Capstone
DESIGN Conference **2010**

June 7-9, 2010 • Boulder, Colorado

CONFERENCE PROGRAM

www.capstoneconf.org

Welcome
from the Co-Chairs

On behalf of the entire Capstone Conference Organizing Committee we would like to welcome you to Boulder for the 2010 Capstone Design Conference.

We are delighted to continue the success of the 2007 inaugural conference and to keep building a community of educators, students, and industry to discuss, analyze, and improve capstone design education. In the development of the 2010 conference we chose to focus on two themes. These are the primary theme of capstone pedagogy and a forward looking "new frontier" theme of international teams.

The 2010 conference was intentionally designed to promote discussion and interaction across the capstone community. Rather than the traditional oral paper presentation format, we opted for a conference-wide poster session to encourage vibrant and extensive sharing of ideas and experiences. Based on themes that emerged from the accepted papers, we constructed panels to deliberate topics related to the conference themes. Multiple short courses have been scheduled in their own designated time slots so attendees can learn new skills and strategies pertaining to capstone education. New this year, we introduced working group sessions to initiate discussions on topics and tools that are useful for capstone educators. We envision that these working groups will continue their work between conferences to develop tools and materials that will be made available to the wider capstone community via the web.

Also new to the 2010 conference is student involvement, reflecting students' role as important stakeholders in capstone design. We issued a request for exemplary capstone design projects and student panelists and were overwhelmed with submissions. Look for featured capstone student projects in the poster session as well as invited student participation in some of the panel sessions. We are grateful to the contributions of our conference sponsors who supported the student involvement and helped us keep the conference fees low.

During the conference planning process the organizing committee addressed the issue of sustainability. We envision holding the conference biannually on the even years, with a different theme for each conference. Currently, we are planning several activities to carry forward the momentum from the 2010 conference. This includes a special issue in the *International Journal of Engineering Education* following the 2010 conference and a follow-up session at ASEE on the odd years. We expect that the working group discussions started at this conference will serve as the thread that connects the biannual conferences, informing you about future conference topics, disseminating best practices, and strengthening the greater capstone community.

Take the opportunity this week to immerse yourself in this conference; expand your capstone network, exchange ideas, and empower your involvement with capstone design courses. We want to thank you for attending the conference and look forward to collaborating with you now and in the future!

—Scott Palo and Susannah Howe, co-chairs

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Internet access is available to all conference participants at no cost. A username and password will be provided to participants when they check in at the registration desk.

Monday
June 7, 2010

8 a.m. - 5 p.m.	Registration Check-in — Engineering Lobby
9 a.m. - noon	Short Courses — DLC & ITLL
noon - 1 p.m.	Lunch (for Short Course participants only)
1 - 1:45 p.m.	Introduction & Icebreaker Activity — Math 100
1:45 - 3:15 p.m.	Keynote Speaker: William Grogan — Math 100
3:15 - 3:30 p.m.	Coffee Break — Engineering Lobby
3:30 - 5 p.m.	Panels — Engineering Center
5 - 5:30 p.m.	Working Group Overview — ECCR 245
5:30 - 7 p.m.	Reception — DLC Atrium
7 - 10 p.m.	Short Courses — DLC & ITLL

Tuesday
June 8, 2010

8 a.m. - 5 p.m.	Registration Check-in — Engineering Lobby
8:30 - 10 a.m.	Keynote Speaker: Alice Phinney — Math 100
10 - 10:30 a.m.	Coffee Break — Engineering Lobby
10:30 a.m. - noon	Panels — Engineering Center
noon - 1:15 p.m.	Lunch — Engineering Lobby
1:15 - 2:45 p.m.	Panels — Engineering Center
2:45 - 3:30 p.m.	Transition to Poster Session — Stadium Club
3:30 - 6:30 p.m.	Poster Session — Stadium Club
	Poster Group 1, 3:30 - 4:30 p.m.
	Poster Group 2, 4:30 - 5:30 p.m.
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7 - 10 p.m.	Short Courses — DLC & ITLL

Wednesday
June 9, 2010

8 - 8:30 a.m.	Continental Breakfast — Engineering Lobby
8:30 - 10 a.m.	Keynote Panel: Alan Parkinson and David Wilson — Math 100
10 - 10:30 a.m.	Coffee Break — Engineering Lobby
10:30 a.m. - noon	Panels — Engineering Center
noon - 2:30 p.m.	Closing Plenary and Lunch — Math 100

Organizing Committee

● **Scott Palo** ●
University of Colorado
Co-Chair

● **Susannah Howe** ●
Smith College
Co-Chair

Gary Pawlas ● University of Colorado ● *Local Organizing Committee Chair*

Tom Barber ● University of Connecticut

Steve Beyerlein ● University of Idaho

Steve Zahos ● University of Illinois

Keith Stanfill ● University of Florida

Jack Zable ● University of Colorado

Jay Goldberg ● Marquette University

Fred Looft ● Worcester Polytechnic Institute

Anthony Marchese ● Colorado State University

Junichi Kanai ● Rensselaer Polytechnic Institute

David Klappholz ● Stevens Institute of Technology

Glen Livesay ● Rose-Hulman Institute of Technology

Janis Terpenny ● Virginia Polytechnic Institute and State University

Email
capstoneconf@gmail.com
if you'd like to become involved in future Capstone activities.

