Integrated Software and Systems Engineering curriculum

Graduate Software Engineering Reference Curriculum (GSwERC)

Workshop Four

Curriculum Author Team (CAT)

July 29-30, 2008 Naval Postgraduate School Monterey, CA, USA

WORKSHOP REPORT
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1. iSSEc Project

Software engineering (SwE) is the acknowledged discipline by which large-scale and complex software is developed. Many universities teach software engineering at the undergraduate level. More than 30 colleges and universities helped create the 2004 model curriculum for undergraduate SwE education that was published by the IEEE and ACM.

Many universities offer a Masters degree in SwE. Yet the only existing reference curriculum for graduate SwE was created in 1991 by the Software Engineering Institute. Since then, technology changes, such as the World Wide Web, have vastly changed how the world communicates, and software being developed today has become enormously more complex. Considering the reliance of the world economy on the quality of SwE professionals, there is a clear need to develop a graduate reference curriculum.

The iSSEc (integrated Software and Systems Engineering curriculum) project is creating a new reference graduate SwE curriculum that reflects new understanding of how to build software, how software engineering depends on systems engineering, and how software engineering education is influenced by individual domains such as telecommunications and defense systems. The proposed reference curriculum will be suitable for university education leading to a Masters Degree in SwE or its equivalent.

As per the initial iSSEc project plan, an Early Start Team (EST) was formed and an organizing workshop was conducted in August 2007 to bring the members together and to jump-start the project activities. Following the workshop, members of the EST began working on an initial version of the reference curriculum. A second workshop was conducted in December 2007 to review the current status and to plan future activities. The EST then prepared and released version 0.25 of the Graduate Software Engineering Reference Curriculum (GSwERC v0.25) in March 2008, which was sent to over 150 reviewers from the world-wide software and systems engineering communities – academia and industry, as suggested by EST members. A third workshop was conducted in April 2008 to discuss the reviews received on GSwERC v0.25. Following this workshop, the EST transitioned into the Curriculum Author Team (CAT), which continued revision of GSwERC v0.25 based, in part, on reviewer comments. In July 2008, the CAT met to discuss progress in creating GSwERC v0.50 and a pathway to deliver the updated curriculum for review. This report provides an overview of the July Workshop.

2. GSwERC Workshop 4

The fourth workshop was held at the Naval Postgraduate School in Monterey, CA on July 29-30, 2008. The objectives of the workshop were to:
3. Workshop Proceedings

3.1 Current Status of iSSEc/GSwERC

Dr. Art Pyster, principle investigator of the iSSEc Project, opened the meeting with a discussion of the status of GSwERC to date.

Progress to date. The survey on current graduate software engineering programs was completed at the end of Nov 2007. In late Feb 2008, v0.25 was published and sent to approximately 150 reviewers. Comments were received from approximately 40 reviewers. These review comments have been used, in part, to create the current draft of GSwERC.

Schedule. Based on the current project plan, the iSSEc project is slightly behind schedule. The schedule has been modified to reflect a publication of GSwERC v0.50 by October 2008.

Endorsements. Since workshop 3, the IEEE Educational Activities Board agreed to officially participate in GSwERC and Boots Cassel, the ACM volunteer, has agreed to seek similar official participation from the ACM. The CAT will continue to work with these organizations with the objective of eventually obtaining full endorsement. The CAT discussed the need for industrial involvement. A recommendation was made that professional committees be leveraged to foster involvement outside academia. Dr. Pyster requested that CAT members provide recommendations for specific committees that should be approached regarding GSwERC.

Publicity. Publicity efforts have continued since workshop 3. A paper on GSwERC was presented at the ASEE International Conference in June, a presentation was made at the Academic Forum in the INCOSE 2008 International Symposium, and a paper was accepted for presentation at APCOSE 2008. In addition, there is now a plan to deliver workshops on GSwERC at upcoming CSEET and SIGCSE conferences in 2009. Dr.
Pyster encouraged additional participation from the CAT in development and delivery of presentations, papers, or workshops. Dr. Pyster also solicited recommendations for additional venues for GSwERC publicity.

**Industry Survey.** In addition to identifying opportunities for industry participation in GSwERC, the Stevens team is developing a survey of industry and government software engineering education needs. The CAT discussed the types of companies and agencies which should be surveyed, the types of individuals who may be able to provide the critical information on software engineering needs, and the objectives of the survey. The survey interviews and analysis should be completed by the end of 2008. Dr. Pyster requested that CAT members provide recommended industry contacts and solicited volunteers to assist with the survey. A journal paper on the survey will be written in early 2009.

