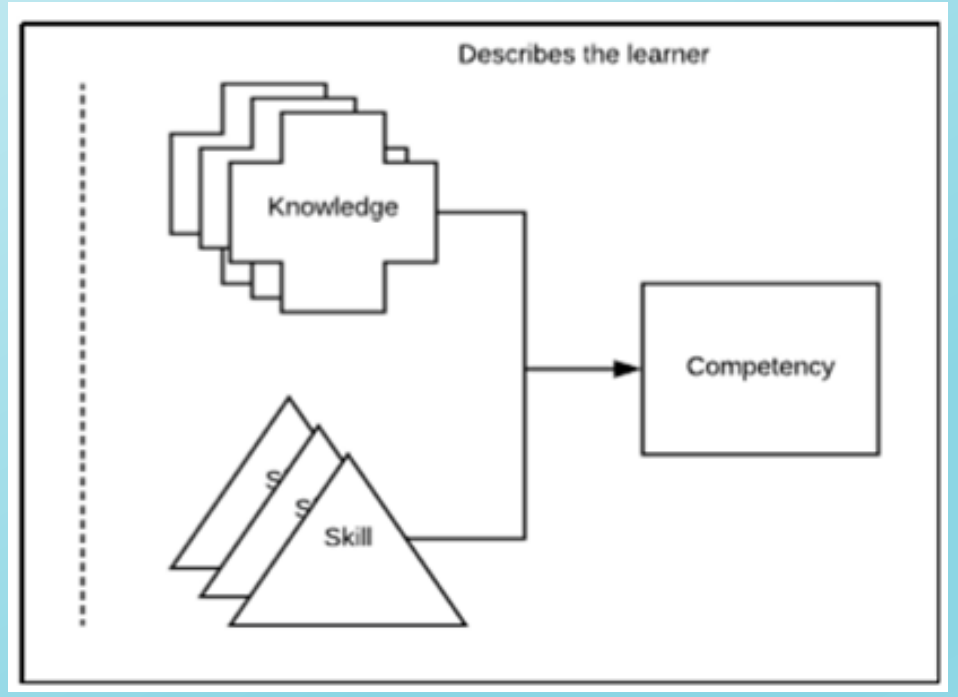
Work Roles: Most detailed groupings of cybersecurity and related work described in the NICE Framework - knowledge, skills, and abilities (KSAs) and tasks performed in that role

Knowledge, Skills, and Abilities (KSAs): KSAs are attributes required to perform work roles.

Tasks: Each task in the framework is a specific defined piece of work

Competency: An observable group of related Knowledge and Skills statements.

Related Terminology



Source:
https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-181r1-draft.pdf

Mapping Degree Curricula to NICE Framework – Secure Software Developer Competencies

Entry/Junior Level Developer

The job duties of junior-level software developers typically include relatively simple routine tasks, such as debugging, testing, and code documentation. Using information from freely available resources, partners from SC HBCUs, and Urban Institute, we derived KSAs for our consortium as shown in right. This also resulted in 6 job functions with 11 courses as shown in the next few slides.

NICE Framework KSA's for Software Developers	
Total Number of Knowledge Units in NICE Framework: 45	Knowledge Units Selected for Mapping of CS/TI/Cybersecurity Curriculum in SC HBCUs: 8
Total Number of Skill Units in NICE Framework: 14	Skill Units Selected for Mapping of CS/TI/Cybersecurity Curriculum in SC HBCUs: 7
Total Number of Abilities Units in NICE Framework: 5	Ability Units Selected for Mapping of CS/TI/Cybersecurity Curriculum in SC HBCUs: 4
Total Number of Tasks Units in NICE Framework: 34	Knowledge Units Selected for Mapping of CS/TI/Cybersecurity Curriculum in SC HBCUs: 9

Source of KSA's: https://www.nist.gov/file/372581

Mapping Degree Curricula to NICE Framework – Job Functions

Job Functions	Job Descriptions
JOB FUNCTION 1: Participation in the Development of a new platform – collecting and analyzing user needs	Participates in and supports the collection and analysis of user needs for the development of a new secure software platform by assisting the Principal Developer and the team.
JOB FUNCTION 2: Supporting the development of a new platform	Participates in and support designing a of new software platform by assisting the Principal Developer and the team.
JOB FUNCTION 3: Modifying an existing platform	Participates in and supports the analysis of performance issues and limitations of an existing platform and identifies needs for modification of an existing platform by assisting the Principal Developer and the team.
JOB FUNCTION 4: Testing, Debugging, and Deployment	Supports the team or Principal Developer in the testing, debugging and deployment of the new or modified secure software platform
JOB FUNCTION 5: Monitoring and Maintenance	Supports the team or Principal Developer in the monitoring and maintenance of the new or modified secure software platform.
JOB FUNCTION 6: Customer Support and Documentation	Supports the team or Principal Developer in providing technical support to customers who need assistance utilizing client-level hardware and software in accordance with established or approved organizational process components

