

**National Centers of Academic Excellence in
Information Assurance /Cyber Defense (IA/CD) - Research**
*Jointly Sponsored by the National Security Agency (NSA)
and the
Department of Homeland Security (DHS)*

The goal of the CAE-R program is to proactively increase our understanding of robust IA technology, policy, and practices that will enable our Nation to effectively prevent and respond to a catastrophic cyber event. This program will contribute significantly to the advancement of state-of-the-art IA knowledge and practice.

The vision for the CAE-R Program is to establish a process that will:

1. Recognize schools with programs that integrate research activities into the curriculum and into the classroom setting.
2. Provide NSA, DHS, and other federal agencies with insight into academic IA programs (with their reach into industry) that can support advanced academic, research, and development capabilities.
3. Serve as potential source and facilitator for government-academia researcher exchanges.
4. Present opportunities for IA research centers to drill deeper into much needed solutions for securing critical information systems and networks.

CAE-R Program Requirements: There are seven (7) foundational criteria for establishing CAE- Research:

1. Applicants must either be an existing Center of Academic Excellence in Information Assurance Education or meet the revised CAE criteria outlined here:

Please indicate CAE status: Yes or No

1. a. Provide evidence of significant engagement in IA research initiatives, community service, and outreach with regard to IA research initiatives, such as serving on technical program committees of IA conferences, editing IA journals, hosting conferences and workshops, and collaborating with or assisting local government, business, universities and industry.

1. b. The academic program encourages research in IA. This criterion focuses on *STUDENT*-based research. Provide titles and *links* to thesis, dissertations, or projects within the last five years. Provide links to **actual** papers, not a subscription service.

1. c. The academic program, within a nationally or regionally accredited four-year college or graduate-level university, has an area of study in IA. Provide syllabus for courses as evidence.

1. d. The university has a declared center for IA education or a center for IA research. Provide link to the center website.

2. The institution must be either a DoD school/or PhD producing military academy or be rated as either Research University - Very High Research Activity (RU-VH), a Research University – High Research Activity (RU-H), or a Doctoral/Research University (DRU) as determined by the Carnegie Foundation Basic Classification system (and/or other independent body to measure IA or written justification as to significant IA research).

<http://www.carnegiefoundation.org/classifications/index.asp?key=784>

3. It is clearly demonstrated that the faculty is active in current IA practice and research and contributes to IA literature. Substantiate depth and length of faculty expertise through submission of biographies and bibliographies with link to CV including main areas of IA research/expertise. The University faculty must consist of more than one full-time instructor who teaches courses that contain IA related material and who conducts research in the IA area.

4. Publication. The baseline that distinguishes research from technical writing is peer evaluation. Those aspiring to CAE-R status must provide evidence of a strong peer-reviewed publication record by IA faculty and students. (*Examples of publications: books or chapters of books, peer reviewed journals, peer reviewed conference reports/presentations, peer reviewed electronic publications, technical/trade magazines, invited presentations, and graduate-level thesis/dissertation.*) Include impact of research – number of papers and how they impact the IA community. What is your schools’ area of expertise? Provide links to 10 to 20 **actual** papers (not a subscription service) that highlight your area of expertise in IA research – it is strongly encouraged that research be conducted in more than one core area. Other research products considered in this section include other IA publications and software or hardware artifacts.

Core area list – includes, but is not limited to the following:

- Principles
 - Domains and domain separation
 - Resources and resource isolation
 - Privileges and least privilege
 - Layering
 - Application of principles to function, component and system levels
 - Composition
- Security Mechanisms / Functionality
 - Cryptography
 - Identification and Authentication
 - Authorization and Access Controls
 - OS/DBMS/Network mechanisms
 - Trusted processes (what are they, when are they needed)
 - Virtualization
 - Biometrics
 - Audit, monitoring, anomaly detection, DLP
 - Wireless, link, and signal security
- Architectures
 - Network models
 - OS/DBMS/Network architectures
 - OS/DBMS/Network subjects and objects (active entities and data containers)
 - Cloud, Grid, distributed computing
 - Custom/specialized architectures (e.g., Ad-hoc networks, SCADA)

