Centers of Academic Excellence (CAE)

in Cybersecurity

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CD SDP

CYBER DEFENCE SMART DEFENCE PROJECTS

19 APRIL 2018

PORTUGAL
LISBOA
ACADEMIA MILITAR

NATO-EU Cooperative Cyber Defence Capability Building:

How Smart Defence and Pooling & Sharing
can foster Cooperation, Transformation and Innovation







Three google searches …

-CAE CYBER DEFENSE

-CAE COMMUNITY

-GEN CYBER



NICE
NATIONAL INITIATIVE FOR CYBERSECURITY EDUCATION

2018 Cyber Challenges …

- National-focus (not just government, DOD, NSA …)

- Educator shortage / Faculty Professional Development
- Competency measurement/metrics
- Cooperative education / Apprenticeship / Internships
- Community College to BA/BS/MS; CAE to CAE articulation
- Peer assistance and evaluation
- K-12 pipeline

GenCyber

K-12 cybersecurity Teacher / Student “Summer Camps”



- Increase diversity
- Inspire interest in cybersecurity careers
  - Especially underrepresented youth
- Teach ethics and safety online
- Improve K-12 teaching expertise & methods

	2014	2017
Teachers Participating	25	>900
Students Participating	256	>3,500
Number of Camps	8	131
Number of Participating Institutions	6	65
Number of States with Camps	2	39

CSUSB -

Cal State University San Bernardino

GenCyber Girl Scout Camp



COMMUTER CAMPS

RESIDENT CAMPS

TEACHER CAMPS

ALL CAMPS ARE FREE





















SPECIAL CAMPS

COMBINATION CAMPS

“HANDS ON” Activities

National Centers of Academic Excellence in Cybersecurity (CAE-C)

The goal of the CAE-CD program is to reduce vulnerability in our national information infrastructure by promoting higher education and research in CD and producing a growing number of professionals with cyber defense expertise.

- -Programs & Background
- -Requirements / Criteria
- -Benefits
- -Impact
- -Initiatives & Way Ahead



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National Centers of Academic Excellence in Cybersecurity (CAE-C)

Cyber Defense (CAE-CD)

- 2Y Education (CAE-2Y)
- Research (CAE-R)
- Cyber Defense Education (CAE-CDE)



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National CAE-Cybersecurity Program

CAE in Cyber Defense (CAE-CD)
Started in 1999 (now 262 schools)
Specific Criteria & Knowledge Units
Designated for 5 years
Partner w/ DHS: National Workforce Needs
Broad Academic Foundation
Optional Focus Area and/or "R" (Research) Designations
NSF Requirement for Cyber Corps (Scholarship For Service) grants



CAE-CD Designation Criteria

CAE-2Y & CAE-CDE		CAE-R
Academic Requirements	Programmatic Criteria	
Curriculum mapped to KUs	Articulation Agreements	Carnegie Research Rating
Program/Student Path	Regional Accreditation	University has CD area of study
Faculty Qualifications	Faculty in CD Research	CD Research Collaboration
Program Maturity	Program Outreach	Faculty CV
Interdisciplinary Program	Cybersecurity in practice	Publication & Research
All designations require the institution have an active Cyber Center on campus		

Designation Process

On Line Application

Extensive evaluation by 2 or 3 experts

Program Office / Technical Directors / Academia

Review all submitted evidence
Syllabi, Resumes, Articulation Agreements, Web Sites, etc