Mapping Degree Curricula to NICE Framework – Courses and Hours

Course Title	Course Credits	Semester hours (15 week semester)
Introduction to Computer Science (or similar title)	3	45
Introductory Programming (or similar title)	3	45
Introduction to Cybersecurity (or similar title)	3	45
Advanced Programming (or similar title)	3	45
Introduction to Assembly Language Programming (or similar title)	3	45
Introduction to Discrete Mathematics (or similar title)	3	45
Introduction to Networking (or similar title)	3	45
Introduction to Network Security (or similar title)	3	45
Introduction to Software Engineering – Software Design and Development (or similar title)	3	45
Introduction to Management of Information Security (or similar title)	3	45
Total:	**33**	**495**

Current State of the Degree Apprenticeship Consortium

- Registered with Department of Labor (DoL) with SC State as the sponsor and lead
- SC HBCU Member Institutions – Benedict College, SC State University and Voorhees College
- Program Offered – Degree programs/Minors in Computer Science/Cybersecurity
- Enrollment (2019-20 numbers): Benedict 50; SC State – 85; Benedict – Data NA
- Other SC HBCU Institutions Expected to be Members – Claflin University, Morris College and Allen University
- Industry Partners: Integer Technologies and Robert Half
- Recruitment of first apprenticeship cohort: Summer 2022 - Ongoing; 4 applicants from Benedict, SC State and Voorhees

Acknowledgement

Partial funding for the SC State University component of this work has been provided by the National Science Foundation through awards (award number HRD-1912085, and award number HRD 1912284). Additional resources were provided by SC State University. The author wishes to acknowledge and thank NSF and SC State University for this support.

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Questions/Comments

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IT and Cybersecurity Degree Apprenticeship Cohorts at HBCUs

Katie Adams
Senior Director
Safal Partners

Deborah McLeod
President and Apprenticeship Director
McLeod Information Systems

Laura Jones
Workforce Extension Program Specialist
Prairie View A&M University

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Birds of a Feather: Apprenticeships in Cybersecurity

Tony Bryan
Executive Director
CyberUp

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CASCADE Team Work - Creating a Strong Cyber Ecosystem

Jo Marie Diamond
Strategic Advisor, San Diego
East County Economic Development Council

Martin Minnich
Program Manager
Cal Poly San Luis Obispo, CA

Judy Steingass
Director of Customer Experience
Journeys Map

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PARTNERING FOR A STRONGER CYBERSECURITY COMMUNITY

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CASCADE Teamwork
Creating a Strong Cyber Ecosystem

Panel of CASCADE Partners

CAL POLY
California Cybersecurity Institute

Journeys

Key Takeaways

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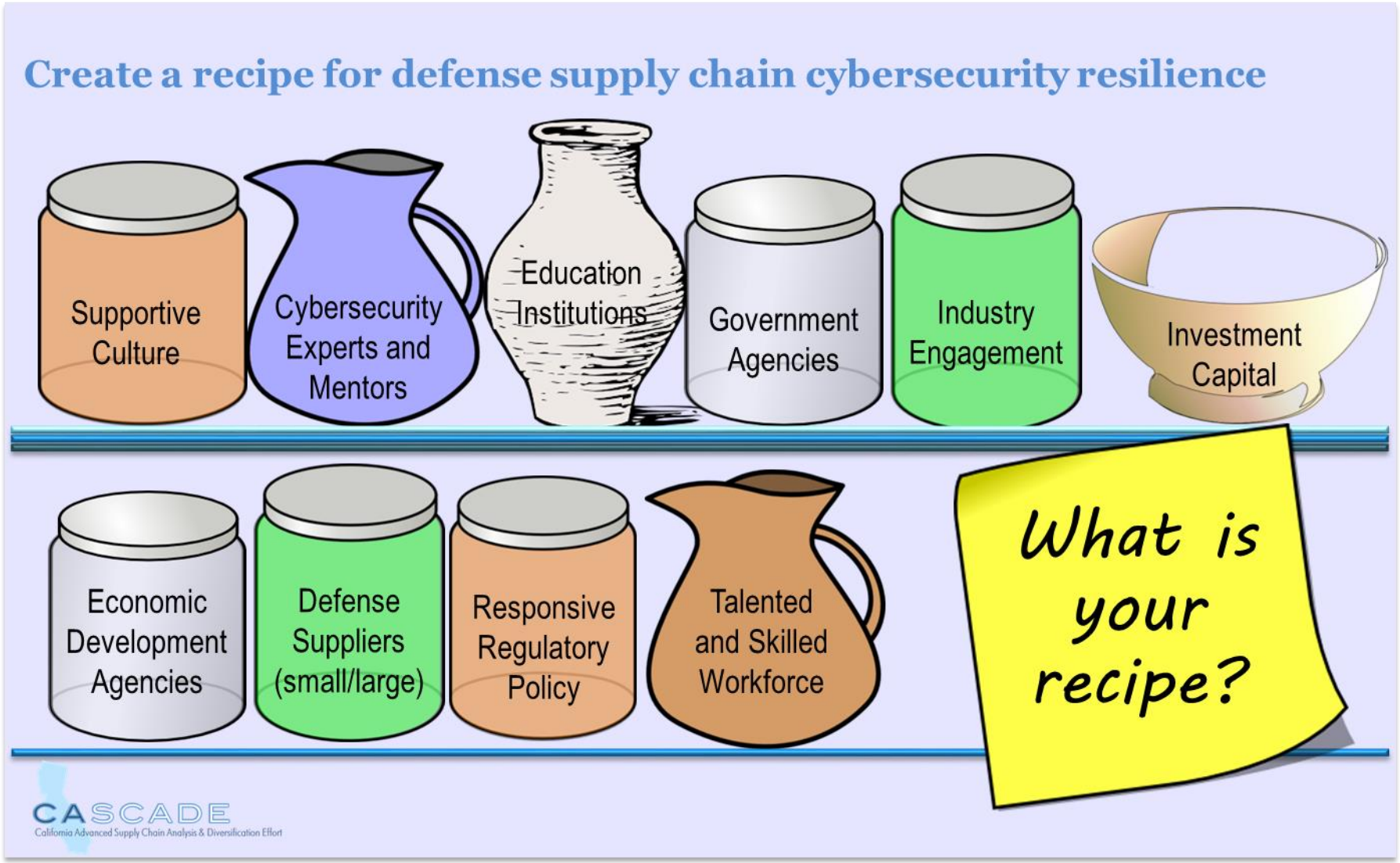
Partnering to Create a Stronger Cybersecurity Community