- Interconnectivity and routing
- Privilege and separation issues
- Components vs. Solutions vs. Systems
- Critical infrastructure security
- Assurance
 - Software
 - Hardware
 - Testing (functional, penetration, black box, white box, measurement, etc.)
 - Modeling and Formal methods (need focus on feasibility, applicability, strengths/weaknesses)
- Operations
 - Configuration
 - Security automation
 - Intrusion detection/analysis/remediation
- Analysis
 - Cryptanalysis
 - Malware analysis
 - Forensics
 - Data mining
 - Process
 - Audit
 - Certification and accreditation

Non-technical IA Issues

- Legal issues
- Policy issues
- Privacy
- Business Case / Economics
- Awareness
- Supply Chain

5. Graduate-level Production. The CAE-R applicant must provide evidence that they are producing graduate level (PhD and Masters) students in IA. Provide information regarding the number of M.S. or Ph.D. students who completed an IA focused thesis (complete with name, date, and thesis title and *link*), regardless of department (such as CS, EE, MIS, or Math). The thesis or dissertation must have a clear IA focus. The CAE-R candidate school should have an average of three PhD students enrolled with an IA emphasis in a one-year period. In addition, three PhD students should graduate within a five-year period. Provide links to the best works of PhD or Masters students in the area of IA (at least 3).

6. Research Funding. The CAE-R applicant must provide a history of research funding for the past five years and, wherever possible, from sources such as DARPA, NSF, and IARPA. Include highlights of the IA aspect of at least 10 best research projects, in addition to a brief description of other IA related research projects. Wherever possible, documentation from the funding source (government, industry, etc.) verifying that funded research in core IA and with IA implications of a significant level and impact is occurring, and/or provide evidence of patents awarded, or applied for if applicable. If documentation from the funding source is not available, a letter of verification from the Dean will suffice. The program should produce evidence of conducting research/study of particular interest to the NSA.

7. Adequate Subject Matter Preparation. Graduate/research programs must demonstrate that students have received adequate subject matter preparation. Explain how your graduate level research students have met this requirement either at your university or as a transfer from another university. The requisite subject matter must encompass the Information Assurance/Cyber Defense field or demonstrate relevance to the field (see criteria 4). Evidence can include verification of transcripts (actual transcripts not required for PII reasons – or if submitted, remove names and PI information), topics and numbers of students conducting IA/CD research, written verification from a department leader attesting to how the students received the knowledge, etc.

Evaluation Criteria

1. Either a current CAE or must meet the revised CAE criteria outlined in 1. a – d. Yes/No

2. PhD. producing DoD school/military academy: Yes/No
Carnegie Foundation Classification level/or other independent body to measure IA/or written justification as to significant IA research: _____

- 3: List IA faculty with a link to CV including main areas of IA research/expertise:

4. Publications:
Quantity – Provide link to 10 to 20 papers that highlight contributions in IA. Yes/No
Core area list:
Quality – 1. Evidence of peer review Yes/No
 2. Significance and impact Yes/No
 3. Impact Yes/No
 If no impact – explain:

5. Graduate-level Student Production
Average of three PhDs enrolled with an IA emphasis in a one-year period. Three PhD students graduated over a five-year period. Research papers provided. Yes/No

6. Research Funding/Grants
Quantity – Evidence of new and sustained research funding. Yes/No

Quality – Evidence of significant impact Yes/No
Impact summary:

7. Adequate Subject Matter Preparation: Graduate/research programs must demonstrate that students have received adequate subject matter preparation before entering the doctoral/Ph.D. program. Yes/No

Review Process

Members of the IA research community will conduct reviews. Two reviewers will review each application, independently. If the two reviews are not in agreement, a third reviewer will be assigned. The program office will make a final determination based on all three assessments.

CAE-R Program Terms

- The burden is on the university to clearly demonstrate their qualifications for the CAE-R Program.
- Evaluation results will be provided to each applicant regarding their own application. Reviewer comments will be provided upon request.
- CAE-R status is good for a period of five academic years.
- If an application is not approved, the University may reapply during the next annual cycle.