### 3.2 Review of Revisions to GSwERC v0.25

The Stevens team catalogued all comments received on GSwERC v0.25. The comments were then provided to each of the three teams (Guidance, Expectations, Objectives, and Outcomes; Architecture; and Body of Knowledge). The team leads—Art Pyster, Tom Hilburn, and Jim McDonald, respectively—provided an overview of the action items developed for their respective teams based on the review comments and the status of those actions. (Please see appendices D-F to view the slide presentations provided).

**Guidance, Expectations, Outcomes, and Objectives—Art Pyster**

A major decision during discussion of this section was that specific Objectives are not appropriate for inclusion into GSwERC. Outcomes, which include the general knowledge, skills, and abilities, that students should possess after completing a GSwERC-compliant curriculum are acceptable. Program objectives, however, should be set by the individual university. GSwERC, then, should include appropriate discussion of the need for program objectives, but should not recommend specific ones. The CAT also discussed revisions to the current outcomes to better align with the current BOK. In addition, clear explanation of the expectations, why they were chosen, and how these expectations align with the general SWE student population, need to be refined.

**Architecture—Jim McDonald**

In general, reviewers indicated that there should be elaboration on certain principles which were more implicitly stated in v0.25. In addition, some of the figures will be updated based on reviewer comments.

**Body of Knowledge (BOK)—Hilburn**

For the BOK section, there is a need to develop clear definitions and explanations of elements which are not defined by the Software Engineering Body of Knowledge (SWEBOK), such at Systems Engineering or Engineering Economics. There was
discussion that the mixing of different techniques within the BOK may increase 
confusion, so this level of detail is likely not appropriate in the body of the document.

The matrix of review comments, action items, and status will be posted to the iSSEc 
website and provided to reviewers. This will be the primary method used to provide 
feedback to the reviewers of GSwERC v0.25. Each team lead will ensure that the 
changes discussed in the workshop are completed for GSwERC v0.50.

3.3 Discussions on Sample Implementation and Comparison Sections

Ten to fifteen page descriptions of hypothetical sample implementations will illustrate 
how the curriculum guidelines could be applied to build GSwERC-compliant programs. 
Professors from various universities, who will write these implementations, will base 
them on their current SwE graduate programs.

Outline. Sample implementations will be 10-15 pages in length. They will include 
considerations of how the university will handle the following information:

- **Entrance Expectations.** Will the recommended entrance expectations be used, 
  and, if not, how will the university ensure that incoming students are prepared to 
  take on the graduate work necessary to meet the Expected Outcomes? This may 
  include consideration of additional coursework, extra curricular work with 
  professors, or other solutions.

- **BOK.** This will include discussion of how the core BOK will be covered (i.e. what 
  courses will provide this information) as well as the additional BOK that the 
  program will target.

- **Course Listing.** This will include the core and suggested elective courses for 
  the program as well as a *brief* course description for at least the core courses.

- **Program Objectives.** The samples should include an explanation of the 
  objectives and mission of the university with respect to the program. This may 
  include desired student population (i.e. relatively new graduates, seasoned 
  professionals, individuals making mid-career changes), target industry or 
  government sectors, specialization, or other attributes which give the program a 
  unique character.

By mid-August, the Stevens team will further develop guidance and templates for 
sample implementations. This guidance will be disseminated to the CAT.

**Quantity.** For GSwERC v0.50, there will be two sample implementations provided - 
one by the Stevens Institute and one by Embry Riddle. Additional sample 
implementations will be provided over the review period for GSwERC v0.5, including 
several from non-U.S. universities. Some CAT members volunteered to develop a 
sample implementation or discuss development with faculty at their universities. All
CAT members were encouraged to reach out to members of their university or colleagues at other universities for development.

### 3.4 Review outline of GSwERC v0.50

The proposed GSwERC v0.50 outline was reviewed by the CAT. Discussions were made as to appropriate placement of information. A major discussion point was the amount of information to include in the body text versus in appendices. CAT members indicated concern that if the base document was not very concise, people would not read it, and GSwERC may not gain traction in the SwE community. Sample implementations and comparisons to existing programs were moved to appendices. Appendix D of this workshop report provides an updated outline of GSwERC v0.50.

