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SYSTEMS ENGINEERING
Research Center

Research on Building Education & Workforce Capacity in Systems Engineering

Interim Technical Report SERC-2010-TR-008-1

August 2, 2010

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ABSTRACT

The critical challenge addressed by this research task is the development of systems engineering (SE) talent for future DoD and related industry workforce needs. A 45% growth is expected in SE jobs in the next decade¹; numerous studies have highlighted the shortfalls in both the number and capability of the SE workforce. New academic and career pathways are urgently needed to build the talent base required by DoD and associated industries. Operating through the Department of Defense Research and Engineering (DDR&E) STEM Development Office and the Systems Engineering Research Center (SERC), DoD is sponsoring a research effort aimed at building education and workforce capacity in systems engineering. This research will analyze the outcomes on student learning of and career interest in SE and DoD careers through analysis of a series of systems engineering pilot capstone courses. These courses are being offered in a variety of contexts at eight universities and separately, through six service academies. Products of this research will include: SE curriculum and assessments; compilation and analysis of the methodologies and approaches to SE course delivery; and recommendations of effective practices for scaling up the program to larger numbers of institutions nationwide.

¹ Rosato, D., Braverman, B., & Jeffries, A. (2009, November). The 50 best jobs in America. *Money*, 88-96.
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1 SUMMARY

This research effort was catalyzed by the Department of Defense's challenge to increase workforce capacity and career interest in systems engineering (SE), with particular focus on increasing awareness and interest among undergraduate and graduate students of relevant, engaging, DoD problems and careers pathways. The objective of the research is to explore, analyze, and make recommendations based on a variety of approaches to increase undergraduate and graduate learning and career interest in SE and related DoD careers. Funding for this project is provided by the Department of Defense Research and Engineering (DDR&E) STEM Development Office.

The project has three phases:

Phase 1/Startup (March 1, 2010-May 15, 2010) provided program requirements and subcontracts to enable partner universities to develop materials and conduct program implementation in the Fall 2010 academic semester. Pilot programs are one or two semesters long. Phase 1 had three key activities:

1. Develop Requirements and Specifications for Capstone Team Projects
2. Develop Draft Capstone Team Project Specifications Document
3. Select up to 10 Capstone Teams, eight from SERC university partners and two team members (AFIT and NPS) implementing Capstone Projects and coordinating activities among service academies.

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Phase 2/Pilot Implementation (May 15, 2010-June 30, 2011): Capstone Team Members develop course materials and assessment instruments; deliver the courses and administer assessments; and submit two interim reports and a final report that assesses the extent to which the learning goals were met. Phase 2(a) included planning and course development; development of assessment frameworks and instruments; and coordination with DoD on the assignment of advisors to Capstone Project teams; Phase 2(b) includes the delivery of courses and assessments.

Phase 3/Analysis, Recommendations & Dissemination (July 1, 2011 – September 30, 2011):

Phase 3 will analyze the results from all Capstone Team Members and integrate them into a single set of observations to the sponsor about the effectiveness of the pilot programs, analysis of pre-/post learning of SE content, skills, and career interest, and the degree to which learning outcomes were achieved. It will also create specific recommendations on how to scale-up the pilot program to be conducted across the U.S

Following the development and release of a request for proposals (RFP), developed in consultation with the DDR&E STEM Development Office, the following 11 SERC institutions submitted proposals for RT-19. A comprehensive review by an independent panel according to a rubric (See Appendix A) led to the recommendation for funding eight of the institutions listed below, listed in bold:

- **Auburn University**
- **Missouri University of Science and Technology**
- **Pennsylvania State University**
- Purdue University
- **Southern Methodist University**

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- **Stevens Institute of Technology**
- University of Alabama
- **University of Maryland**
- University of Southern California
- **University of Virginia**
- **Wayne State University**

In addition, six service academies/institutions received separate funding to conduct SE Capstone Projects; coordinating institutions are noted with an asterisk:

- Air Force Institute of Technology*
- Air Force Academy
- Coast Guard Academy
- Naval Post Graduate School*
- U.S. Naval Academy
- U.S. Military Academy

This interim report will focus on work completed through July 31, 2010 (end of Phase 2(a)).

