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Conference Overview

**Monday, June 6, 2016**

7:00 – 8:30 a.m.  Registration / Continental Breakfast
8:30 – 10:00 a.m.  Opening Session
10:30 a.m. – 12:00 p.m.  Panel & Workshop Session 1
12:15 – 1:45 p.m.  Keynote Lunch
2:00 – 3:30 p.m.  Panel Session 2
4:00 – 5:30 p.m.  Poster Session 1
6:00 p.m.  Workshop Session 2 (with box dinner)
8:00 – 9:30 p.m.  News and Brews

**Tuesday, June 7, 2016**

7:00 – 8:30 a.m.  Registration
7:30 – 12:30 p.m.  Local Tours and Activities
7:00 – 9:00 a.m.  NSF “Office Hours”
9:00 – 10:30 a.m.  Workshop Session 3
10:45 a.m. – 12:15 p.m.  Workshop Session 4
12:30 – 2:00 p.m.  Birds of a Feather Lunch
2:15 – 3:45 p.m.  Panel Session 3
4:00 – 5:30 p.m.  Poster Session 2
6:00 p.m.  Workshop Session 5 (with box dinner)
8:00 – 9:00 p.m.  Dessert Break

**Wednesday, June 8, 2016**

6:30 – 7:30 a.m.  Informal Walk/Run
8:00 – 9:00 a.m.  Registration / Continental Breakfast
9:00 – 10:30 a.m.  Panel Session 4
11:00 a.m. – 12:30 p.m.  Panel Session 5
12:45 – 2:00 p.m.  Closing Lunch and Next Steps
Greetings! On behalf of the entire Capstone Design Conference Organizing Committee we welcome you to Columbus, OH for the 2016 Capstone Design Conference!

We are thrilled to continue the success of the previous capstone conferences and to continue building a community of educators, students, and industry to discuss, analyze, and improve capstone design education. As with the previous capstone conferences, this conference is intentionally designed to promote discussion and interaction across the capstone community. In other words, welcome to a conference at which you will get a chance to confer! As capstone design educators and consumers, we appreciate the importance of understanding our own challenges, the need to look outside our own organization to find new ways to continuously improve, and the value of experiencing failure – occasionally. At the 2016 Capstone Conference, you will find opportunities to share and learn about all of these!

In contrast to the traditional podium presentation format, this conference instead features two conference-wide poster sessions (including both posters about capstone design and posters by capstone design teams) to encourage vibrant and extensive sharing of ideas and experiences. Based on themes that emerged from our planning session at the 2015 ASEE conference, and from the selection of 2016 Capstone Conference accepted papers and posters, we have created a series of interactive panel discussion topics related to capstone design. In addition, a range of workshops will provide attendees hands-on opportunities to learn new skills and strategies to improve their own capstone design programs. Finally, look for a series of quests designed to help you network with other attendees, learn a little bit about our host institution, The Ohio State University, and get the most out of the conference.

The 2016 conference continues the tradition of student involvement, reflecting students’ key role in capstone design. Keep an eye out for featured capstone student projects in the poster session as well as invited student participation in many of the panel sessions. We are grateful to the contributions of our many conference sponsors, exhibitors, and advertisers who support the conference and help us keep our conference fees as low as possible.

So, again, welcome! Please take the opportunity to immerse yourself in this conference; expand your capstone network, exchange ideas, and empower your involvement with capstone design courses. We thank you for attending the 2016 conference – we welcome feedback on conference effectiveness and encourage you to spread the word. We look forward to collaborating with you now and in the future!

– Renee Rogge and Beth DeBartolo, co-chairs
Organizing Committee

Renee Rogge, co-chair
Beth DeBartolo, co-chair
Steve Beyerlein, Workshops
Patsy Brackin, Panels
Jay Goldberg, Industry Involvement
Robert Hart, Papers
Amy Hortop, Student Involvement
Susannah Howe, Communications
Junichi Kanai, Member-at-Large
Cameron Lindsey, Local Organizing
Glen Livesay, Special Sessions
Scott Palo, Webmaster
Peter Rogers, Local Organizing
Shraddha Sangelkar, Posters
Alisha Sarang-Sieminski, Quests
Keith Stanfill, Fundraising
Jim Vallino, CMT
Steve Zahos, Fundraising

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The Ohio State University
Penn State-Erie
Olin College
University of Florida
Rochester Institute of Technology
University of Illinois at Urbana-Champaign

All campus photos courtesy of The Ohio State University
What is better than having a little fun and being a little silly at a professional conference?