Must Pass each (every) Criteria + All Mandatory Kus + Optional KUs

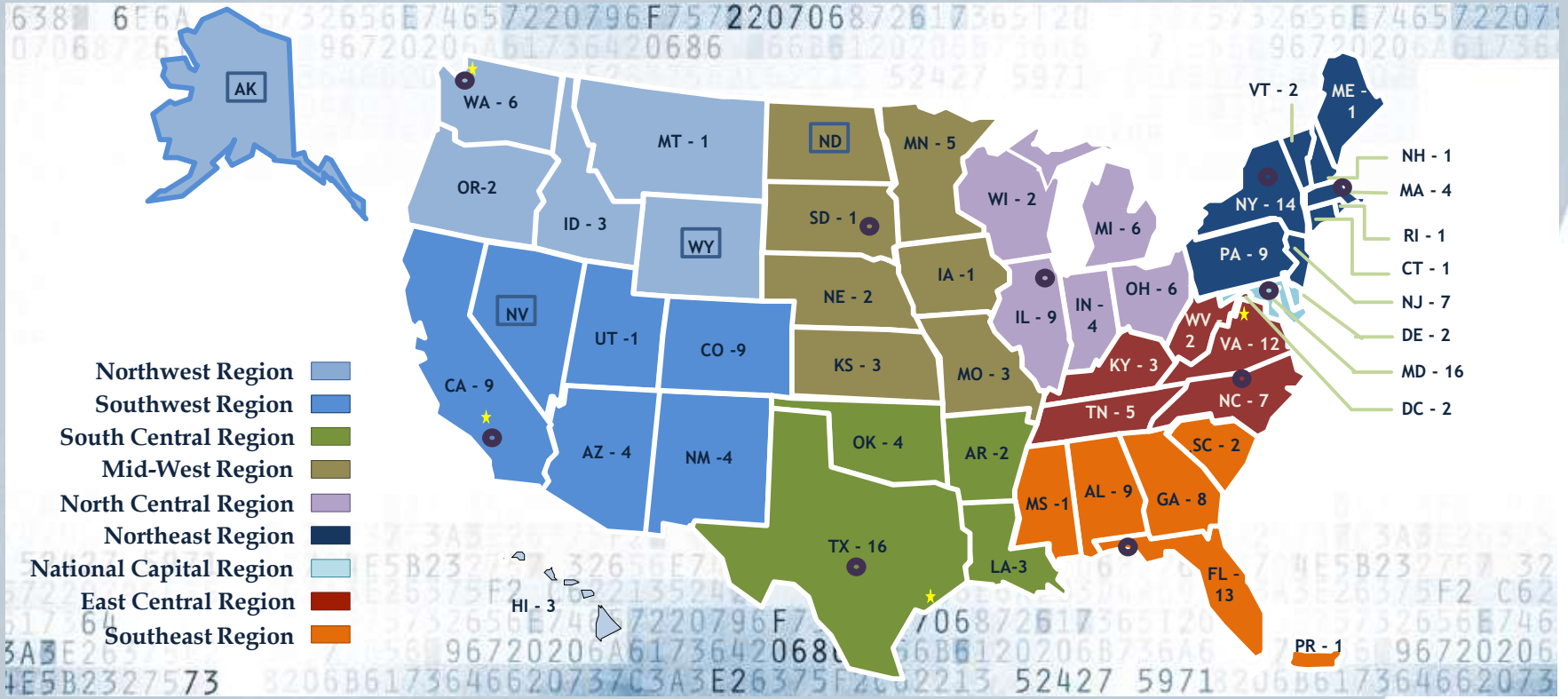
Formal Designation Ceremony

Historical Pass Rate ~ 50 percent

2017 Designated CAE-C Schools

232 CAE-CD institutions in 46 states, the District of Columbia and Commonwealth of Puerto Rico

https://www.iad.gov/NIETP/reports/cae_designated_institutions.cfm



28 CAE-2Y States:

Alabama (2)
Arizona (1)
California (1)
Colorado (2)
Hawaii (1)
Idaho (1)
Illinois (3)
Indiana (1)
Louisiana (1)
Maryland (7)
Michigan (1)
Minnesota (1)
Missouri (1)
Montana (1)
New Jersey (1)
New Mexico (2)
New York (2)
North Carolina (2)
Ohio (3)
Oklahoma (1)
Oregon (1)
Pennsylvania (1)
Tennessee (1)
Texas (4)
Virginia (4)
Washington (4)
West Virginia (1)
Wisconsin (1)
(52)

CAE National Resource Centers: ☆
California State University San Bernardino, Northern Virginia Community College, University of Houston, Whatcom Community College

CAE Regional Resource Centers: ●
Coastline Community College, Dakota State University, Forsyth Technical Community College, Mohawk Valley Community College, Moraine Valley Community College, Northeastern University, Prince George's Community College, San Antonio College, University of West Florida, University of Washington

CAE Designation Requirements

Curriculum

Mapped to Knowledge Units
Student Path and Recognition
Faculty Qualifications
Program Maturity
Interdisciplinary
Focus Areas

