# STAFF SUMMARY SHEET

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<th>ACTION</th>
<th>SIGNATURE (Surname), GRADE AND DATE</th>
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<td>Steve Hadfield</td>
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<tr>
<th>SUBJECT</th>
<th>Clearance for Material for Public Release</th>
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**SUMMARY**

1. **PURPOSE.** To provide security and policy review on the document at Tab 1 prior to release to the public.

2. **BACKGROUND.**
   Author: Steve Hadfield

   **Title:** Integrating Security and Software Assurance Concepts and Mindsets in an Undergraduate Computer Science Curriculum

   **Circle one:** Abstract | Tech Report | Journal Article | Speech Paper | Presentation | Poster
   ___________ | ___________ | ___________ | ___________ | ___________ | ___________

   **Check all that apply (For Communications Purposes):**
   - [ ] CRADA (Cooperative Research and Development Agreement) exists
   - [ ] Photo/Video Opportunities
   - [ ] STEM-outreach Related
   - [ ] New Invention/Discovery/Patent

   **Description:** Invited talk at the Software Assurance Forum, Mclean, VA

   **Release Information:**
   Previous Clearance information: (If applicable): N/A

   Recommended Distribution Statement: (Distribution A, Approved for public release, distribution unlimited.)

3. **DISCUSSION.** None.

4. **VIEWS OF OTHERS.** The Department Research Director has reviewed this paper and recommends it for public release.

5. **RECOMMENDATION.** Sign coord block above indicating document is suitable for public release. Suitability is based solely on the document being unclassified, not jeopardizing DoD interest, and accurately portraying official policy.

**STEWEN M. HADFIELD**
Associate Professor

I Tab
Presentation for approval

AF IMT 1768, 19840901, V5
PREVIOUS EDITION WILL BE USED.
Integrating Software Assurance and Secure Programming Concepts and Mindsets into an Undergraduate Computer Science Program

Striving to Achieve the Goals of the SEI/CERT Software Assurance Curriculum Project (Undergraduate)

Steve Hadfield
U.S. Air Force Academy, Department of Computer Science

Realization

In an outcome-based curriculum, some outcomes need to be purposefully developed across courses and years.

Result

A retrospective, outcome-based look at an existing curriculum (Felder & Brent)
### Key Cross Curricular Initiative

<table>
<thead>
<tr>
<th>Software Engineering Discipline</th>
<th>Needs Analysis, Requirements Elaboration, Design</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Testing Rigor, Quality Assurance</td>
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<tr>
<td>Ethical, Legal, Social Issues</td>
<td>Moral Frameworks &amp; Decision Making</td>
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<tr>
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<td>Ethical Codes (IEEE, ACM, Software Engineering)</td>
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<tr>
<td>Research Skills</td>
<td>Literature Review, Framing/Scoping Topics, Hypotheses</td>
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<td>Investigation, Support of Conclusion, Reporting</td>
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<tr>
<td>Communications Skills</td>
<td>Oral Presentations</td>
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<td>Written Communications</td>
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<tr>
<td>Team Work</td>
<td>Team Building, Team Maintenance</td>
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<td>Pair Programming, Four-Five Member Team Dynamics</td>
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<tr>
<td>Security &amp; Software Assurance</td>
<td>Secure Programming</td>
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<td>Cyber Security</td>
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</tbody>
</table>

### Security & Software Assurance

**SEI/CERT SwA Curriculum**
- Computer Science I
- Computer Science II
- Intro to Computer Security
- Software Security Engineering
- Software Quality Assurance
- Software Assurance Analytics
- Software Assurance Capstone

**USAFA Computer Science**
- Computer Science I
- Computer Science II
- Computer Security & Information Warfare
- Software Engineering I
- Software Engineering II
Security & Software Assurance Initiative
Sophomore Year

- Computer Science I - Intro to Programming
  - Input interpretation validation, array bounds checking
  - Integer overflow, error/exception handling, file I/O issues

- Computer Science II – Data Abstraction
  - Pre- and post-conditions, more advanced debugging
  - Testing & debugging techniques, reinforce CS I topics

- Computer Organization & Architecture
  - Data type overflow, divide-by-zero, round-off error
  - Stack overflows

Security & Software Assurance Initiative
Junior Year

- Programming Paradigms
  - Memory allocation/deallocation, termination conditions
  - Stack/buffer overflows and protections, type safety

- Operating Systems
  - Deadlock issues, race conditions, system calls
  - Signals, file system security

- Databases & Web Programming
  - Defense against SQL injection attacks
  - Cross site scripting attacks

- Networks
  - Secure protocols, wireless encryption, Man-in-the-Middle attacks
  - Adversarial view of protocols, network access control
Security & Software Assurance Initiative
Senior Year

Languages & Machines (compilers & language theory)
- Type checking mechanisms, array bounds checking mechanisms
- Translation to machine language

Computer Security & Information Warfare
- Security & threat models
- Range of security strategies and techniques

Software Engineering I
- Security requirements, security analysis of system design, risk management
- Formal test plans/procedures/reports
- Integration/system/verification/smoke/stress/security testing

Software Engineering II
- Introduction to Formal Methods
- Reengineering & forward engineering

Software Assurance & Security for ALL

Algorithmic Reasoning
- Input Validation
- Exception Prevention
- Requirements Analysis
- Incremental Build/Test

Cyber Security
- Information Security
- Cryptography
- Cyber Warfare & Crime
- Offensive Cyber Ops
- Defensive Cyber Ops
Enrichment Activities
Interdisciplinary Courses

Cyber Law
Cyber Security Policy & Politics
Information & Cyberspace Operations

Enrichment Activities
Defensive Competitions

Cyber Patriot
www.uscyberpatriot.org

Collegiate Cyber Defense Competition
www.nationalcdc.org

Cyber Defense Exercise
Vectors

- Professionals
  - Comp Sci, Info Sys, Info Tech, MIS
  - Curricular & pedagogical resources

- General Awareness
  - Personal awareness & defense
  - Bigger issues – enterprise, national, global

- Specialization
  - Defense is the ‘hard job’
  - Funding for developing experts

Questions?

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