The great success of Quests from the 2014 Capstone Design Conference led us to continue to support the spirit of play and give gentle nudges to engage with other participants in fun ways by bringing back Quests for a second round! The quests are designed to encourage participants to fully experience the conference, make social and networking connections that otherwise might not occur, explore some local activities, and generally have fun. Look for the Quest Center table in the Exhibit Hall on the 3rd floor of Pfahl Hall to get more information and claim prizes or be entered into prize raffles based on the quests you’ve completed. And look for evidence of completed quests on people’s name tags to find others engaging in quests.

Exhibitors

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Exhibits will be open on the 3rd floor of Pfahl Hall throughout the conference:  
Monday 10am-6pm, Tuesday 8:30am-6pm, and Wednesday 9am-2pm.

Capstone Conversation

Don’t forget! Contribute your “most important takeaways” sticky notes at the end of each panel session.
Capstone Overview

The goal of the Capstone Design Conference is to provide a forum for the engineering and applied science capstone community to share ideas about implementing and improving design-based capstone courses. Conferences are held biannually in even years.

Through the four previous Capstone Design Conferences, we have established a network of capstone design educators and associated stakeholders committed to supporting one another in implementing various capstone course models, managing teams and projects, engaging stakeholders, incorporating new technology and collaborating to identify and disseminate effective practices in capstone design education. We welcome the 2016 conference attendees into this friendly and talented community.

As an outcome of the 2007, 2010, 2012, and 2014 conferences, we published an extensive set of peer-reviewed articles about capstone pedagogy in special issues of the International Journal of Engineering Education (IJEE, vol. 27-6, vol. 30-1, and vol. 31-6B). We intend to pursue another special issue of IJEE following the 2016 conference. We invite you to join us in our quest for shared excellence in capstone design instruction.
DAY 1 — Monday, June 6, 2016

7:00 a.m. – 8:30 a.m.  Registration / Continental Breakfast — Blackwell Lobby, 2nd floor

8:30 a.m. – 10:00 a.m.  Opening Session — Ballroom

10:00 a.m. – 10:30 a.m.  Break

10:30 a.m. – 12:00 p.m.  Panel Session 1

Panel 1A: Entrepreneurship in Capstone Design — Pfahl 230
Facilitator: John Ochs, Lehigh University
Panelists: Sean Carroll, Georgia Institute of Technology; Jay Goldberg, Marquette University; Victoria Matthew, VentureWell; Doug Melton, Kern Entrepreneurial Engineering Network; Elizabeth Schmitt, Florida Institute of Technology
Capstone provides a natural opportunity for students to engage in entrepreneurial activities. In this panel, a mix of students and professionals will discuss best practices in supporting and encouraging student entrepreneurs.

Panel 1B: Enhancing Capstone Success I — Pfahl 202
Facilitator: John Peeples, The Citadel
Panelists: Jered Dean, Colorado School of Mines; George Fleming, University of Texas-Dallas; Gregory Kremer, Ohio University; Nathan Scott, Johns Hopkins University
Nationally recognized capstone programs will share course practices that enhance the success of the programs. Topics covered include best practices in skill development, using junior assistants, developing common models, design team facilitation, assessment, etc.

Panel 1C: Roles & Responsibilities in Capstone Design — Pfahl 330
Facilitator: Brian Novoselich, Virginia Tech
Panelists: Terence Jordan, University of North Carolina-Charlotte; Neil Littell, Ohio University; Robert Stwalley, Purdue University
There are many participants in capstone - students, TAs, corporate sponsors, project advisors, course instructors, and mentors. How do you define roles so that students are successful?