Programmatic Criteria

Cyber Center
Robust Program
Regional Accreditation
Articulation Agreements
Faculty in Cyber Defense Research
Students in Cyber Defense Research
Outreach (other Colleges or High School)

CD Knowledge Units

Foundational KUs

- Cybersecurity Foundations
- Cybersecurity Principles
- IT Components

CORE Technical KUs

- Basic Cryptography
- Basic Networking
- Scripting & Programming
- Network Defense
- Operating Systems

CORE Non-Technical KUs

- Cyber Threats
- Cybersecurity Planning & Management
- Policy, Legal, Ethics, Compliance
- Security Program Management
- Security Risk Analysis

CD Optional Knowledge Units

- Advanced Cryptography
- Advanced Network Technology and Protocols
- Algorithms
- Analog Telecommunications
- Cloud Computing
- Cybersecurity Planning and Management
- Data Administration
- Data Structures
- Database Management Systems
- Digital Communications
- Digital Forensics
  - Device Forensics
  - Host Forensics
  - Media Forensics
  - Network Forensics
- Embedded Systems
- Forensic Accounting
- Formal Methods
- Fraud Prevention and Management
- Hardware Reverse Engineering

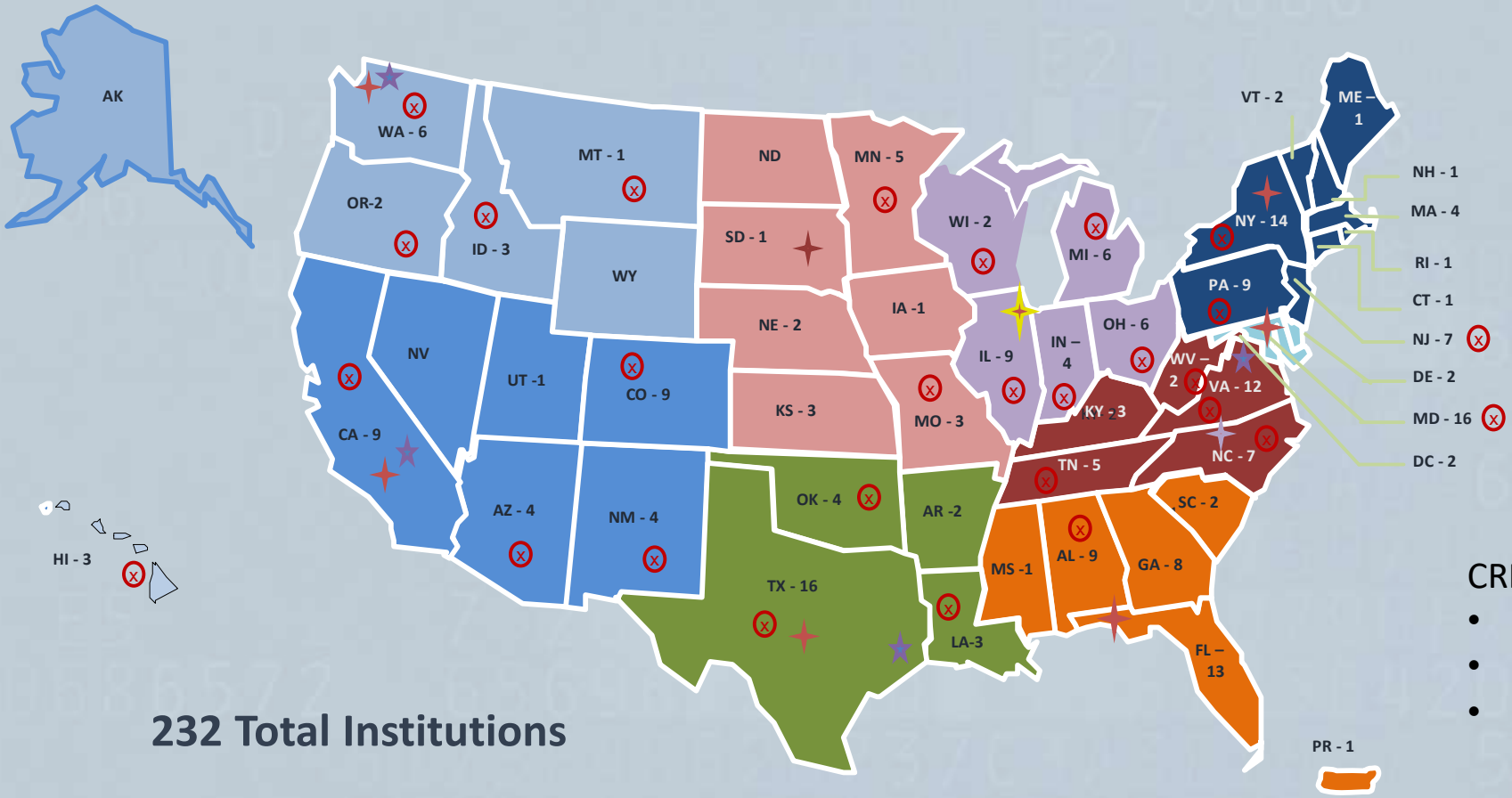
CD Optional Knowledge Units

- Hardware/Firmware Security
  - IA Architectures
  - IA Compliance
  - IA Standards
  - Independent/Directed Study/Research
  - Industrial Control Systems
  - Intro to Theory of Computation
  - Intrusion Detection
  - Life-Cycle Security
  - Low Level Programming
- Mobile Technologies
  - Network Security Administration
  - Operating Systems Hardening
- Operating Systems Theory
  - Overview of Cyber Operations
- Penetration Testing
  - QA / Functional Testing
  - RF Principles

CD Optional Knowledge Units

- Secure Programming Practices
  - Security Program Management
  - Security Risk Analysis
  - Software Assurance
  - Software Reverse Engineering
  - Software Security Analysis
  - Supply Chain Security
  - Systems Programming
- Systems Certification and Accreditation
  - Systems Security Engineering
  - Virtualization Technologies
  - Vulnerability Analysis
  - Wireless Sensor Networks

New Paradigm 2017



Legend:
State - # of CAEs as of November 2017
States with designated Community Colleges ⓧ

232 Total Institutions