- **Ideas to identify various stakeholders involved in building small business cybersecurity resilient ecosystems**

- **Three key questions:**
  - What is Happening?
  - How does it Impact Me?
  - Am I Part of the Solution?

Ideas: Cybersecurity resilient ecosystems



Question 1: What is Happening?

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Cyber threats keep evolving. *Impact Magnification* affecting small businesses and others is in the proficiency and multitudes of attackers

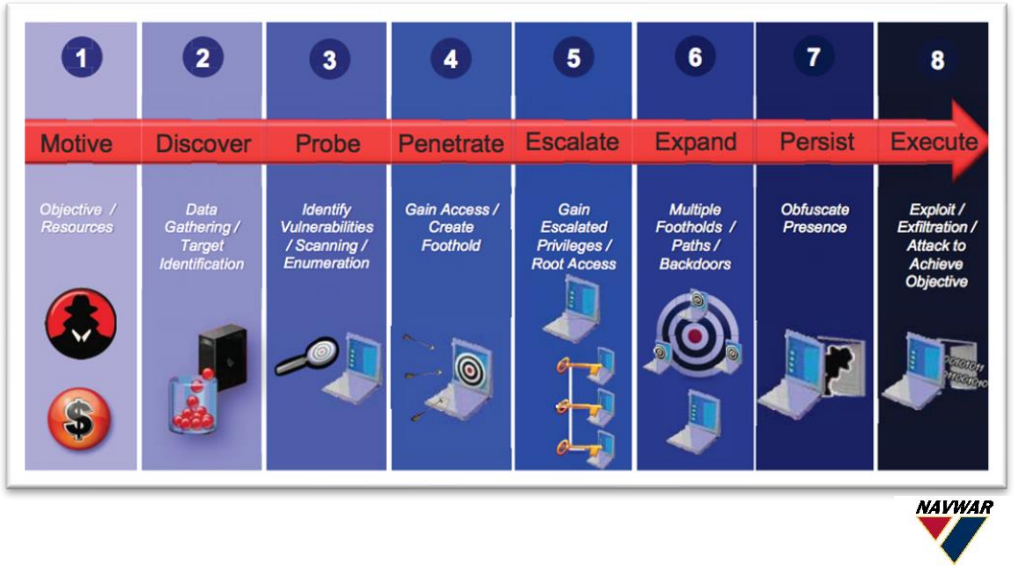
∞ Indiscriminate

∞ Mercenary

∞ **Nation State APT**

∞ **Artificial Intelligence**

Anatomy of an Attack



Question 2: How does it Impact Me?

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The security stakes are raised for suppliers performing on defense priorities and innovation technologies