10:30 a.m. –12:00 p.m.  Workshop Session 1

Workshop 1A: Capstone Product Idea Generation with Design Heuristics — Scott Lab (E100)
Capstone Product Idea Generation with Design Heuristics
Facilitators: Keelin Leehy, Iowa State University; Shanna Daly, University of Michigan; and Seda Yilmaz, Iowa State University
The 77 cards in the Design Heuristics for Inspiring Ideas toolbox can be used to support design teams in generating more diverse and creative ideas in their capstone projects. This workshop will introduce this research-grounded ideation tool and overview of multiple lesson versions for integrating this tool into capstone course activities.

Speaker: Susannah Howe, Smith College

Susannah Howe, Ph.D., is the Design Clinic Director in the Picker Engineering Program at Smith College, where she coordinates and teaches the capstone engineering design course. Her current research focuses on innovations in engineering design education, particularly at the capstone level. She is invested in building the capstone design community; she is a leader in the biannual Capstone Design Conferences and the Capstone Design Hub initiative. She is also involved with efforts to foster design learning in middle school students and to support entrepreneurship at primarily undergraduate institutions.

Her background is in civil engineering with a focus on structural materials. She holds a B.S.E. degree from Princeton, and M.Eng. and Ph.D. degrees from Cornell.

Inspired by the first national survey of capstone design programs in 1994 by Bob Todd and colleagues at BYU, Susannah conducted a similar comprehensive survey in 2005 and again in 2015. These decennial surveys capture data about capstone course information, pedagogy, evaluation, faculty, students, projects and teams, expenses and funding, and sponsors. This keynote talk reports on data from the 2015 survey and also provides longitudinal comparisons for context. Collectively, the data capture common practices as well as the variety of implementation strategies within capstone design programs.

Panel Session 2

Panel 2A: Project Management in Capstone Courses — Pfahl 230

Facilitator: Ada Hurst, University of Waterloo

Panelists: Ashley Forsythe, Project Management Institute; Samuel Malachowsky, Rochester Institute of Technology; Alisha Sarang-Sieminiski, Olin College; Baldur Steingrimsson, Portland State University

Project management is a critical component of any capstone experience, but it is often overlooked in favor of the “technical” challenges that teams are more comfortable confronting. Panelists will share the project management tools they use in their capstone courses and techniques for encouraging students to use them.

Panel 2B: ABET and Capstone Design — Pfahl 202

Facilitator: John Mirth, Rose-Hulman Institute of Technology

Panelists: Denny Davis, The Ohio State University; John Estell, Ohio Northern University; Benjamin Lutz, Virginia Tech

Many programs rely heavily on capstone design courses for assessing ABET outcomes. Join this panel to participate in a discussion of current assessment practices and get in on the discussion of how things may change in the future!

Panel 2C: Tips for Teaching Capstone Design — Pfahl 330

Facilitator: Steve Beyerlein, University of Idaho

Panelists: Junichi Kanai, Rensselaer Polytechnic Institute; Keith Stanfill, University of Florida; Steve Zahos, University of Illinois

Teaching capstone design is “different”! Join experienced panelists as they discuss some of the perks and perils of teaching design with new design instructors and how it is “different” from teaching a discipline-specific course.

Panel 2D: Encouraging Creativity in Capstone Design — Pfahl 302

Facilitator: Steve Chenoweth, Rose-Hulman Institute of Technology

Panelists: Keelin Leahy, University of Limerick; Dan Phillips, Rochester Institute of Technology; Stan Rickel, Rochester Institute of Technology; Allen White, Rose-Hulman Institute of Technology

Can creativity be taught? How can you encourage engineering students to participate in the creative process? This panel will discuss approaches for encouraging creativity in capstone design.
3:30 p.m. – 4:00 p.m.  Break

4:00 p.m. – 5:30 p.m.  Poster Session 1 — CBEC Lobby

Food and beverages will be available while you browse the posters and chat with the authors in the beautiful Chemical and Biomolecular Engineering and Chemistry (CBEC) Building Lobby.