2 PROGRESS TO DATE

2.1 Objective of RT-19: Research on Building Education and Workforce Capacity in Systems Engineering

The objective of the research is to explore, analyze, and make recommendations for scale-up based on a variety of approaches to increase undergraduate and graduate learning and career interest in SE and related DoD careers. Detailed monthly reports have delineated progress toward key benchmarks. Major milestones are listed below:

Phase 1/Startup (March 1, 2010-May 15, 2010)

- a. RT-19 Invitation to SERC Partners was completed, disseminated, and shared with SERC institutions via a webex technical assistance session. Invitation included project requirements and specifications, including the selection of one of five DoD problems, the participation of a DoD mentor/client, and the development by student teams of a real product or artifact. This invitation included as Appendix B.
- b. RT-19 proposal scoring rubric finalized; external review panel recruited.
- c. Technical assistance session detailing review process, deadlines, and scoring rubric held for independent review panel, recorded and posted on project website on Sakai.
- d. 11 SERC member institutions submitted proposals.
- e. A password access Sakai site was created to house proposals, review rubrics, recorded technical assistance webex and other key project artifacts.
- f. 8 proposals recommended for funding. These institutions and the principal investigators appear as Table 1.

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Table 1.

No	Partner Institution	Principal Investigator
1	Auburn University	David Umphress, PhD
2	Missouri University of Science and Technology	Cihan Dagli, PhD
3	Pennsylvania State University	James Nemes, PhD
4	Southern Methodist University	Liguo Huang, PhD
5	Stevens Institute of Technology	Keith Sheppard, PhD
6	University of Maryland	John Baras, PhD
7	University of Virginia	William Sherer, PhD
8	Wayne State University	Walter Bryzik, PhD

Note: Air Force Institute of Technology (AFIT) and Naval Postgraduate School (NPS) will coordinate the work of the service academies in the implementation of the Capstone Project.

g. Submitting principal investigators were notified of the status of the funding recommendations (recommended for funding or not recommended for funding). Those recommended for funding received reviewer comments to strengthen their proposals, while those not recommended for funding received a summary of reviewer comments (see Appendix C).

h. Sakai site and access was established for DOD/AFIT/NPS

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- i. Coordination was begun between DOD representative (B. McGahern) and Capstone team PIs to connect DOD clients with Capstone project teams.
- j. May 26 SERC Monthly Collaborator WebEx meeting updated progress of RT-19
- k. PIs of proposals recommended for funding were notified that an interim report will be due on 7/15/2010, which is to include an updated workplan and timeline that incorporates recommendations from the review panel and an update on development and implementation status as of that date.

Phase 2 (a) May 15 – July 31, 2010:

The following activities have been completed or are in progress in Phase 2(a):

- a. Each Capstone Team Member submitted an updated work-plan and timeline that incorporates recommendations from the review panel (completed). A summary of the curriculum development, course revisions, and course implementation timeline from each Capstone partner appear as Appendix D.
- b. Each Capstone Team Member will submit a comprehensive interim report of implementation status (completed). Interim reports from each partner institution contain detailed information of project revisions and progress. These reports are available for review in Sakai at the following link: <https://gateway.stevens.edu/portal>.
- c. The PI/Research Team will compile and submit a project report comprised of updated work-plan/timeline and interim reports from each Capstone Team Member (completed).

- d. Development of evaluation framework and common assessments for use by all Capstone Projects (in progress). Section 3 details the evaluation and assessment work in progress, and Appendix F contains the evaluation framework and draft evaluation instruments.
- e. Development of public web site template (in progress). Section 3.2 contains a draft web site template, subject to sponsor input and approval.
- f. Coordination with AFIT and NPS on service academies' implementation of SE Capstone projects (in progress).
- g. Review of Institutional Review Board needs and status for all Capstone Team partners (in progress).

