# SCOPE Expo 2013

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Welcome from the Director of SCOPE

Franklin W. Olin College of Engineering, established in 1997, is dedicated to producing technological leaders for the future. We recruit outstanding students and faculty and provide the conditions for their best work - an innovative curriculum, modern facilities and a unique learning environment that prizes technical rigor, creativity, risk-taking, communication and teamwork. From day one, our students learn by tackling open-ended engineering problems - the kind that go beyond textbooks and call for creativity and initiative.

SCOPE is the culmination of Olin’s project-based curriculum. Our students undertake an authentic, year-long engineering challenge funded by an external sponsor. SCOPE students bring all the skills they have learned at Olin with outstanding results. When possible, inclusion of Wellesley College students and Babson College MBA candidates add to the diversity of the teams.

We hope you enjoy interacting with our students and find their projects noteworthy.

Andrew Bennett

SCOPE Leadership Team:

Andrew Bennett  Director of SCOPE  Associate Professor of Mechanical Engineering
Alisha Sarang-Sieminski  Assistant Director of SCOPE  Associate Professor of Bioengineering
Ruth Levine  Director of Business Development
Tracy Tully  SCOPE Program Manager
SCOPE Team Sponsor: **AGCO**

“UAVs for Agricultural Survey and Early Treatment”

The AGCO-Olin SCOPE team worked to determine the feasibility of unmanned aerial vehicles (UAVs) for agricultural applications and to create a launching point for further research and development of a commercially marketable agricultural UAV. This included investigating the potential financial benefits of UAVs over current surveying and spraying methods, designing a preliminary system architecture for a UAV for an agricultural application, and putting together a demonstration prototype of an agricultural UAV. Throughout this process, the team documented their methods and identified areas that required further research for the development of a final project.

Faculty Advisor:  Andrew Bennett

Team Members:  David Gaynor  
Geetanjali Gubba  
Geoffrey Pleiss  
Travis St. Onge  
Ilana Walder-Biesanz
SCOPE Team Sponsor: Analogic

“High Capacity Wireless CT Data Link”

Analogic produces custom medical imaging systems for other companies to incorporate into their CT and MRI scanners. The Analogic-Olin SCOPE team worked on the wireless data transfer between the rotating gantry and the stationary frame of a CT scanner.

In the medical imaging field, the more detailed information captured, the better the final image and the better the doctors can see and diagnose. As the number of elements in 2-D CT detector arrays and rotation speed both increase in order to support faster scan times and higher resolution, newer scanners will produce more data at higher rates, and demand a higher throughput on the wireless image data link that the team investigated. The team’s goal was to increase the data transfer rate using the same basic antenna design as in the current system.

Faculty Advisor: Siddhartan Govindasamy

Team Members: Jared Kirschner
Eric Kolker
Philip Loh
Nathaniel Ting
Teodora Vidolova
SCOPE Team Sponsor: **Ariens**

“**Traction Control System for Commercial Lawn Mowers**”

The Ariens-Olin SCOPE team built a research platform to monitor and record the driving behavior and dynamics for the Ariens family of products. The team demonstrated the ability of the research platform by addressing traction control over a variety of terrains. The team also instrumented an Ariens product with sensors to quantify the ability of the product to react to a variety of terrain and operating situations. This data allowed us to model and simulate potential systems, before implementing these controls to create a live demo.

**Faculty Advisor:** Aaron Hoover

**Team Members:**
- Andrew Carmelelle
- Lucas Hill
- Eric Jones
- Casey Landey
- Timothy Raymond
SCOPE Team Sponsor: Army Research Laboratory

“Autonomous Reconfigurable Mobile Robot for Broad Application”

The Army Research Laboratory-Olin SCOPE team designed a robotic base platform that can be used to test ARL’s algorithms and sensors both in the lab and in the field. This development will reduce hardware costs and allow ARL to increase the number of robots in use to support multi-robot collaboration research. The team aims to address ARL’s needs by designing and fabricating a small, durable, practical, and low-cost robot. The team evaluated several design concepts in order to select one to move forward with and begin fabrication. The team used an iterative test-and-redesign process to ultimately produce a ready-to-use robot.

Faculty Advisor: David Barrett

Team Members: Jessica Bethune
Andrew Heine
Robert McMullen
Jessica Noglows
Thomas Pandolfo
Robert Sobecki
“Enhancing the Autodesk 123D Experience for Secondary School Students”

Secondary school students are being taught design, engineering, and CAD in ways that often fail to engage and excite them in meaningful ways. The Autodesk-Olin SCOPE team’s aim was to provide strategies, insights, materials, and workflows that better enable students to learn STEM subjects (science, technology, engineering and math) and beyond by connecting the digital and physical worlds. Through Autodesk's 123D collection of consumer software, Autodesk has a unique ability to spark creativity and excitement throughout the learning process.

To do this, the team created an integrated product and program to engage secondary school students with Autodesk software inside and outside of the classroom. The team worked to incentivize teachers and energize students to explore 3D design and creativity by connecting digital tools and physical building in secondary education.