INTELLECTUAL PROPERTY THEFT

OPERATIONAL DISRUPTION

ALTERED BEST PRACTIES

UNRECOVERABLE COSTS

REPUTATIONAL DAMAGE

ADVERSARIAL CAPITAL

Distro of China's Espionage Cases in USA

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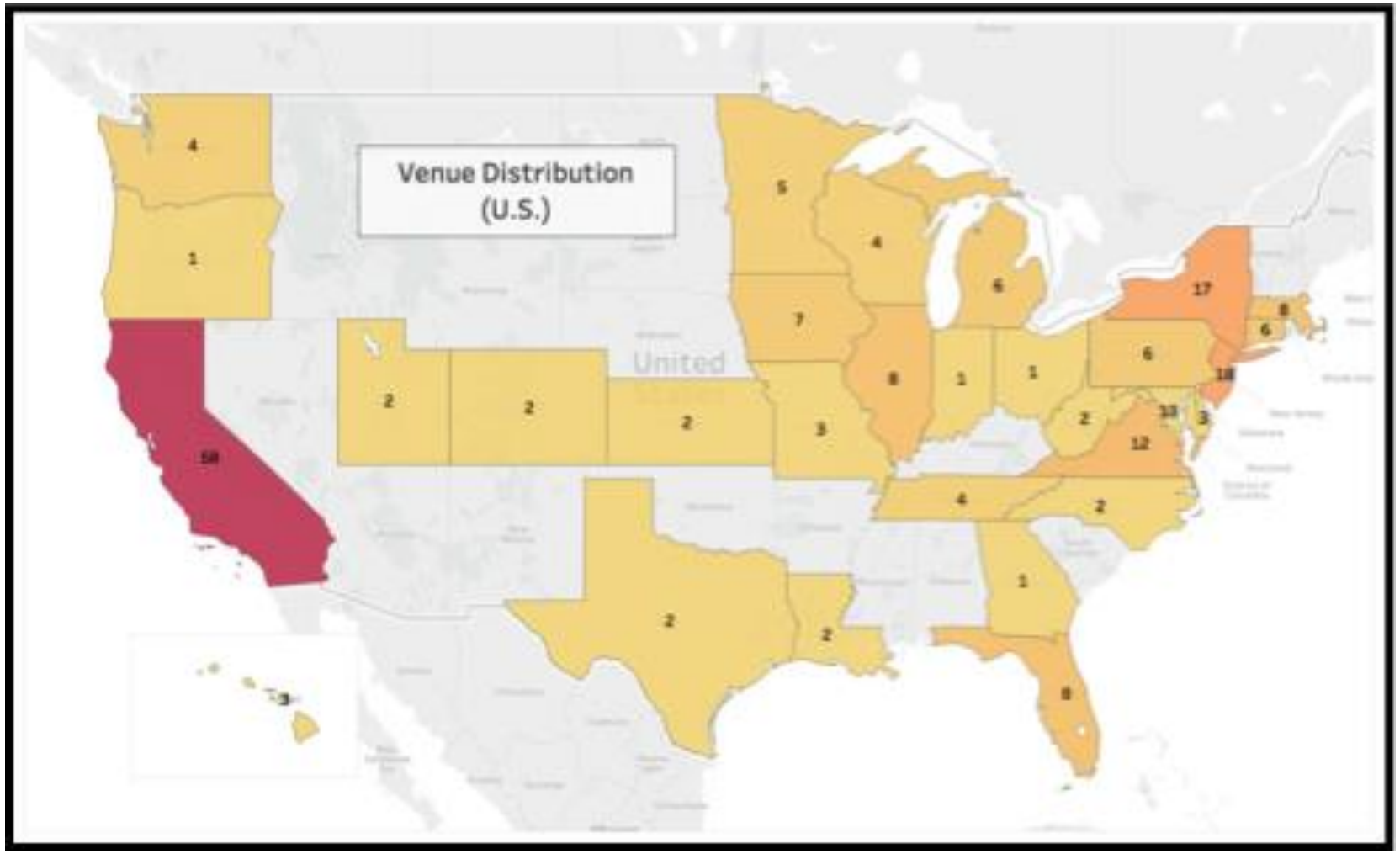

A Blueprint To Stop Chinese Espionage, IP Theft: Nick Eftimiades, Top Intel Expert

https://breakingdefense.com/2018/12/how-to-combat-chinese-espionage-ip-theft-nick-eftimiades-top-intel-expert/

Defense Sector and Economic Impact

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U.S.A: **280,000+ Defense Suppliers** **60,000+ manufacturers**

California: **30,000+ Defense suppliers** **6,000+ manufacturers**

Direct, indirect and induced impact of the defense sector in California

California plays a key role in the national security posture of the United States.

Defense spending in California

FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
$52.5 billion	$49.3 billion	$48.8 billion	$48.8 billion	$57.7 billion	$66.2 billion

Critical Economic Adjustment

Question 3: Am I Part of the Solution?