3 EVALUATION FRAMEWORK AND ASSESSMENTS

3.1 Evaluation Framework

The evaluation process of the SE Capstone project is designed to understand the approaches, relationships, methodologies, and curricular materials that lead to increased student learning of and career interest in systems engineering, with particular emphasis on DoD problems and careers. To this end, data will be collected from students, from faculty, and from DoD advisors to inform the research team. Among these data are:

- Reports from faculty of each participating institutions
- Surveys of participating students, faculty, and DoD advisors

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- Ongoing blogs contributed by participating students during the conduct of the courses
- Pre- and post-assessments of student interest in SE, understanding of SE, and ability to use SE concepts and approaches
- SE case study analysis

In addition to these project-wide evaluation instruments, each Capstone Project will administer and report on outcomes from its own customized student assessment instruments.

3.1.1 Common Student Assessments

The research team will administer project-wide assessments to all students, using the following instruments:

Pre/post survey: To be administered at the beginning and at the end of capstone coursework. This survey will be used to assess students' baseline understanding and changes as a result of participating in a capstone course. It will include questions that allow the students to demonstrate that they:

- Understand what systems engineering is
- Understand what systems engineers do
- Understand the qualities and skills that systems engineers bring to projects
- Are considering a career in systems engineering

The specific questions pertaining to this survey are still under review. The most up-to- date version can be found at the following link:

<http://www.surveymonkey.com/s/serc01>

Students Blogs (Weblogs): Each student in a capstone course will be required to post weekly to a blog, addressing the following questions:

- What did you and your group accomplish this week?
- Which systems engineering competencies best align with what you did this week? [See Appendix B, pp. 26]
- What specifically did you do in terms of each of the competencies you checked?

Use of weekly student blogs is to gauge the extent to which students have:

- Developed and practiced systems engineering competencies

At the end of the capstone course students will be required to post to a final blog, addressing the following questions:

- What were the most important system level tradeoffs you had to consider during this project?
- If you were to start this project over again what would you do differently?

The final blog post seeks to elucidate student mastery of:

- Understanding what systems engineers do
- Understanding how systems engineers think (analytical skills)

Blog posts will be accessible to DoD mentors and experts, as well as to the research team. DoD mentors and experts may use the blogs as one method of communicating with the Capstone Teams.

SE Case Study: Students will read a brief case study of the Bradley Fighting Vehicle, supplemented with 15 minutes of video from the feature film *The Pentagon Wars*, available on YouTube, after which, they will respond to the following prompt:

- How might a systems engineer have approached the development of the Bradley Fighting Vehicle?

Students will complete the SE Case Study as both as a pre/post assessment, before and after the course. The objective of the case study analysis is to understand students' baseline understanding of what systems engineers do and how systems engineers think (analytical skills) and to see the changes in understanding that have occurred as a result of the course.

3.1.2 Faculty Assessment

In addition to the information faculty provide in their project reports, the research team will administer surveys to all faculty teaching Capstone Courses. These surveys will ask the faculty about the effectiveness of the course sequence and of the capstone project experience and will be used for a comparative analysis. These specific evaluation instruments are being developed.

3.1.3 Department of Defense Advisor Surveys

DoD advisors will be asked to keep a monthly blog in which they respond to the following prompt:

- In your view, how are the students that you are advising progressing? What difficulties are they facing?

They will also be asked to respond to a survey at the end of the project that will ask them to evaluate the success of their role and to offer suggestions for improving it. This survey is also being developed.

4 ONLINE RESOURCES

Figure 1

The screenshot displays the Systems Engineering Research Center website. The header includes the logo and name of the center, a navigation menu with links like 'My Workspace', 'AFIT', 'Auburn University', 'Missouri University', and 'NPS', and a 'Logout' link. The main content area shows 'Site Info' for 'Auburn University' with various management options and a list of site items.

Property	Value
Site Contact and email	Doris Schultz, dschultz@stevens.edu
Available to	Site participants only
Display in public site list (share public files / announcements / syllabus)	no
Creation Date	Jul 27, 2010 2:16 pm
Site Description	The critical challenge addressed by this research task is the development of systems engineering (SE) talent for future DoD and related industry workforce needs. PI: Elisabeth McGrath, Stevens Government Project Lead: Laura Adolphie, Don Gelosh
Auburn University Participant List (# 2)	

Viewing 1 - 2 of 2 Items
 |< < show 200 items per page > >|

4.1 Online Collaboration Tools

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Online collaboration and document sharing among the research team, the sponsor contacts, the service academy coordinators, and, ultimately, among PI and Capstone Teams is being implemented using Sakai, a free, open source, educational software platform.