Faculty Advisor: Amon Millner

Team Members: Matt Belland
Reyner Crosby
Andrea Cuadra
Aiswarya Kolisetty
Tanner Reid
Brittany Strachota
SCOPE Team Sponsor: Boeing

“Improving the Optimization Process of a Boeing 777 Thrust Reverser”

The Boeing-Olin SCOPE team applied Boeing’s structural design and optimization process on example engine thrust reverser components. The team specifically explored the optimization process and identified areas of opportunities for improvement. They chose to focus on improving the learning process of a newly-hired engineer by creating a series of tutorials for the finite element analysis software used in the optimization process. The tutorials are directly tailored for Boeing applications using real aircraft components so that the new engineer can get up to speed as quickly and easily as possible.

Faculty Advisor: Christopher Lee

Team Members: Rachel Biniaz
Caroline Condon
Mariah Dunn
Casey Karst
Jacqueline Rose
SCOPE Team Sponsor: **Boston Scientific**

**“Designing a Tool for Greater Confidence in Lung Biopsies”**

When a patient is at risk for lung cancer, low-dose computed tomography (CT) scans can show physicians whether there is a dense area of tissue, or lesion, in the lungs. If there is, a physician will do a bronchoscopy procedure to determine if the lesion is cancerous - a bronchoscope is passed into the patient’s lungs, a tool at the end of a long catheter is passed through the bronchoscope, a sample is taken to be analyzed later, and the bronchoscope is removed. One primary problem in this procedure is lack of confidence that the physician has taken a sample of the same dense area that showed up on the CT scan.

The Boston Scientific-Olin SCOPE team designed a new tool to address this issue. The team delivered a developed tool concept that takes a sample of tissue and gives physicians confidence that the sample was indeed a part of the lesion.

**Faculty Advisor:** Jessica Townsend

**Team Members:**
- Kelsey Breseman
- Molly Farison
- Michael Heyns
- Jenny Ma
- Sarah Mathew
- Daniel Wilson, Babson MBA
“Automated System Design for Microfluidic Drop Creation”

Microfluidics is rapidly becoming a large field in research, especially for medical applications. Two of its most attractive attributes are the ability to perform high-throughput experiments and the ability to use extremely low volumes of limited samples. Different microfluidics systems can be optimized for either of these properties.

The Fraden Research Group at Brandeis University has created a prototype of a system that manually produces a few drops on demand, using extremely low volumes of rare, expensive samples. However, this system’s current hardware and software setup is not optimized, is expensive and operator-dependent. The Brandeis-Olin SCOPE team worked to automate this process by designing a portable platform for drop-on-demand technology using electrical controllers, pneumatic systems, and image processing algorithms.

Faculty Advisor:        Brian Storey

Team Members:        Victoriea Hamilton
                    Jeffrey Hart
                    Benjamin Smith
                    Lillian Tseng
SCOPE Team Sponsor: DePuy Mitek

“Next Generation ACLR Surgical Tools”

Anterior cruciate ligament (ACL) rupture is one of the most common sports injuries in the United States with over 100,000 cases per year. Even with direct repair after rupture, the ACL is unable to heal itself due to being in an environment which is hostile to healing. In order to return functionality to the knee, ACL reconstruction surgery is performed using grafts such as hamstring tendon, patellar tendon, and allograft tissue grafts. ACLR has a post surgical failure rate of up to 10-15%. The long term effects of different ACLR techniques have not been fully explored or documented. Failure is often associated with anatomical differences, such as the position and tension, between the replacement graft and native ACL. Non-standardized surgical techniques result in inconsistencies between surgeons and surgeries. There is a need for alternatives to existing surgical tools to address these inconsistencies.

The DePuy Mitek-Olin SCOPE team was tasked with designing and developing such alternatives. The goals of this project were to understand the surgical processes of ACL reconstruction, identify areas of opportunity, delineate critical product requirements, and prototype a functional product concept. Using a surgeon-oriented design process, the team built and demonstrated the use of a fully functional prototype of a new surgical tool for ACLR.

Faculty Advisors: Alisha Sarang-Sieminiski
Rebecca Christianson

Team Members: Erica Chin
Aaron Greenberg
Kendall Pletcher
Michael Sullivan
Elizabeth Threlkeld
SCOPE Team Sponsor: Facebook

“Jumpstart the Industry of Physical Devices Connected to Facebook Timeline”

The Facebook-Olin SCOPE team built a platform that catalyzes the growth of an ecosystem around devices that document and share everyday interactions in the physical world. Facebook’s Open Graph allows people to record and share their online activities and interactions to their timeline through third-party apps such as Spotify and social newsreaders like the HuffPost Social Reader. However, the majority of a person’s interactions occur in the physical world, a domain that currently lacks a comprehensive means of seamless social-sharing. The Facebook-Olin SCOPE team imagined, prototyped, and fostered excitement around a compelling hardware device that integrates with Facebook’s Open Graph API (Application Programming Interface). The team then designed a hardware platform that developers and other third-parties were excited to build upon. The final stage of the process involved the release and marketing of this platform in order to inspire and spur interest of hardware applications connected to the Open Graph.