**Implementation Considerations.** In addition to the new implementation example and GSwERC comparison sections, there will be a new section titled “Implementation Considerations”. This section will provide a discussion of the types of issues that will affect a university’s ability to develop GSwERC-compliant programs; e.g., faculty qualifications to teach GSwERC-compliant curricula. To facilitate development of this section, a new team was created. The Implementation Considerations Team will be led by Dr. Bret Michael from the Naval Postgraduate School. Several CAT members volunteered to serve on this team.

### 3.5 Discuss schedule and responsibilities for preparation and release of GSwERC 0.5

Reflecting the amount of work remaining, the expected release date for GSwERC v0.50 has been moved from 30 September 2008 to 31 October 2008. Team leads will continue revising their respective sections based on discussion in the workshop. Individual CAT members volunteered to lead the development of new materials for GSwERC v0.50. In addition, there was discussion on the release of GSwERC v0.50. There will be a general release, including posting of the document and comment guidance on the iSSEc website. In addition, Art Pyster will continue coordination with IEEE and ACM. The CAT hopes that these organizations, as well as INCOSE and the NDIA Systems Engineering Division, will also post the document for comment to their respective websites. Dr. Pyster also solicited assistance from the author team to identify additional venues which may help promulgate the document, including through industry-focused organization. There will also be a targeted release of the document to the individuals who provided review comments on GSwERC v0.25.

Appendix C provides a list of the critical action items for the completion of GSwERC v0.50, as well as the task leads.
4. Way Ahead

All CAT members will provide their new materials to the Stevens team no later than Friday, September 26, 2008. The Stevens team will then build the draft version of GSwERC v0.50. The CAT team leads will meet October 2 at Colorado Tech University to review the latest draft and develop an “endgame” strategy to support Version 0.5 release by October 31. Other CAT members are also welcome to attend the October 2nd meeting. The first round of public review will occur from November 1, 2008 to January 31, 2009.

The next full CAT workshop will occur on January 13-14, 2009 at Embry Riddle University in Daytona Beach, Florida to review comments received on GSwERC v0.50 and to consider lessons learned from those who prepared sample implementations of GSwERC-compliant curricula. The meeting will include adjudication of comments as well as discussion of way ahead to v1.0 and utilization of the industry survey results.
Appendix A: Workshop Participants

Curriculum Author Team

Present
Rick Adcock, Cranfield University and INCOSE Representative
Larry Bernstein, Stevens Institute of Technology
John Brackett, Boston University
Dick Fairley, Colorado tech. University
Thomas Hilburn*, Embry-Riddle Aeronautical University (Body of Knowledge Coordinator)
Phillip Laplante, Penn State University
James McDonald*, Monmouth University (Architecture Coordinator)
Bret Michael, Naval Postgraduate School
Art Pyster*, Stevens Institute of Technology (Objectives and Outcomes Coordinator)
Mary Shaw, Carnegie Mellon University
Richard Thayer, California State University at Sacramento
Richard Turner, Stevens Institute of Technology
Joseph Urban, Texas Tech University
Kahina Lasfer, Stevens Institute of Technology
Nicole Long, ANSER

Joining via WebEx
Dennis Fairley
Barry Boehm, University of Southern California (via telephone)
Pierre Bourque, Quebec University and SWEBOK volunteer (via telephone)
David Klappholz, Stevens Institute of Technology (via telephone)
Devanandham Henry, Stevens Institute of Technology (via telephone)

NPS Faculty

Mantak Shing, Dept. of Computer Science
Jim Kays, Dept. of Systems Engineering and former Dean of Engineering
Luqi, Dept. of Computer Science
Richard Riehle, Dept. of Computer Science
Paul Shebalin, Dept. of Systems Engineering
Cliff Whitcomb, Dept. of Systems Engineering
Appendix B: Workshop Agenda

Day 1: July 29th, 2008

8:30a Introductions and current status of iSSEc project & GSwERC 0.5 - Art Pyster
9:30a Discussions on Guidance, Entrance Expectations, Outcomes & Objectives sections - Art Pyster
10:30a Discussions on Architecture section – Jim McDonald
11:15a Discussions on Core BOK section – Tom Hilburn
1:00p Continue discussions on BOK and other existing sections
2:15p Discussions on Course (sample) Implementation sections
3:15p Discussions on other new sections to be added in GSwERC 0.5
5:00p Adjourn for the day

Day 2: July 30th, 2008

8:00a Recap of previous day’s discussions
8:15a Review outline of GSwERC 0.5
9:00a Discuss schedule and responsibilities for preparation and release of GSwERC 0.5
10:00a Discuss GSwERC related publications and participation in upcoming conferences
## Appendix C: Critical Task List for GSwERC v0.50