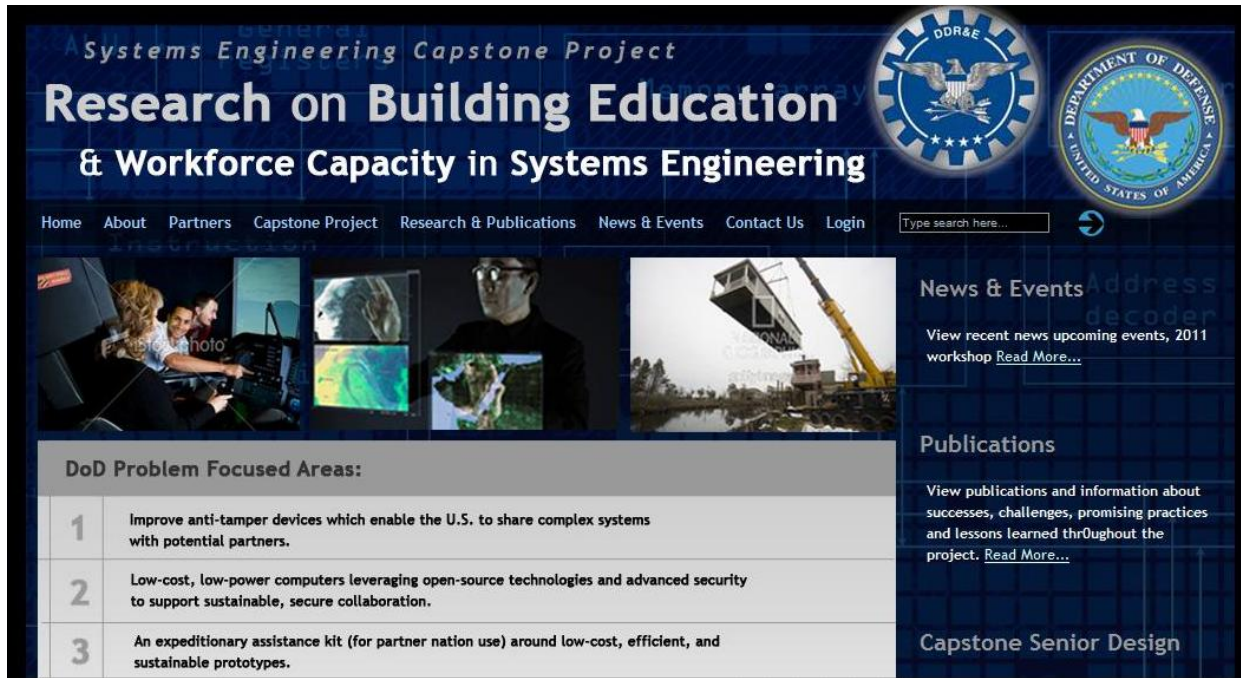
The Sakai software includes features such as document distribution, discussion forums, assignment uploads, live chat, wikis, blogs, etc. An assessment of PIs' desired functionality for this online learning tool is currently in progress in order to build out these resources.

4.2 RT-19 Public Website

A public website containing general information about the project for other stakeholder groups, including the SE education community, other federal agencies, and other organizations, is being developed. Login access into Sakai from this public website will be enabled specifically for RT-19 participants. The current draft web site template can be found at:

<http://www.stevens.edu/provost/test/home.html>. This site is pending feedback from the sponsor regarding graphical appearance and online content.

Figure 2. Website Home Page-partial view



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Appendices

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Appendix A: Review Panel Rubric

Research on Building Education & Workforce Capacity in Systems Engineering

REVIEWER GUIDELINES

Use a 1-5 rating for each question, with 5 being the highest rating and 1 the lowest. Please include written comments, as warranted, to highlight aspects of the proposal pertaining to each question.

Systems engineering

1. How well does this proposal address and plan for student learning of critical SE competencies? Consider each competency in terms of its importance to SE education and practice and the depth to which it has been addressed.

1 2 3 4 5

Comments:

2. Is the project well-planned and executable (e.g., planning, implementation, coordination, recruitment, development of course materials, reasonable timeline)?