Faculty Advisor: Amon Millner

Team Members: Paul Booth
                 Jialiya Huang
                 Jon McKay
                 Seungwhan Moon
                 Tim Ryan
                 Margaret-Ann Seger
SCOPE Team Sponsor: **Hutchinson/Barry Controls**

“**Developing New Applications for Active Vibration Dampening**”

The Hutchinson/Barry Controls-Olin SCOPE team worked to develop an active vibration control system for hand-held construction equipment. Workers who use this equipment for extended periods of time are in danger of developing hand-arm vibration syndrome, a condition that can result in severe nerve damage. Decreasing construction equipment vibration will not only protect workers’ health but also save companies time, cost, and resources. Every current active vibration control system Barry Controls creates is highly specialized and time-consuming to develop and install.

Barry Controls would like to move toward developing solutions that are more widely applicable, and therefore challenged the SCOPE team to create an active control system that is less specialized and more efficient to implement than previous Barry Controls systems. During the fall semester, the team identified market areas that could benefit from simple active control systems. After deciding to focus on construction equipment, the team devoted the spring semester to designing, prototyping, and testing their active control system on an electric breaker.

Faculty Advisor:       Scott Harris

Team Members:         Kory Kautz  
                       Allen Koh  
                       Tara Krishnan  
                       Heidi Nafis  
                       Rebecca Schutzengel
SCOPE Team Sponsor: **Orica**

“**Borehole Localization and Detection for Mining**”

Orica is a multinational supplier of mining chemicals and services, and is a new sponsor of the SCOPE program this year. The Orica-Olin SCOPE team investigated opportunities for automation of dirty and dangerous tasks associated with the surface mining process.

Faculty Advisor: Brad Minch

Team Members: Samantha Becht  
Thomas Dugger  
Blair Emanuel  
Arjun Iyer  
Luis Rayas
SCOPE Team Sponsor: Parietal Systems

“Location-Based App for iOS Platform”

The Parietal Systems-Olin SCOPE team developed a shared, location-based, to-do list application for iOS which uses Parietal’s Geo Toolkit Platform as a Service. The idea was selected from over 800 location-based app ideas generated through the innovation tournament process. While developing the app, the team evaluated and provided feedback on the toolkit, which provides a database for developers that stores location data associated with specific users.

Faculty Advisor: Allen Downey

Team Members: Rachel Bobbins
Molly Grossman
Mandy Korpusik
Jing Li
Hannah Sarver
SCOPE Team Sponsor: Raytheon

“Efficient Superposition of Communication and Radar Waveforms”

The Raytheon-Olin SCOPE team worked to expand potential applications for multi-function radar arrays by researching methods for superimposing radar and communication waveforms. Current radar application areas often require system designers to co-locate specialized radar and communications antennae, introducing interference and consuming space and power. By transmitting radar and communications signals simultaneously, this work has the potential to enable technologies that consume significantly fewer resources than present-day communication and radar systems.

Transmitting these two types of waveforms through the same device requires amplifying communication signals in a high-distortion regime that compromises signal integrity. The goal of the Raytheon-Olin SCOPE team was to identify pairs of communication and radar waveforms that could be superimposed through a single nonlinear amplifier while still fulfilling primary communications and radar functions. The team investigated candidate performance using hardware experimentation and industry-standard simulation. The results of this study begin to define the conditions for successful simultaneous communications and radar transmission through a single non-linear amplifier.

Faculty Advisor: Siddhartan Govindasamy

Team Members: Anton Frolenkov
Vidie Pong
Sasha Sproch
Amy Whitcombe
In Appreciation

We would like recognize our 2012-2013 SCOPE sponsors. Their support of the SCOPE program represents a significant contribution to the advancement of the College’s mission and the creation of a successful and challenging program for our students.

AGCO

Analogic

Ariens

Army Research Laboratory

Autodesk

Boeing

Boston Scientific

Brandeis University/National Science Foundation

DePuy Mitek

Facebook

Hutchinson/Barry Controls

Orica

Parietal Systems

Raytheon

A special thank you to Aramark for sponsoring today’s campus-wide barbeque lunch.
SCOPE EXPO
Schedule of Events
2013

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<td>Continental Breakfast and Registration</td>
<td>Milas Hall Lobby and Gallery</td>
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<td>9:45 am - 10:00 am</td>
<td>Welcome from Olin Leadership</td>
<td>Milas Hall Auditorium</td>
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<tr>
<td>10:00 am - 11:00 am</td>
<td>Rocket Talks by SCOPE Teams 1-7 (Teams will go in alphabetical order)</td>
<td>Milas Hall Auditorium</td>
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<td>11:00 am - 11:15 am</td>
<td>Break</td>
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<tr>
<td>11:15 am - 12:15 pm</td>
<td>Rocket Talks by SCOPE Teams 8-14 (Teams will go in alphabetical order)</td>
<td>Milas Hall Auditorium</td>
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<td>12:15 pm - 1:30 pm</td>
<td>Barbeque Lunch</td>
<td>Campus Center</td>
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<td>1:30 pm - 3:00 pm</td>
<td>Poster Session</td>
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