<table>
<thead>
<tr>
<th>Action Item/Task</th>
<th>Task Lead</th>
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<tbody>
<tr>
<td>Completion of Near-Final Draft of Guidance &amp; Outcomes</td>
<td>Art Pyster</td>
</tr>
<tr>
<td>Completion of Near-Final Draft of Entrance Requirements</td>
<td>Art Pyster</td>
</tr>
<tr>
<td>Completion of Near-Final Draft of Architecture</td>
<td>Jim McDonald</td>
</tr>
<tr>
<td>Completion of Near-Final Draft of Core Body of Knowledge</td>
<td>Tom Hilburn</td>
</tr>
<tr>
<td>Comparison of Current Program to GSwERC v0.50: Stevens</td>
<td>Larry Bernstein</td>
</tr>
<tr>
<td>Comparison of Current Program to GSwERC v0.50: Embry Riddle</td>
<td>Tom Hilburn</td>
</tr>
<tr>
<td>Sample Implementation of GSwERC Compliant Curriculum: Stevens</td>
<td>Larry Bernstein</td>
</tr>
<tr>
<td>Sample Implementation of GSwERC Compliant Curriculum: Embry Riddle</td>
<td>Tom Hilburn</td>
</tr>
</tbody>
</table>
Appendix D: Updated Table of Contents for GSwERC v0.50

i. Preface
ii. Acknowledgements
iii. Executive Summary

I. Introduction
II. Guidance for the Construction and Maintenance of GSwERC
III. Expected Outcomes When a Student Graduates
IV. Expected Student Background When Entering
V. Curriculum Architecture
VI. Core Body of Knowledge
VII. GSwERC-Compliant Implementations
VIII. Comparison of 4 to 6 Current Programs to GSwERC
IX. Implementation Considerations
X. Anticipated GSwERC Evolution
XI. Next Steps to Develop GSwERC Version 1.0

References
Glossary

Appendix A. Summary of Current Graduate Software Engineering Programs
Appendix B. Bloom Levels for the Body of Knowledge
Appendix C. Traceability from Outcomes to Core Body of Knowledge

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Workshop Objectives

• **Objectives:**
  • To discuss the progress of work towards preparation of GSwERC 0.5
  • To discuss preparation of remaining sections of GSwERC 0.5
  • To discuss release and review of GSwERC 0.5
  • To discuss GSwERC related publications and conference participation
  • To discuss industry survey objectives

• **Format:**
  • All sessions will be in plenary format.
  • Teleconferencing is available for plenary sessions via WebEx
  • Continental breakfast and lunch will be served both days. Dinner is planned for Tuesday July 29th, 2008. All are invited.
## Workshop Agenda

### Day 1: July 29th, 2008

<table>
<thead>
<tr>
<th>Time</th>
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<tr>
<td>8:00a</td>
<td><strong>Continental breakfast</strong></td>
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<tr>
<td>10:15a</td>
<td><strong>Break</strong></td>
</tr>
<tr>
<td>10:30a</td>
<td>Discussions on Architecture section – Jim Mc Donald</td>
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<tr>
<td>11:15a</td>
<td>Discussions on Core BOK section – Tom Hilburn</td>
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<tr>
<td>12:15p</td>
<td><strong>Lunch</strong></td>
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<tr>
<td>1:00p</td>
<td>Continue discussions on BOK and other existing sections</td>
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<td>2:15p</td>
<td>Discussions on Course (sample) Implementation sections</td>
</tr>
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<td>3:00p</td>
<td><strong>Break</strong></td>
</tr>
<tr>
<td>3:15p</td>
<td>Discussions on other new sections to be added in GSwERC 0.5</td>
</tr>
<tr>
<td>5:00p</td>
<td><strong>Adjourn for the day</strong></td>
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<tr>
<td>5:30p</td>
<td><strong>Dinner</strong></td>
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### Day 2: July 30th, 2008

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<tr>
<td>10:00a</td>
<td>Discuss GSwERC related publications and participation in upcoming conferences</td>
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<tr>
<td>12:00p</td>
<td><strong>Lunch with NPS Systems and Software Engineering faculty</strong></td>
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<tr>
<td>1:00p</td>
<td><em>For those who are able to attend, there will be a tour of NPS facilities</em></td>
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GSwERC Author Team