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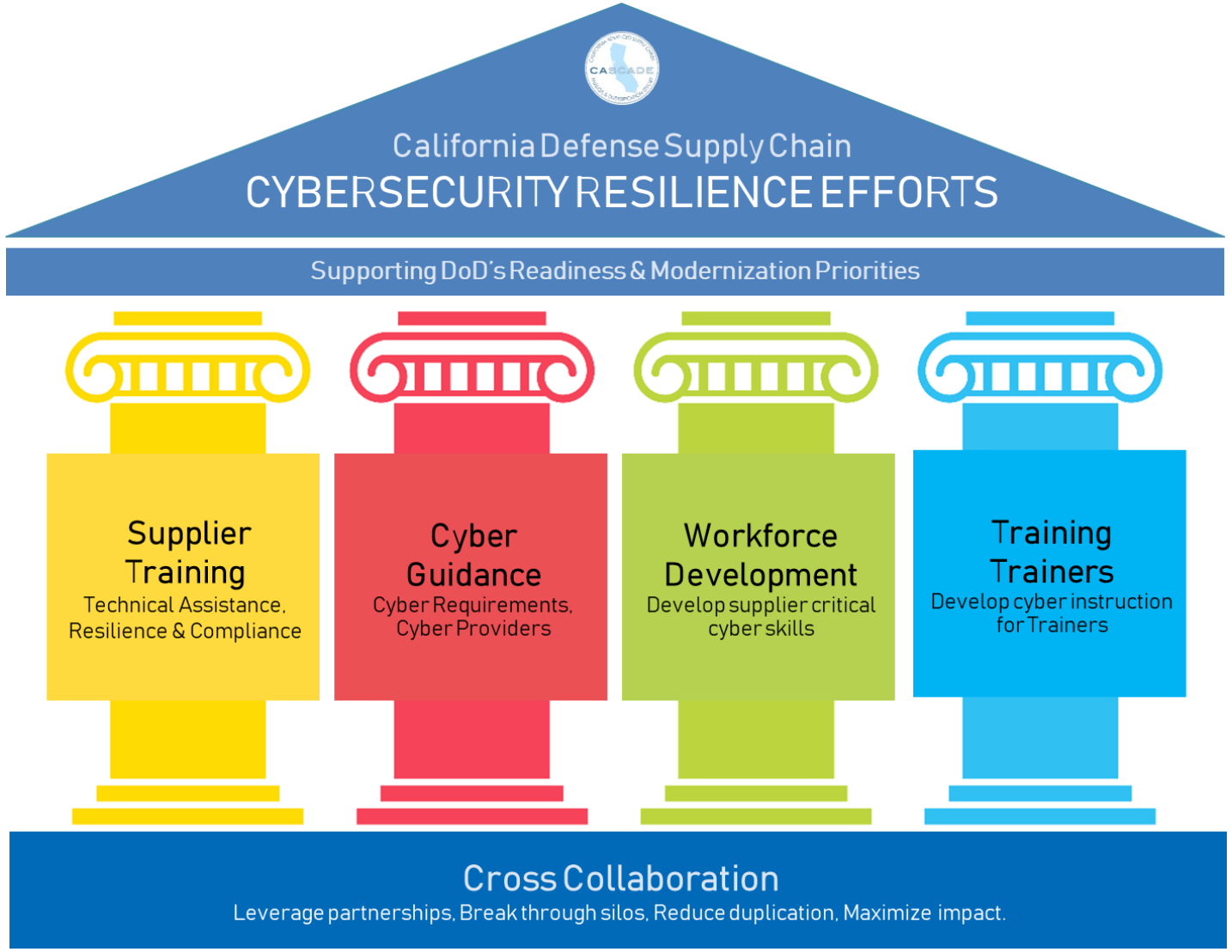

CASCADE Fundamentals

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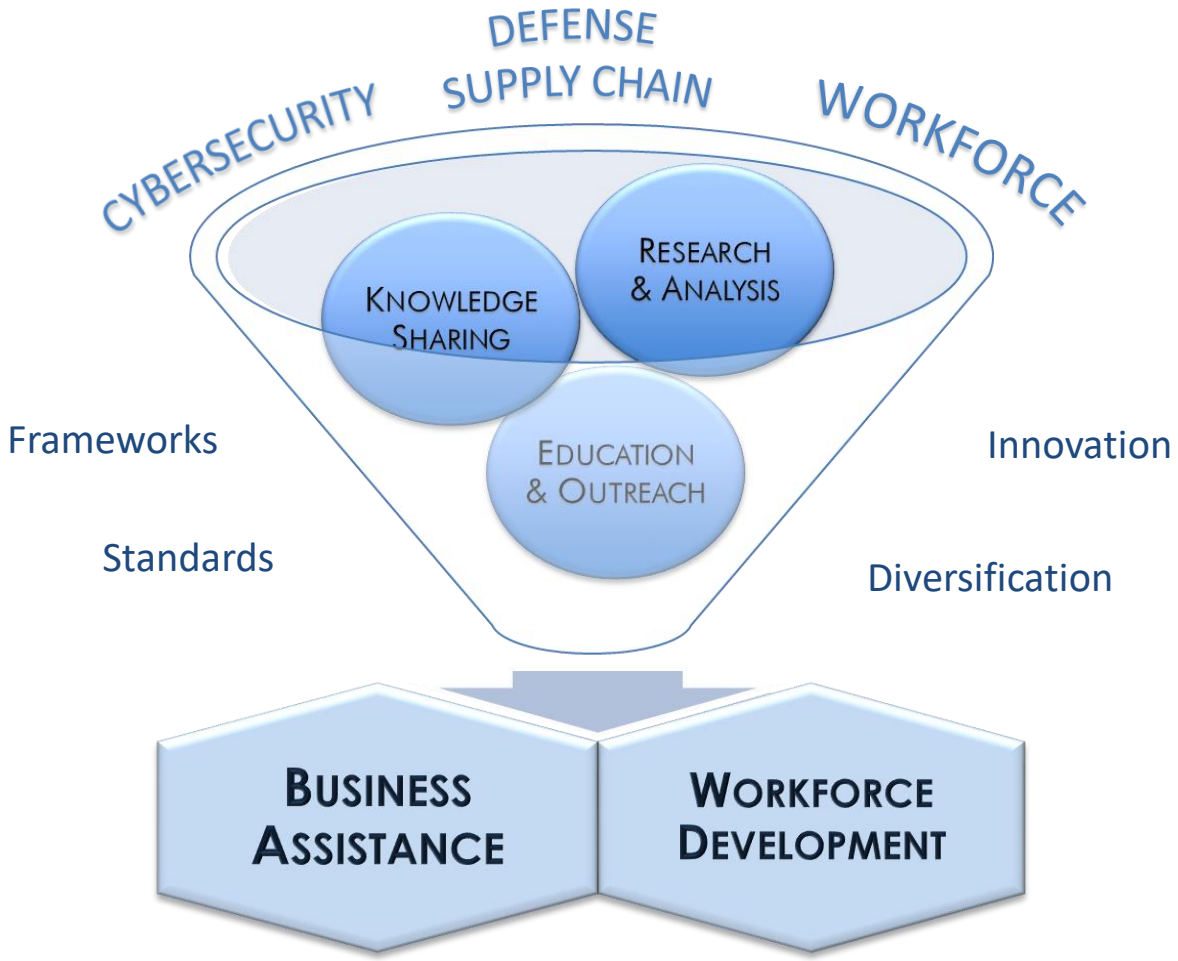
Includes projects in partnership with government, industry, community, non-profits and academic institutions