1 2 3 4 5

Comments:

3. Overall, how would you rate this proposal in terms of innovating over prior programs or practices at this institution?

1 2 3 4 5

Comments:

4. To what extent does the proposal ensure that students will develop real products that demonstrate SE learning?

1 2 3 4 5

Comments:

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Student learning

5. To what extent are specific teaching and learning goals/objectives listed and clearly articulated?

1 2 3 4 5

Comments:

6. To what extent does the proposal identify specific methods of *assessing student learning*? For example, are specific instruments listed? Are plans for developing assessments discussed? Is there sufficient evidence that student learning can be effectively measured?

1 2 3 4 5

Comments:

7. To what extent does the proposal describe the PI/team's plans to *evaluate the course* and its components, including course materials, assessments, delivery of course, and other aspects of the course, such as recruitment, coordination among departments, etc.?

1 2 3 4 5

Comments:

8. How likely is this project to increase student awareness of SE career opportunities, and/or of the practice and role of SE in the workplace?

1 2 3 4 5

Comments:

9. What impact, if any, will this project have on advancing understanding of SE education, including approaches, models, etc.? (Please provide a brief statement, if applicable; otherwise, write n/a or unknown).

Other

10. How well-aligned is the proposal with one of the required DOD problem areas (see Appendix B for list)?

1 2 3 4 5

Comments:

11. To what extent does the team possess the necessary internal expertise and resources to effectively implement the project?

1 2 3 4 5

Comments:

12. To what extent does the team make use of external expertise, such as DoD or industry mentors or clients?

1 2 3 4 5

Comments:

13. To what extent does the proposal present a strong plan for continuing, sustaining, and institutionalizing the course after this funding cycle?

1 2 3 4 5

Comments:

14. Does the proposal include any plan for dissemination?

YES NO

15. Is the budget reasonable, well-justified, and clearly aligned with project activities?

1 2 3 4 5

Comments:

Recommendation for funding

High

Medium

Low

Areas of strength:

Suggestions for improvement:

Other comments, if applicable:

Initials:

Date:

Appendix B: Invitation to SERC Collaborators

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Appendix C: Review Panel Summaries

University of Maryland

Overall rating: 208 out of 260, with three High recommendations and one Medium recommendation for funding.

The panelists considered this to be a good proposal, with clear goals, a strong team, and good ties with outside experts. There were concerns that there were too many competencies addressed for one course. Therefore, please identify the competencies that are the highest priority that you will measure, and a secondary set of priorities. Please provide additional details explaining how the project will impact graduate level education.

Missouri University of Science and Technology

Overall rating: 208 out of 260, with three High recommendations and one Medium recommendation for funding.

The panelists felt that this was a strong proposal, well thought-out, with clearly articulated goals and a detailed evaluation plan. The panelists noted several concerns that should be addressed in the updated work-plan and timeline. Provide assurances that the budget includes the funds needed to purchase the necessary materials. Also, please provide a description of how the course will be institutionalized, given the very specific nature of the deliverables

Stevens Institute of Technology

Overall rating: 204 out of 260, with two High recommendations and two Medium recommendations for funding.

The panelists felt that this proposal's strengths were its focus on a small number of competencies and its evaluation plan. Some parts of the proposal lacked specifics, and that therefore it was difficult to be sure that this would be a replicable model.

There were concerns that no DoD subject matter experts were named, that the role of the workshops was unclear. Please provide additional details about these concerns as well as the plans for the monthly, “all hands” workshops.

University of Virginia

Overall rating: 204 out of 260, with two High recommendations and two Medium recommendations for funding.

The panelists felt that this proposal was strong in that it focused on expanding SE to non-systems engineering students. There were concerns that too many competencies were addressed. The panelists were also unclear whether a course, a project within a course or seminar was being offered. Please provide a more detailed explanation of the plan for the course or seminar that will be conducted and of how the course will be institutionalized.

Pennsylvania State University

Overall rating: 202 out of 260, with three High recommendations and one Medium recommendation for funding.