5:30 p.m. – 6:00 p.m.  Break

6:00 p.m.  Workshop Session 2 (with box dinner)


*Facilitators: James Irvine, University of Strathclyde; Jennifer McClain, IEEE; Susan Tatiner, IEEE; James Olshefsky, ASTM International*

During this evening workshop, representatives of the IEEE Standards Education Committee will facilitate an interactive consensus-building exercise in which attendees take on the roles of different members of a standards working group tasked with developing a new technical standard. The workshop demystifies how standards are developed and used, and provides ideas how capstone instructors can bring industrial standards that students are likely to encounter in the workplace into classroom and design suite experiences.

**Workshop 2B: Capstone Project Scoping & Negotiation with Prospective Clients** — Pfahl 302

*Facilitators: Chuck Pezeshki, Washington State University; Steve Beyerlein, University of Idaho*

Starting the relationship between industrial sponsors and a capstone instructor is an important, but overlooked first step in running a successful externally focused capstone program. In this workshop, participants will examine new approaches for dialoguing with potential sponsors about appropriate project scope and suitable levels of financial support. This will include a prospecting template that has been used successfully by the workshop facilitators to secure over $2M in funding for capstone projects over the last ten years. Major topics that will be covered are: Assessment of project difficulty using NASA Technology Readiness Levels (NASA TRLs), Negotiation for Early Agreement, and understanding the Arc of the Project. As with all Pezeshki/Beyerlein workshops, this one will incorporate active, energetic and enjoyable participation with numerous role-playing and simulation sub-sessions. Some modest amount of pre-work will be highly recommended for maximum learning impact.

**Workshop 2C: Using the Constraint Source Model to Manage ABET Design Expectations** — Pfahl 230

*Facilitators: John K. Estell, Ohio Northern University; Ken Reid, Virginia Tech*

In preparation for our students’ “major culminating design experience,” how can we best present how constraints affect design such that it more than just checking off the laundry list of terms found in ABET EAC Criterion 3(c)? The purpose of this workshop is to present a framework to the capstone community for review, discussion, and refinement where the constraints affecting a design are modeled as being derived from business-, customer-, societally-, and technically-driven sources – in other words, as being derived from reality. Resources developed in support of this framework will be applied toward identifying the design constraints in two planned activity sessions. Both activity sessions will be followed by facilitated discussion sessions. Workshop leaders include an ABET expert with both program evaluator and commissioner experience, and a director of multiple undergraduate programs with experience in pedagogical development and studying student success.

8:00 p.m. – 9:30 p.m.  News and Brews — Pfahl Patio

This informal session (with drink!) will provide an opportunity for capstone “newbies” to connect with more seasoned capstone colleagues for casual conversation. Whether you’re new to capstone or have been around the capstone block (or you just like microbrews!), you are welcome to join in the discussion.
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DAY 2 — Tuesday, June 7, 2016

7:00 a.m. – 8:30 a.m.  Registration & Continental Breakfast — Blackwell Lobby, 2nd floor

7:30 a.m. – 12:30 p.m.  Local Tours and Activities

See program insert for local information and activities available in the OSU area this week!

9:00 a.m. – 10:30 a.m.  Workshop Session 3: Rapid Design of Embedded Systems and Projects with NI myRIO — Pfahl 202
Facilitators: Mark Walters and Eric Dean, National Instruments
This hands-on workshop seeks to familiarize educators and students with embedded technology to complete real-world design projects in one semester or less. Find out how your students can develop real, complex engineering systems more quickly using an embedded hardware device with a dual-core ARM® Cortex™-A9 real-time processor and customize I/O with a Xilinx FPGA.

10:45 a.m. – 12:15 p.m.  Workshop Session 4: Hands-on Workshop with MATLAB, Simulink, and Raspberry Pi — Pfahl 302
Facilitator: Balaji Sharma, MathWorks
This hands-on workshop introduces users to MATLAB and Simulink for developing and deploying algorithms with low-cost hardware, such as the Raspberry Pi, for use in engineering education as well as Capstone Design projects.

12:30 a.m. – 2:00 p.m.  Birds of a Feather Lunch (box lunch, open seating by topics of interest)
Please refer to the program insert for a list of topics & locations for each lunch discussion group. A sign-up sheet is located at the registration table!