CASCADE Cyber Career Map

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- Overview of the Cyber Career Map
- Addition of WBL resources – Types of WBL
- Opportunity to include the Haiku simulator
- Future of the Cyber Career Map – cross-over technologies (AI, ML & 5G), employer offerings and NICE article

Industry Cybersecurity Workforce Strategy

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East County EDC's CASCADE Project

- Curated a database of Work Based Learning (WBL) opportunities to incorporate into CCOE's Cyber Career Map.
- Developed industry-driven guidelines & best practices for informing students/candidates of WBL opportunities.
- Developed Engagement Management Structure as model for fostering industry involvement in Cyber WBL. Geared primarily for small/medium sized businesses.
- Developed case studies on Trade/Industry Associations that have implemented successful Cyber WBL activities.

San Diego East County Economic Development Council

Engagement Management Structure

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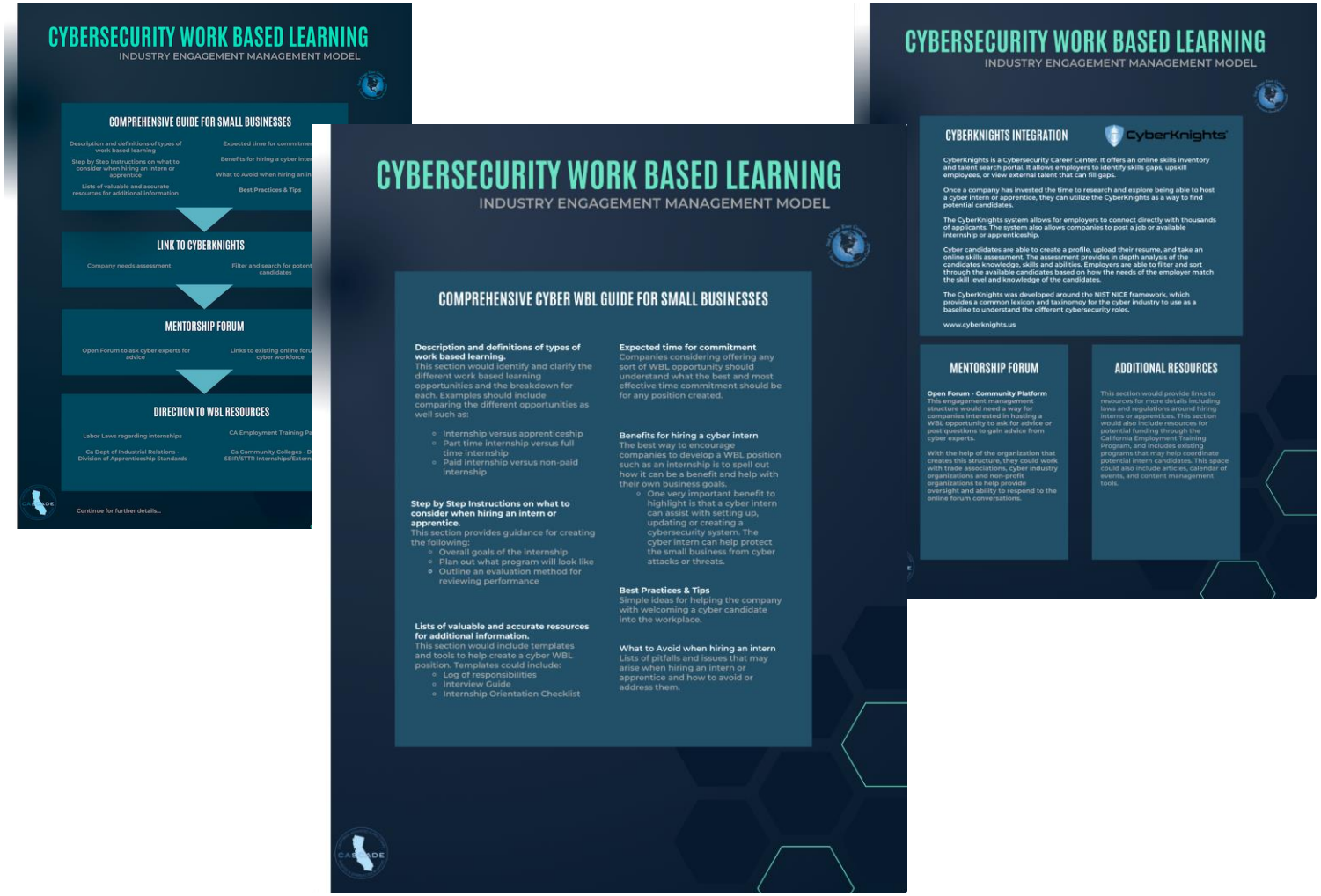
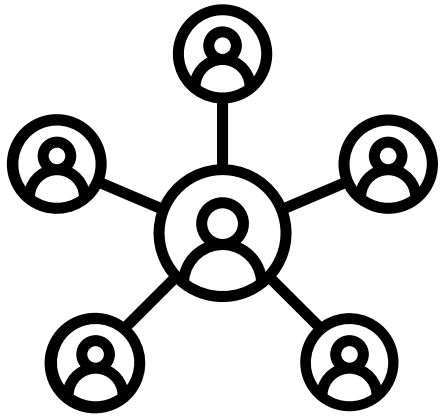