The panelists felt this was a strong proposal because of its interdisciplinary aspects. The panelists were concerned that too many competencies were addressed for a one semester course. Some reviewers were concerned that one course would not be enough to introduce students to SE and fabricate a prototype as well. Please provide a more detailed description for how SE will be addressed and the level to which it will be addressed within the one-semester course, and/or a justification for conducting this effort as a one-semester course. Address reviewers’ concerns that the SE competencies along with a prototype can be developed in the context of a one-semester course.

Southern Methodist University

Overall rating: 201 out of 260, with two High recommendations and two Medium recommendations for funding.

The panelists considered this proposal strong because of the client and the access to the Skunk Works IDE that requires students to participate in client and risk driven, real world challenges. Reviewers expressed concerns that it may not be possible to address in depth all the SE competencies listed. Therefore, please identify the competencies that are the highest priority that you will measure, and a secondary set of priorities. Please provide a more detailed explanation about the need for capital equipment, non-capital equipment and foreign travel.

Auburn University

Overall rating: 200 out of 260, with two High recommendations and two Medium recommendations for funding.

The panelists felt this was a good proposal. Areas of strength noted by the panelists included the bridging of two departments, the strong team and the involvement of the Biggio Center.

The panelists noted several concerns that should be addressed in the updated workplan and timeline. The proposed course addresses many competencies. PI is requested to specify the most critical competencies and the degree to which they will be addressed. Plans for student recruitment and institutionalization need to be described in greater detail.

Wayne State University

Overall rating: 198 out of 260, with two High recommendations and two Medium recommendations for funding.

The panelists liked the idea of introducing modules into various courses, which they felt was a different and feasible approach to expanding SE concepts, and the focus on a limited number of SE competencies. There were suggestions that the dissemination plan needs strengthening and that it was not clear how the external experts would contribute to the course modules. Please address these concerns in your project plans and provide a response.

Purdue University (not recommended for funding)

Overall rating: 174 out of 260, with no High recommendations and 4 Medium recommendations for funding.

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The panelists felt that this proposal did not clearly articulate the teaching and learning objectives for the course and that too many competencies were addressed. The proposal is a moderate improvement of a previous existing course but it doesn't constitute an important innovative approach to teach Systems Engineering. It includes a strong research team and shows potential in the initial phase of definition of requirements; however, it doesn't clearly address the development of real products by students.

University of Alabama (not recommended for funding)

Overall rating: 162 out of 260, with no High recommendations and 2 Medium recommendations for funding.

From the review panel perspective Systems Engineering learning objectives in this proposal are not clearly established. In other words, although a detailed plan is shown and a strong multidisciplinary team is involved the SE educational content remains vague. The topic is aligned with DOD focus areas; however, traceability to competencies of interest (Appendix A) is not evident at all.

University of Southern California (not recommended for funding)

Overall rating: 162 out of 260, with no High recommendations and 2 Medium recommendations for funding.

The panelists gave this proposal the lowest score. There's no significant innovation over prior programs as already existing courses are used. Although an experienced PI is involved, the proposal itself is weak. There's no evidence of competencies addressed, not even a detailed plan was provided.

Appendix D: Summary of Course Implementation/Revisions

Institution	# students Involved	DoD problem area(s) targeted (numerical code)	*Competencies Addressed (numerical code)	Term of Course
Auburn University	40	1	Primary: 12 Secondary: 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29	Two sequential courses: Fall 2010 Spring 2011
Missouri Science & Technology	30	5	1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29	Two sequential courses: Fall 2010 Spring 2011
Penn State University	25 - 35	2, 3, 4, 5	Primary: 4, 5, 6, 8, 9, 10, 14, 15, 19, 26, 27 Secondary: 2, 16, 18, 22, 24, 25, 29	One Course: Fall 2010
Southern Methodist University	73	5	Primary: 4, 5, 6, 8, 18, 21, 22, 26, 27 Secondary: 2, 7, 9, 10, 13, 14, 17, 19, 25, 29	Fall 2010 Spring 2011
Stevens Institute of Technology	17 - 22	4	Primary: 2, 4, 5, 6, 8, 9, 10, 19, 21, 26 Secondary: 1, 7, 18, 24	Fall 2010 Spring 2011
University of Virginia	18 - 20	3, 5	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 21, 22, 26, 27, 28, 29	Fall 2010 Spring 2011
Institution	# students involved	DoD problem area(s) targeted (numerical code)	*Competencies Addressed (numerical code)	Term of Course
Wayne State University	80 - 100	3	2, 4, 6, 8, 14, 17, 18, 20	Fall 2010 Spring 2011
University of Maryland	46	1, 2	Primary: 4, 5, 6, 24 Secondary: 8, 9, 10, 14	Fall 2010 Spring 2011
Air Force Institute of	3 - 6	2	2, 3, 4, 5, 6, 7, 8, 9, 10	Fall 2010 Spring 2011