- Rick Adcock, Cranfield University and INCOSE
- Edward Alef, General Motors
- Bruce Amato, Department of Defense
- Mark Ardis, Rochester Institute of Technology
- Larry Bernstein, Stevens Institute of Technology
- Barry Boehm, University of Southern California
- Pierre Bourque, Quebec University and SWEBOK volunteer
- John Brackett, Boston University
- Murray Cantor, IBM
- Lillian Cassel, Villanova and ACM volunteer
- Robert Edson, ANSER
- Dennis Frailey, Raytheon & Southern Methodist University
- Dick Fairley, Colorado tech. University
- Garry Hafen, Lockheed Martin
- Thomas Hilburn, Embry-Riddle Aeronautical University
- Greg Hislop, Drexel University and IEEE volunteer
- David Klappholz, Stevens Institute of Technology
- Philippe Kruchten, University of British Columbia
- Phillip Laplante, Penn State University
- James McDonald, Monmouth University
- Ernest McDuffie, National Coordination Office for NITRD
- Bret Michael, Naval Postgraduate School
- William Milam, Ford
- Fernando Naveda, RIT and IEEE volunteer
- Ken Nidiffer, SEI
- Art Pyster, Stevens Institute of Technology
- Doug Schmidt, Vanderbilt
- Mary Shaw, Carnegie Mellon University
- Ann E Sobel, Miami university and IEEE volunteer
- Robert Suritis, IBM
- Richard Thayer, California State University at Sacramento
- Barrie Thompson, Sunderland University, UK
- Richard Turner, Stevens Institute of Technology
- Joseph Urban, National Science Foundation observer
- Ricardo Valerdi, MIT & INCOSE
- David Weiss, Avaya

Where We Are Today

Understand the current state of SWE graduate education (November 30, 2007)

Create GSwERC 0.25 with a small team, suitable for limited review (February 2008)

Publicize effort through conferences, papers, website, etc. (continuous)

Obtain endorsement from ACM, IEEE, INCOSE, NDIA, and other professional organizations (continuous)

Create GSwERC 0.50 suitable for broad community review and early adoption (September 30 – but we are a little behind schedule – have to press to keep schedule)

Conduct industry/government survey of SwE needs and their alignment with GSwERC outcomes (Fall 2008)

Create GSwERC 1.0 suitable for broad adoption (2009)
Publicity

- CSEET (April 2008) – paper on survey presented
- ASEE (June 2008) – paper on GSwERC
- APCOSE (September 2008) – paper on GSwERC
- IEEE Software on survey (accepted) – publication date tbd
- CSEET (February 2009) – adoption workshop led by Jim McDonald to be proposed
- SIGCSE (March 2009) – adoption workshop co-sponsored by Boots Cassel to be proposed
- Journal paper on GSwERC (2009) – co-authored by team leads
- European adoption workshop (2009)

Endorsements

- DoD Sponsorship – May 2007
- NDIA Systems Engineering Division endorsement – June 2007
- INCOSE endorsement – October 2007
- ACM Education Board – Boots Cassel exploring official participation
Industry Survey Objectives

• To identify the most common roles and responsibilities that a current or new employee is assigned after earning a master’s degree in software engineer, and how earning a master’s degree affects a current employee’s career path.

• To understand how well GSwERC outcomes match industry needs

• To understand how well new hires and current employees who have just earned a master’s degree in software engineering satisfy those needed outcomes

• To identify how industry supports their employees in obtaining a master’s degree in software engineering (such as time off to attend class or tuition reimbursement)

Industry Survey Participants

• Fortune 1000 companies in variety of industry segments that employ software engineers

• U.S. government agencies

• Need help reaching into top companies

• Need at least 25 organizations. Would like to get 35 organizations.
Industry Survey Schedule

- Develop survey instrument during August
- Data collection during September, October, and first half of November
- Data analysis and write up during second half of November and December
- Complete survey by December 31, 2008

GSwERC v0.5 Outline

- Preface
- Acknowledgements
- Executive Summary (easy - Stevens)
- Introduction
- Guidance for The Construction and Maintenance of GSwERC
- Expected Outcomes When A Student Graduates
- Expected Student Background When Entering
- Curriculum Architecture
- Core Body of Knowledge

Green indicates solid draft is completed
Outline for GSwERC v0.5

- Sample of 2 to 4 GSwERC-Compliant Implementations (hard – selected professors – Course description)
- Comparison of 4 to 6 Current Programs to GSwERC (moderate – selected professors) (including samples Descriptions and details will be in appendix)
- Implementation Considerations (hard – CAT—Support the outcomes)
- Anticipated GSwERC Evolution (easy - Stevens)
- Next Steps to Develop GSwERC Version 1.0 (easy - Stevens)