CRRCs:

- Build regional community
- Provide Faculty Professional Development
- Assist Candidate Institutions

CAE National Resource Centers (CNRCs)
Community - California State University, San Bernardino (CA)
Mentors - Whatcom Community College (WA)
Reviewers - Northern Virginia Community College (VA)
Knowledge Units - University of Houston (TX)

CAE Regional Resource Centers (CRRCs)	
North Western Region - University of Washington (WA)	North Eastern Region - Mohawk Valley Community College (NY)
South Western Region - Coastline Community College (CA)	and Northeast University (MA)
South Central Region - San Antonio College (TX)	National Capital Region - Prince Georges Community College (MD)
North Central Region - Dakota State University (SD)	East Central Region - Forsyth Tech Community College (NC)
Mid-Western Region - Moraine Valley Community College	Southeast Region - University of West Florida (FL)

Other Initiatives …

TECH TALK (Technical)
CAE FORUM (Non Technical)

On-Line hour long academic presentations (monthly)
All presentations are archived

Examples …

- Virtualizing Industrial Control Systems Testbeds for Cybersecurity Research
- Buffer Overflow – Prevention and Defense
- Can Our Elections Systems Be Hacked?
- Catching Bad Guys with Graph Mining and Visualization
- Digital Investigation and Trojan Defense
- Defeating Malware Packing and Code Obfuscation Techniques

The Why Slide

Advantages to University and Students

- Join a select group / a “community”
- Assigned SEAL (Security Education Academic Liaison)
- Eligible for government scholarships & grants
- Annual Meetings (2)
- Prestige and Recruiting Advantages

CAE Costs / Resources / Key to Success

-Program Management Office Staff

- Annual Meetings / Ceremonies

- Capacity Planning Grants

- Scholarships

-Site Visits

CAE Impact

“300% enrollment increase”

“Stopped State Funding Cuts”

“Increased opportunities for NSF grants”

“Influencing regional collegiate programs and outreach activities”

“Increased contact from government and industry seeking partnerships”

“Chosen by State government to consult on Cyber Security Councils ”

“University Administration support to increase faculty and programs for Cyber Operations curriculum”

