



# Capstone Marketplace

**By**  
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**6<sup>th</sup> Annual SERC Sponsor Research Review**  
**December 4, 2014**  
**Georgetown University**  
**School of Continuing Studies**  
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**Washington, DC**

**[www.sercuarc.org](http://www.sercuarc.org)**

- History and previous research
- The Capstone Marketplace
- 2013-14 Project & outcomes
- 2014-15 Ongoing projects
- Current research efforts
- Next steps

# Previous Research

- RT 19/19a: Explored SE in capstone design
  - Multi-disciplinary nature enhanced SE learning
  - SE learning enhanced project & student outcomes
  - Project mentors or subject matter experts proved valuable to student & project outcomes
- RT 43: Pilot with 3 Capstone Projects
  - Established a pilot “capstone marketplace”
  - 3 dual institution projects
  - One of which involved 3 disciplines collaborating on a single project with multiple stakeholders

# What is the Capstone Marketplace?

- An online “dating service” matching students working on capstone design to sponsors with challenging problems
- Sponsors provide:
  - A real problem or engineering need
  - Mentor or subject matter expert
  - Some level of funding for prototype development, demonstration, and or travel
- Students provide:
  - An unbiased, unique, and technologically rigorous approach to developing a solution
- Faculty provide:
  - Advising, assessment, oversight and direction of student team

# Why Do We Want a SE Capstone Marketplace?

- Positive impacts for students, industry, government, and academia
  - Introduction of SE thinking & critical processes at the UG level
- Ability to interact with and observe students during a design project
  - Assess potential employees outside of a internship or provisional process
  - Impact what potential employees will learn before they start working
- Students think differently and develop solutions under a different set of risks and rewards leading to new and truly innovative concepts
  - A unique combination of intelligence, process, and technological savvy
  - Understand a problem - seek a solution unencumbered by institutional obligations
- A broad new network across all 4 groups

<http://www.capstonemarketplace.org>



## About the Capstone Marketplace

Our mission is to match multidisciplinary student teams with challenging engineering projects. Project sponsors provide domain expertise and advice, while faculty supervisors help guide the teams and grade their work. The capstone marketplace makes it easier for sponsors to reach out to potential students, and it helps students find projects best matched to their interests and needs.

Previous research has demonstrated that students who worked on multidisciplinary capstone projects had increased interest and learning in basic systems engineering concepts. They also developed a better appreciation of the differences in methods and tools of different engineering disciplines.

## Enhanced Performance



2014-2015

Enhance and monitor human performance

[Learn More](#) ▶

## Novel/innovative communications



2014-2015

Provide novel/innovative communications mechanisms

[Learn More](#) ▶

## Armored Window Improvements



2014-2015

Design an armored window that can be fully opened

[Learn More](#) ▶

## Communications Box

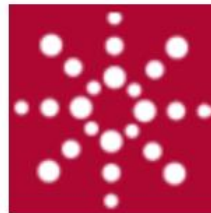


2014-2015

Design a smaller communications junction box

[Learn More](#) ▶

## Stinger Box Improvement



2014-2015

Design a small, rugged communications link

[Learn More](#) ▶

## Water/Pressure-Activated Personal Flotation Device

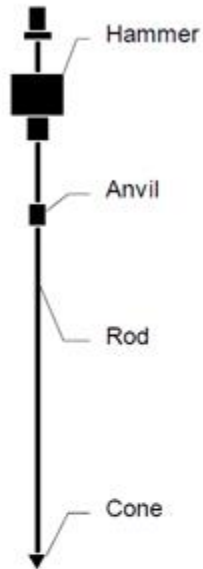


2014-2015

Design water/pressure-activated actuator for an inflatable personal flotation device

[Learn More](#) ▶

## Austere Landing Zone Assessment



### Sponsor

Special Operations Forces (SOF)

### Status

Active: Stevens Institute of Technology

### Summary

Assess a potential landing site under nighttime conditions



## Description

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### Current Capability

- Dynamic Cone Penetrometer (DCP) is the only authorized device to measure weight bearing capacity for landing fixed wing aircraft on austere landing strips.
- Current DCP method for measuring surface weight bearing capability is slow, cumbersome and manpower intensive making potential runway surface measurements difficult to perform in a timely manner in all weather conditions, day or night.

### Issues

- Current system:
  - not reliably operated by 1 person
  - requires min of 25 readings to complete airfield survey (~15 min per reading)
  - is not night readable (Night Vision Goggle capable)
- System computer is not ruggedized and is subject to vibrations from the hammer
- System is noisy for tactical operations

### Desired Research / Capability

- Hyperspectral imagery data is available from a U.S. Navy (Naval Research Laboratory - NRL) sensor installed on the International Space Station (ISS). Research recommendations from the Army Research laboratory will be utilized.
- Research concept is to conduct analysis of ISS sensor hyperspectral imagery data from several (3-5) landing zone areas that have been measured using the DCP method to determine if a California Bearing Ratio (CBR) or equivalent rating type assessment is possible using remote, hyperspectral imaging techniques to a depth of 36 inches below the surface. Research goal is to determine how hyperspectral imagery data might be used to enable a remote sensing capability for future landing zone assessment requirements.