Outline for GSwERC v0.5

- References (easy - Stevens)
- Glossary (easy - Stevens)
- Appendix A. Summary of Current Graduate Software Engineering Programs
- Appendix B. Bloom Levels for the Body of Knowledge
- Appendix C. Traceability from Outcomes to Core Body of Knowledge (moderate - Stevens)
- Index (easy - Stevens)
## GSwERC v 0.5 Schedule

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GSwERC Architecture

Changes since Version 0.25

Reviewers’ Comments and Changes

• Allen Milewski – There also needs to be a listing of user interface/usability testing – Added as an example in Par. 2 on second page of architecture section.

• Andrew P. Sage – Add more details and process descriptions – Several additional details were added throughout the architecture section.

• Bruce Maximum – At the very least the core SE areas should be listed here (analysis, modeling, design, program management, etc.) – They are now listed in the architecture section.

• Dave Belanger – Articulate the nature of the capstone experience given its important role in the overall experience – Description of the capstone experience in the architecture section was expanded.
Reviewers’ Comments and Changes

• DiomidisSpinellis – Add some analysis and concrete examples – Several more examples were added throughout the architecture section.

• HasanSayani – Flexible structure and must include an in-depth study of ethical, professional and legal issues. Also, all programs should contain a significant capstone project with clear ties to the “real world.” – Flexibility of the architecture and discussion of the capstone in the architecture section have been expanded. The depth of study in EPL is specified in the BOK section.

• HasanSayani – New concepts can be introduced into a curriculum by having one or two “special topics” courses = Wording in the architecture section has been changed to explicitly mention special topics courses.

• Jim McDonald – Figure 2 contained some inconsistencies with the text – Figure two was changed to eliminate the inconsistencies.
Report on Work of Body of Knowledge Team

*integrated Software and Systems Engineering curriculum (iSSEc) Project*

GSwERC Workshop
July 29-30, 2008

The BOK Team

- Rick Adcock, Mark Ardis, Pierre Bourque
- John Brackett, Lillian Cassel, Dick Fairley
- Tom Hilburn, Greg Hislop
- Dave Klappholz, Philippe Kruchten
- Bret Michael, Bill Milam, Dick Thayer
- Barrie Thompson, Rich Turner,
- Ricardo Valerdi
Introduction

- The GSwERC BOK is designated as a “Core” BOK (CBOK).
  - CBOK assumes GSwERC core material can be covered in approximately 15 credit hours, about 200 contact hours (North American academic model) - a little less than 50% of a GSwERC program.
- The primary source and foundation organizational structure for the CBOK is the SWEBOK
  - Knowledge elements were added from SE2004 and INCOSE BOK.
  - Also, elements were added based on BOK team ideas/discussions and from 0.25 review comments.

0.25 BOK Review Comments

- Insufficient emphasis on Systems Engineering (SE)
- Questions about Bloom’s Level ratings
- Recommendations about adding new knowledge elements
Changes to the CBOK (1)

- Added a Bloom’s Taxonomy Appendix
  - Explains and illustrates Bloom’s Taxonomy
  - Describes process and rationale for Bloom’s ratings.
- Added the following knowledge elements:
  - unit on Human Computer Interface design
  - unit on Engineering Economics
  - unit on Risk Management
  - unit on V&V under the Software Quality KA (with other changes to the KA)

Changes to the CBOK (2)

- Added more detail on Ethics/Professional Conduct
- Increased the emphasis on Systems Engineering
  - Added text to explain the role of SE in the CBOK.
  - Added more detail to the description of the SE knowledge area.
  - Marked areas where SE issues can be introduced.
  - Changes in the names and the unit/topic organization in three knowledge areas: “Software Requirements” to “Requirements Engineering”, “Software Testing” to “Testing” and “Software Configuration Management” to “Configuration Management”.

Remaining Issues

• Reorganization of CBOK
  – Create a knowledge area (KA) titled “Supporting Processes” that includes configuration management, verification and validation, quality assurance, reviews and audits, and software documentation process. This proposal also included recommended changes in the Software Engineering Management area involving units on organizing, staffing and directing a software project.
  – Create a knowledge area titled “Verification and Validation” that subsumes the Software Testing knowledge area and includes units from the Software Quality area.

• Recommendations for adding other KAs or other cross cutting topics, such as Software Security, Value-Based SwE/SE, and Team Skills and Communication.

• Concerns about the % assigned to the various KAs.