Three google searches …

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Contact: BAGOUKE@NSA.GOV



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BACKUP SLIDES









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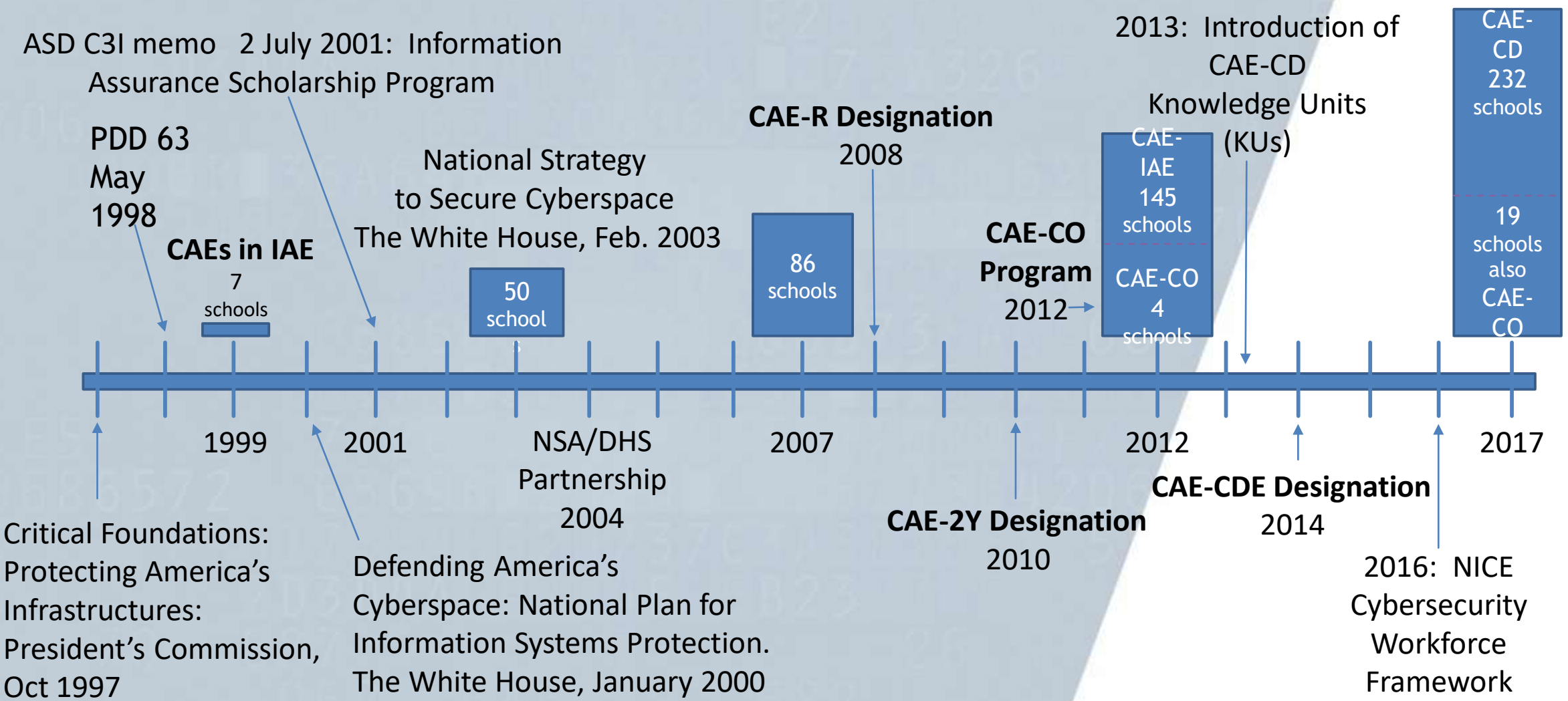
CAE in Cyber Defense



Optional Focus Areas (18)

Cyber Investigations
Data Management
Systems Security
Data Security Analysis
Digital Forensics
Health Care Security
Industrial Control Systems – SCADA
Security Network Security Administration
Network Security Engineering
Secure Cloud Computing
Secure Embedded Systems
Secure Mobile Technology
Secure Software Development
Secure Telecommunications
Security Incident Analysis and Response
Security Policy Development and Compliance
Systems Security Administration
Systems Security Engineering

Emphasis Areas …

- Revising KUs (consolidating – streamlining)
- Standardizing Terminology
- Candidates Program (academic peer involvement)
- National transfer agreements
- Establishment of K-12 pipelines into CAE schools
- Cooperative education programs
- Cybersecurity educator shortage