### Capability Needs

- Aircraft operations require airfield surveys to ensure safe operation. US military forces require the ability to quickly and accurately survey and assess a potential aircraft landing site in one period of darkness.
- The improved capability must:
  - Be timely, silent, accurate, not dependent on GPS for high fidelity geo-coordinates, concealable, light-weight, easily transportable by one man or vehicle mountable and capable of remote operation.
  - Produce a product that measures CBR or equivalent rating of soil shear strength for aircraft landing operations.

Student Application ▶

Faculty Application ▶

## Student Application Form

Project Name:

### 1. Information about you

Name:\*

Email Address:\*

School or Organization

Expected Graduation Date:

### 2. Information about the faculty member who will give you a grade for this project at your school

Faculty Member Name:

Faculty Member Email:

Faculty Member Department:

### 3. Information about the project you want to join

Please specify the type of work you want to perform on the project, such as roles you will assume and tasks you will perform:

In one or two sentences, why do you want to work on this project:

Submit

# 2013-14 Capstone Projects

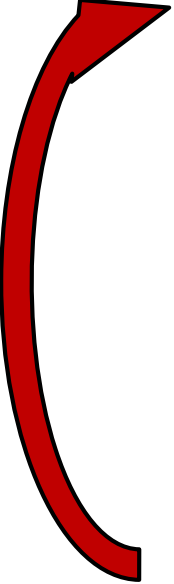
- 6 unique projects from 2 DoD sponsor
- 5 schools (30 students, 6 majors)
  - Smith college (engineering science)
  - Georgia Tech (mechanical & electrical)
  - University of Alabama at Huntsville (mechanical & aerospace)
  - Stevens (mechanical, bio-medical, naval)
  - Johns Hopkins (mechanical)
- 2 student developed solution tested at prototype stage
- 1 provisional patent
- 2 follow on projects

Sponsor request:

Develop a capability to benignly disable a vessel with a length  $\leq 50$  meters and demonstrate efficacy of concept



## Student team's systems engineering methodology:

- Phase 1: Develop clear and concise mission needs, goals, and objectives to focus the project scope
  - Phase 2: Research, Concept Generation, and Concept Elimination
  - Phase 3: System Prototyping and Testing
  - Phase 4: System Verification and Validation
    - Build the right system and build the system right
  - Phase 5: System Optimization
- 

## 1. Final Results :

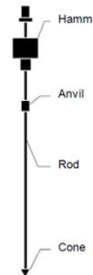
- Given ~\$3,000 budget:
- Developed multiple model-scale prototypes
- Planned, conducted, & documented hundreds of test runs
- Developed proportional and inversely proportional relationships
- Manufactured a full-scale prototype
- Tested at full-scale with 100% success in multiple scenarios and runs

## 2. One (1) satisfied stakeholder

- “The \$10K allotted to SERC for a (Capstone) project could be considered a cost saving to the overarching project in that initial prototype design(s) could commence for that cost.” – Project SME

## 3. Patent-pending status

- 14 projects from 2 DoD sponsors on CM website
- 10 unique projects underway (48 students, 10 majors)
- Georgia Tech: Mobile Situational Awareness System for Soldiers
- University of Alabama at Huntsville
  - Vessel Disablement
  - Armored window improvement
- Stevens
  - Austere Landing Zone Assessment
  - Enhanced Human Performance:
    - Upper & Lower body exoskeletons
    - Fatigue monitoring
  - Vessel Disablement
  - Smart PFD
- North Carolina A&T: Avoiding Information Overload





# Capstone Marketplace Goals

- Establish the Capstone Marketplace as a stand alone resource that enhances SE learning outcomes by enabling capstone students and sponsors to connect and embark on meaningful projects with valuable outcomes
- Move the Marketplace forward
  - Enhance participation:
    - Outreach
    - Develop and make available resources on best practices, SE tools, guidelines, etc to establish the CM as a valuable resource for participants and others
  - Develop a robust & saleable infrastructure to enable transition
  - Begin the process of transitioning out of the SERC

# Moving the Marketplace Forward

- Increasing sponsor and academic participation

- 2015-16 goals

- 20 projects
- 1 additional government sponsor
- 1 non-government sponsor
- at least 5 more schools including 1 international participant
- increased SERC participation



# Moving the Marketplace Forward

- Website upgrades:
  - Develop the website as a robust and scalable face of the CM and a resource for improving SE knowledge and abilities of an emerging workforce
  - Internal communication link
  - The ability for students to self assemble into multi-disciplinary, multi institution teams
  - Pre and post project questionnaires to assess learning outcomes
  - A more robust and manageable database to better enable transition out of the SERC
  - Unique project pages with student and sponsor upload & download capabilities

# Moving the Marketplace Forward

- Begin the process of transitioning the CM out of the SERC
  - Identify and coordinate with a suitable CM administrator
  - identify best practices and implement a plan to enable growth in sponsors and academic participation

- Jason DeMera, Stevens Institute of Technology
- Collaborating Faculty:

<b>Faculty</b>	<b>School</b>
Christina Carmen	UAH
Eirik Hole	Stevens
Vikki Hazelwood	Stevens
Kishore Pochiraju	Stevens
Leslie Brunell	Stevens
Tonya Smith-Jackson	North Carolina A&T
Mick West	Georgia Tech



# Questions

- This is a sample of the template slide for text
- When you click under “new Slide” you will see about 7 pre-formatted versions of slides you can use
  - Test
    - Test
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