2:15 p.m. – 3:45 p.m.  Panel Session 3

Panel 3A: Enhancing Capstone Success II — Pfahl 202
Facilitator: Glen Livesay, Rose-Hulman Institute of Technology
Panelists: Jay Goldberg, Marquette University; Robert Hart, University of Texas-Dallas; Susannah Howe, Smith College; Sophia Poulos, Smith College
Nationally recognized capstone programs will share course practices that enhance the success of the programs. Topics covered include best practices in course design, project selection, design team facilitation, assessment, etc.

Panel 3B: Capstone Expos — Pfahl 302
Facilitator: Amit Jariwala, Georgia Tech
Panelists: Ara Arabyan, University of Arizona; Thomas Barber, University of Connecticut; Bennett Ward, Virginia Commonwealth University
Capstone expos are an exciting way for students to conclude their capstone design experience. They also provide an opportunity for the broader community to see what engineering students have accomplished. The panel (and conference attendees) will discuss best practices in coordinating design expos.

Panel 3C: International Capstone Projects — Pfahl 230
Facilitator: John Aidoo, Rose-Hulman Institute of Technology
Panelists: Megan Bouret, North Dakota State University; Carsten Kleiner, Hochschule Hannover; Dean Knudson, North Dakota State University; Fabian Volkert, Hochschule Hannover
International capstone projects provide a unique set of opportunities to students and faculty. Panel members will discuss their experiences with international projects. Conference attendees interested in starting an international project are encouraged to attend and participate!
Panel 3D: Design Challenges & Competitions — Pfahl 330

Facilitator: Bridget Smyser, Northeastern University
Panelists: Noa Flaherty, OnShape; Roseann Thompson, New Mexico State University; Bob Rhoads, The Ohio State University

Competition projects present different design challenges than “traditional” capstone projects. Join the panelists as they discuss their experiences and share tips and tricks for successful Design Competition experiences.

4:00 p.m. – 5:30 p.m.  Poster Session 2 — CBEC Lobby

Food and beverages will be available while you browse the posters and chat with the authors in the beautiful Chemical and Biomolecular Engineering and Chemistry (CBEC) Building Lobby.

5:30 p.m. – 6:00 p.m.  Break

6:00 p.m.  Workshop Session 5 (with box dinner)

Workshop 5A: User-Oriented Assessment Tools for Industry-Sought Learning Outcomes in Capstone Design — Pfahl 330
Facilitators: Denny Davis, The Ohio State University; Lin Ding, The Ohio State University; Peter Rogers, The Ohio State University

As a component of an ongoing National Science Foundation-funded project, workshop participants will work together in teams to draft assessment tools for selected learning outcomes in capstone design courses. Outcomes will be selected based on importance to employers, while tools will be designed to give greatest benefits to students and faculty.

Workshop 5B: Reflection in Engineering Courses: Focus on Capstone — Pfahl 302
Facilitators: Kristine Csavina and Adam Carberry, Arizona State University

This workshop is intended to stimulate interest in the use of reflection in engineering capstone courses. We will discuss what it means to reflect as a learner, introduce resources created by the Consortium to Promote Reflection in Engineering Education (CPREE), and share ideas for reflective activities/assignments in capstone courses.

8:00 – 9:00 p.m.  Dessert Break — 3rd Floor Pfahl Lobby

Capstone Conversation

Describe your most satisfying capstone project experience to another attendee.

TUESDAY, JUNE 7

11
Standards for Capstone Projects

Capstone projects often incorporate engineering design standards from ASTM International. These standards define the widely-accepted constraints and boundaries established across many industries. Standards help students understand best practices, compliance criteria, testing methodologies, and more.

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Capstone Conversation

What is the craziest thing you’ve ever heard spoken in a capstone team meeting?
DAY 3 — Wednesday, June 8, 2016

6:30 a.m. – 7:30 a.m.  Run/Walk — Meet in the Blackwell Lobby
An informal gathering of attendees who are interested in taking a walk or run around the OSU campus. Can’t make the group meeting? Check out http://recsports.osu.edu/facilities/outdoor-facilities for some running/walking trails around the campus!