Industry Associations, Professional Societies



- Society of Manufacturing Engineers (SME) – *Manufacturing in Cybersecurity* Virtual Event
- Health Information and Management Systems Society (HIMSS) – Cybersecurity Topic and Career Pathway Offering
- National Defense Industrial Association – SoCal Cyber Cup 2021
- Cybersecurity Center of Excellence (CCOE)/National Foundation for Autism Research (NFAR) – Cyber Internship Pilot Program
- Southwest Apprenticeship Group (SWAG) – Cybersecurity Apprenticeship Curriculum for Defense Businesses

CASCADE Education and Workforce

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Cybersecurity Public Private Partnership

DoD Partners → Industry Outreach → Universities & Colleges

DAU

Cyber Center of Excellence

Cal Poly California Cybersecurity Institute

CA ETP

Business & Entrepreneurship Sector

POWERED BY California Community Colleges

Inland Empire Tech Bridge

El Camino College

btc

San Diego East County Economic Development Council

Business Assistance → Workforce Development → Training & Technical Assistance

Education and Workforce

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- Cybersecurity for Space Systems (California Polytechnic State University)
- Cybersecurity Skills Upgrading Support (Upskill California, El Camino Community College)
- Cybersecurity Internships/Externships with DoD SBIR/STTRs (Upskill California)
- Cybersecurity Apprenticeships (Upskill California, College of the Canyons)
- Cybersecurity Job Placements (SynEd, Cyber Guild)

SPACE GRAND CHALLENGE

MISSION KOLLUXIUM Z-85-0 OCTOBER 7-9, 2022

GAMIFICATION & ESPORTS FOR SPACE AND CYBERSECURITY SKILLS DEVELOPMENT

VIRTUAL EVENT

The California Cybersecurity Institute (CCI) will be hosting the first annual Space Grand Challenge on October 7-9, 2022. The 2022 Space Grand Challenge (SGC) is a global cybersecurity competition that allows students to compete while building valuable skills which will prepare them for future careers in cyber, tech, and space industries. The competition will take place in virtual-immersive environments and will focus on digital forensics with a fictional cybercrime storyline. The event will also be live broadcasted on Twitch.

MISSION KOLLUXIUM Z-85-0

Space Grand Challenge 2022 requires participants to compete in Mission Kolluxium Z-85-0. This mission involves a storyline written by the CCI based off of the breach of a network of satellites and involves analyzing puzzles, evidence, and digital forensics in order to solve the cybercrime.

COMPETE

The Space Grand Challenge is open to middle and high school students from all over the world. The competition is split into different divisions—beginner and advanced—and teams from across the globe are encouraged to register and participate in the event. Join the challenge today!

Visit **our registration form** to register a team, support the event, and learn more about SGC 2022.

Scan here to visit our website.

CAL POLY
California Cybersecurity Institute

CASCADE and NICE Collaborations

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- CASCADE grantees have a longstanding partnership with NICE.

- In 2021, CCOE President Lisa Easterly penned an article entitled, *San Diego's Special Sauce: Collaborative Cybersecurity and Workforce Development*.
  - Published in NICE Fall 2021 newsletter
  - Featured other CASCADE partners
  - Distributed to thousands of industry, academic and government cyber leaders across the country
- Easterly presented at the NICE Federal Cybersecurity Workforce Summit on October 26
  - Discussed how federal agencies can use apprenticeships as
    - Part of their overall human resources strategy
    - Means to build a custom pipeline of highly-skilled talent