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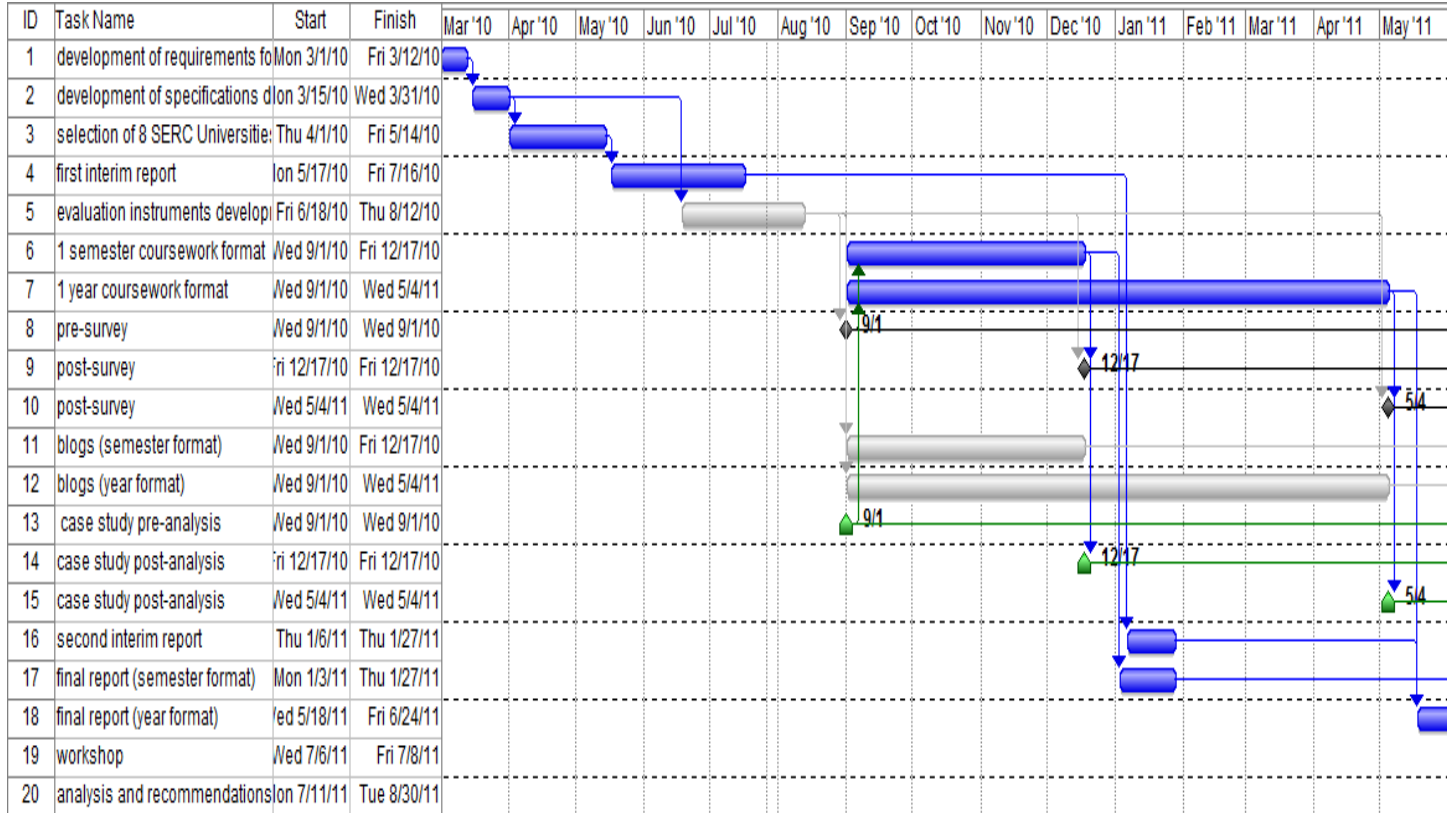
Technology				
US Air Force Academy	6	2, 3	1, 3, 5, 6, 7, 8, 9, 10, 11, 15, 16, 18, 19, 21, 22, 23, 26, 27, 29	Fall 2010 Spring 2011
US Military Academy at West Point	4	5	No information available.	Fall 2010 Spring 2011