8:00 a.m. – 9:00 a.m.  Registration / Continental Breakfast — Blackwell Lobby, 2nd floor

9:00 a.m. – 10:30 a.m.  Panel Session 4

**Panel 4A: Corporate Sponsored Projects** — Pfahl 302  
*Facilitator: Charles Pezeshki, Washington State University*  
*Panelists: Douglas Chickarello, Clemson University; Meghan Daly, James Madison University; Leesa Duckworth, Pacific Northwest National Laboratory; Shraddha Sangelkar, Penn State-Erie*
How do you work with companies to enhance the experience for students, faculty, and the company, too? Join this panel for an informative session that will address many concerns for corporate sponsored projects.

**Panel 4B: Systems Engineering in Capstone Design** — Pfahl 330  
*Facilitator: Fred Looft, Worcester Polytechnic Institute*  
*Panelists: Bill Fortney, North Carolina State University; Scott Kirkpatrick, Rose-Hulman Institute of Technology*
Systems engineering methods are critical to the successful development of any complex system. Panelists will discuss ways to incorporate systems engineering concepts and tools into any capstone experience.

**Panel 4C: What I Wish I Had Known...** — Pfahl 140  
*Facilitator: Patsy Brackin, Rose-Hulman Institute of Technology*
An open student panel, with representatives from multiple schools and disciplines, will share their capstone design experiences and reflect on their preparation.

**Panel 4D: Multidisciplinary Model for Capstone Success** — Pfahl 340  
*Facilitator: Robert Hart, University of Texas-Dallas*  
*Panelists: Jeff Arrington, Abilene Christian University; Beth DeBartolo, Rochester Institute of Technology; Summer Garland, University of Arizona; Abhinav Gautam, Carnegie Mellon University; Todd Polk, University of Texas-Dallas*
Nationally recognized capstone programs that involve multi-disciplinary projects will share best practices in course design, project selection, design team facilitation, and assessment.

10:30 a.m. – 11:00 a.m.  Break

11:00 a.m. – 12:30 p.m.  Panel Session 5

**Panel 5A: Nifty Ideas and Surprising Flops** — Pfahl 302  
*Facilitator: Susannah Howe, Smith College*
This rapid-fire session will feature a collection of “nifty ideas” and “surprising flops” from capstone design. Each presenter will briefly share a nifty/flop, followed by Q&A from the audience. Time permitting, walk-ons from the audience will be welcome - bring an idea to contribute!
Panel 5B: Prototyping in Capstone — Pfahl 330
Facilitator: Peter Rogers, The Ohio State University
Panelists: Soraya Bailey, Johns-Hopkins University; John Mirth, Rose-Hulman Institute of Technology; Vito Moreno, University of Connecticut

Prototyping is useful in conceptualization and design proof of concept. Resources to support prototyping activities are discussed, along with the timing of various prototyping activities.

Panel 5C: Difficult Conversations — Pfahl 140
Facilitator: Renee Rogge, Rose-Hulman Institute of Technology
Panelists: Ashley Bernal, Rose-Hulman Institute of Technology; Bridget Smyser, Northeastern University; Keith Stanfill, University of Florida

One of the challenges of teaching design is the difficult conversations that a design instructor sometimes has to have with teams or team members. Join your capstone colleagues in a dynamic session where we role-play some situations and discuss strategies for helping faculty manage these difficult conversations.

Panel 5D: EPICS Panel — Pfahl 340
Facilitator: Maeve Drummond, Purdue University
Panelists: William Oakes, Purdue University; Carla Zoltowski, Purdue University

Civic and community engagement can add an extra dimension to the learning experience in capstone. Panelists will discuss their institutional approaches to integrating community engagement into their capstone courses, including topics such as customer relationships, communication, and assessment.

12:45–2:00 p.m.  Closing Lunch and Next Steps — Ballroom

Capstone Conversation
What’s the best change you ever made to your capstone course?
## POSTER SESSION

**PROFESSIONAL POSTERS — Alphabetical by Last Name**

*Poster ID's, M# or T#, correspond to the featured day (Mon. or Tues.) and location within the poster area.*

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