San Diego's Special Sauce: Collaborative Cybersecurity and Workforce Development

By Lisa Easterly, President and CEO, San Diego Cyber Center of Excellence

Credit: Lisa Easterly

Lisa Easterly
President and CEO
Cyber Center of Excellence

Cyber Center of Excellence - Cyber Career Map

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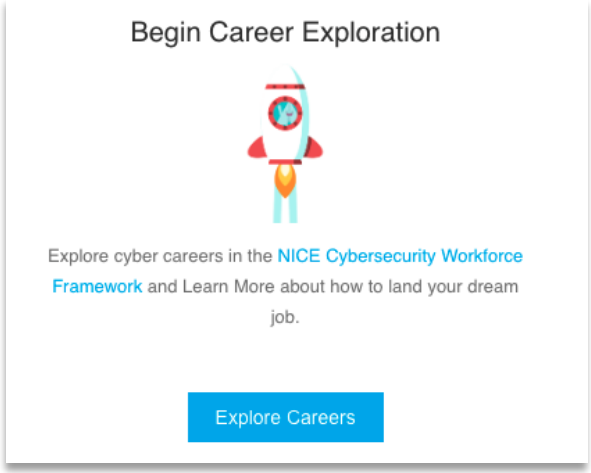
- **Cyber Center of Excellence** (CCOE) is a San Diego-based nonprofit that mobilizes businesses, academia and government to grow the regional cyber economy and create a more secure digital community for all.
- As part of our CASCADE grant efforts, CCOE is partnering with **Journeys Map** on an interactive pilot to map cyber education, trainings, certifications and career pathways. Users can chart their personal path to a cyber career with the exploration dashboard and zoom in for jobs, education, resources and much more.
- California's only Cyber Career Map includes the NIST/NICE cyber crosswalks and national certifications for individuals to connect existing work roles and related skills to potential opportunities in the cyber and defense industries.

Journeys



Cyber Career Map Evolution

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- **CCOE** and **East County EDC** worked with **Journeys Map** to expand the Career Map to include Work-Based Learning (WBL) opportunities that deliver the experiential engagement the Cyber industry demands, including the addition of the Haiku cyber range simulator.
- With guidance from our WBL Advisory Board, we focused on specific WBL opportunities.
  - Internships, apprenticeships, challenges, simulations, events, info feeds
  - Finding ways to continue adding “evergreen" WBL” resources
- Now continuing the evolution of the Cyber Career Map to include AI/ML track additions, a new upskilling/employer widget and the launch of a mobile app.

Cyber Center of Excellence

San Diego East County Economic Development Council

[Hai : ku]
CYBER RANGE

Launch Simulator

Cyber Career Map Demo

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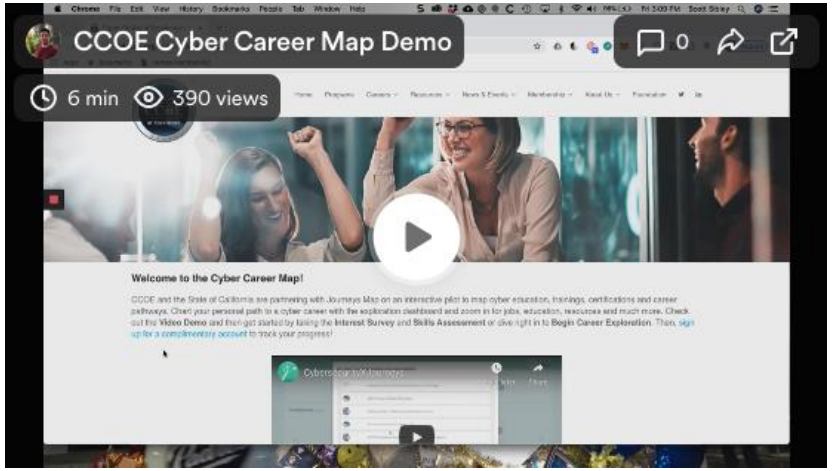
This tool is offered for FREE on the CCOE website via CASCADE grant funding, and connects the global cyber workforce, students and veterans with job opportunities and career paths!



https://sdccoe.org/careermap/

More Information on CASCADE

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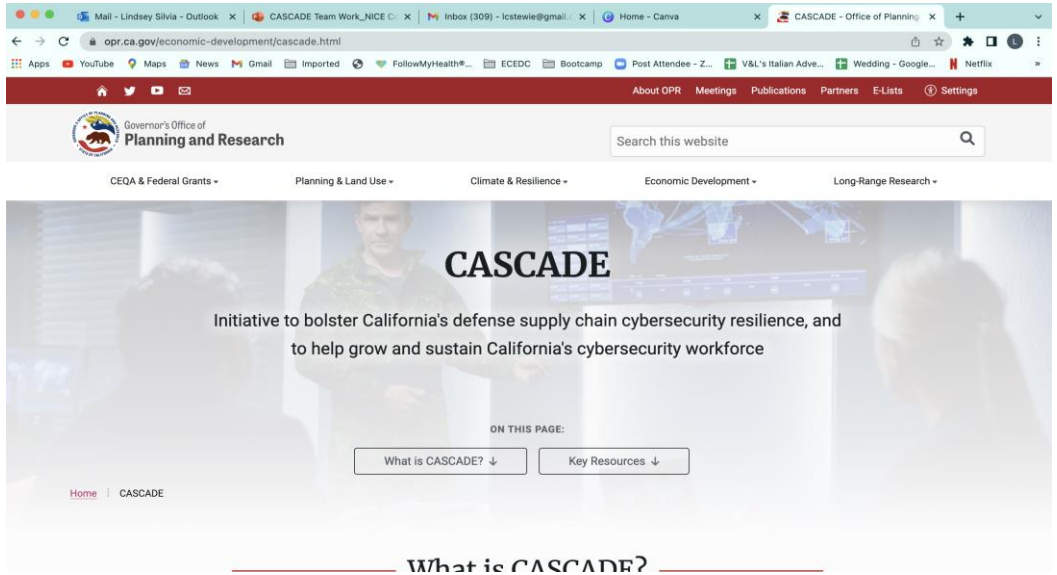
- Get Project Summaries
- Find Contacts
- Learn about Resources



https://opr.ca.gov/economic-development/cascade.html

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