*Appendix A, SPRDE-SE/PSE Competency Model

NOTES:

1. All information pertaining to NPS is still pending
2. Over 350 students impacted by this pilot program.
3. The most targeted DoD problem areas are: 2, 3, 5
4. The addressed competencies were revised by corresponding PIs of each partner institution after receiving comments from the panel review.
5. Interim reports of each partner institution contain detailed information of their own pilot programs. These reports are available for review in Sakai at the following link:
<https://gateway.stevens.edu/portal>.

Appendix E: Course Implementation Program Timeline



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Appendix F: Evaluation Framework, Assessments and Data Sources*

*As of July 20, 2010

STUDENTS		
Objectives: At the end of the capstone course, students should:	Possible questions:	Instrument
Understand what systems engineering is	What is systems engineering? Define it as best you can.	Pre/post survey
	In the context of systems engineering, give an example of a system that would be addressed by a systems engineer.	Pre/post survey
Understand what systems engineers do	How might systems engineers differ from disciplinary engineers (mechanical, structural, etc.) working on a multidisciplinary team? Give an example.	Pre/post survey
Understand the qualities and skills that systems engineers bring to projects	List five words that describe the skills and qualities needed by a systems engineer.	Pre/post survey
Consider a career in systems engineering	On a scale of 1 to 5, with 5 being the highest (Not at all to Very much), how interested are you in becoming a systems engineer? [Include Don't know/Not sure]	Pre/post survey
	Post only: On a scale of 1 to 5, with 5 being the highest (Not at all to Very Much), how much did this project make you want to explore systems engineering further?	
Develop and practice the skills of systems engineers	What did you and your group accomplish this week?	Weekly blogs
	Which systems engineering competencies best align with what you did this week? [Choose from list]	Weekly blogs
	What specifically did you do in terms of each of the competencies you checked?	Weekly blogs
Understand what systems engineers do/how systems engineers think (analytic skills)	What were the most important system-level trade-offs you had to consider during this project?	Final blog post
	If you were to start this project over again, what would you do differently?	Final blog post
Understand what systems engineers do/how systems engineers think (analytic skills)	How would a systems engineer have approached the problem described in this scenario? [Pre version has individual response, followed by group discussion, followed by revisit of original post; post-version has one individual response only]	Pre/post scenario

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FACULTY		
Create an effective course sequence	To what extent did the courses you created give students an understanding of what systems engineering is and what systems engineers do?	Survey/interview
	How was SE learning integrated into the capstone sequence? What methods did you use (lecture, etc.) and how did you time when the competencies would be introduced?	Survey/interview
	How do you know? What are/were your criteria for judging this?	Survey/interview
	If this was a two-course sequence, did the first course sufficiently prepare the students for the capstone project?	Survey/interview
Create an effective capstone project experience	On a scale of 1 to 5, with 5 being the highest, how effective was the relationship with the client? Please describe the benefits and the issues (if any).	Survey/interview
	Overall, how well did the students' final projects meet your learning objectives?	Survey/interview
	How did you assess them? What were your criteria?	Survey/interview
	What would you do differently the next time around?	Survey/interview
	How do you plan to institutionalize this sequence?	Survey/interview
DOD ADVISORS		
Effectively consult with one or more groups of students	In your view, how are the students you are advising progressing? What difficulties are they having?	Monthly log
	Overall, did you feel that your advice was useful to the group and that the students took advantage of it?	Survey/interview
	Did you feel that the projects were successful? If so, what was successful about them? If not, why not?	Survey/interview
	How could the role of the DoD Advisor have been better defined or implemented to improve the process in the future?	Survey/interview

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