8 a.m. - 5 p.m. Registration Check-in — Engineering Lobby

9 a.m. - noon **Short Courses**

ITLL 1B50

1.1 Establishing a Product-Oriented Entrepreneurial Capstone Experience

Joseph Morgan and Jay Porter, Texas A&M University
contact: porter@entc.tamu.edu

This short course will provide participants with ideas, methodologies, and resources that can be used to create a capstone design learning experience resulting in a prototype that is ready for commercialization. This process has been in place at Texas A&M for three years and has resulted in numerous successes, including three commercialized products. Another goal of the session is to explore educational methods that prepare students to incorporate entrepreneurship in to their lifelong learning and career goals.

DLC 1B70

1.2 Identifying and Managing Health/Safety Issues Associated with International Projects

Natalie Mello and Fred Looft, Worcester Polytechnic Institute
contact: fjlooft@wpi.edu

Drawing on their many years of experience with off-campus projects, the facilitators will help participants:
  (a) understand the difference between risk management and crisis management,
  (b) appreciate reasons for implementing a risk management program for off-campus projects,
  (c) identify strategies for managing risk associated with off-campus project advising, and
  (d) become familiar with resources to advance risk management efforts.

DLC 1B60

1.3 Integrating Professional Skills Assessment Curricula and Assessment in Capstone Courses

Patsy Brackin, Rose-Hulman Institute of Technology
Jay McCormack, University of Idaho
Javed Khan, Tuskegee University
Phil Thompson, Seattle University
contact: brackin@rose-hulman.edu

This short course introduces curricula and assessments by the Transferable Integrated Design Engineering Education (TIDEE) consortium for cultivating design-related technical, interpersonal, and professional skills in the context of a capstone course. Facilitators will present an overview of the capstone design curricula and assessments. Then they will engage participants by allowing them to examine and score student work that probes professional development planning and growth appraisal related to personal and team needs. Participants will also review and customize lesson plans for using one or more of TIDEE's supporting curriculum modules in conjunction with TIDEE assessments in individual courses.

ITLL 1B10

1.4 LabVIEW Embedded for ARM and the Control of Dynamic "Minisystems"

Jeff Jensen and Shekhar Sharad, National Instruments
contact: shekhar.sharad@ni.com

Capstone design teams often require programming an embedded hardware device based on an ARM, FPGA or similar technology to make their system functional. While electrical engineering students have the knowledge and skills to program these devices, other majors may not have had the formal training on these skills. Graphical system design opens up embedded programming to all majors because of its intuitive, dataflow approach thus making it possible for students from to design, prototype and deploy their capstone designs in under a semester with no previous embedded design experience. In this session, attendees will experience programming a Stellaris CORTEX-M3 ARM board with LabVIEW graphical programming in a hand-on manner. Attendees will then perform a series of tasks LabVIEW, the Stellaris ARM platform, and an iRobot Create to understand how LabVIEW makes it easier to program embedded systems while still providing the powerful functionality offered by traditional embedded system approaches.

MONDAY, JUNE 7

noon - 1 p.m.	Lunch (for Short Course participants only) — DLC Atrium
1 p.m.	**Conference Begins**
1 - 1:45 p.m.	Introduction and Icebreaker Activity — Math 100
1:45 - 3:15 p.m.	**Keynote: Capstone Power**

MATH
100

William Grogan
Dean Emeritus, Worcester Polytechnic Institute

William Grogan was named WPI's first Dean of Undergraduate Studies in 1970 and served in that capacity until his retirement in 1990. In that role, he led the development of the WPI Plan (including the Major Qualifying Project, MQP), which combines theoretical study with project-based problem solving. He was also instrumental in implementing the WPI Global Studies Program, and helped develop multiple off-campus project centers, both nationally and internationally.

Grogan graduated from WPI in 1945 and served in the U.S. Navy as an electronics officer (both during WWII and the Korean War). He returned to WPI to earn a master's degree in electrical engineering and began teaching in the Department of Electrical Engineering in 1946. For the next 20 years, Grogan taught at WPI, working his way up to the rank of professor by 1962, while consulting and developing patents for the U.S. Department of the Navy in Washington, D.C., and General Electric in Pittsfield, Mass., every summer. Grogan has been recognized with major awards from ASEE, the IEEE, and WPI.

Welcome to Boulder!

Boulder is located in the foothills of the Rocky Mountains, just 35 miles northwest of Denver. Home of the University of Colorado's main campus and the National Center for Atmospheric Research, Boulder sits 5,430 feet above sea level and is surrounded by a greenbelt of city parks and open spaces. Boulder is known for its natural beauty, outdoor recreation, natural product retailers and restaurants, outstanding transportation options, diverse businesses, and technological and academic resources.

As the flagship university of the state of Colorado, CU-Boulder is a dynamic community of scholars and learners situated on one of the most spectacular college campuses in the country. As one of 34 U.S. public institutions belonging to the prestigious Association of American Universities (AAU) — and the only member in the Rocky Mountain region — we have a proud tradition of academic excellence, with four Nobel laureates and more than 50 members of prestigious academic academies.

3:15 - 3:30 p.m.   Coffee Break — Engineering Lobby

3:30 - 5 p.m.   **Panels**

ECCR 245

Session A: Student Perspectives on Pedagogy

Scott Palo, University of Colorado Boulder (facilitator)
Phillip Daw, Texas A&M University
Jordan Jalving, Colorado State University
Shraddha Joshi, Clemson University
Kimberly Landick, Michigan Technological University

ECCR 265

Session B: Nifty Ideas/Surprising Flops

Susannah Howe, Smith College (facilitator)
Kevin Caves, Duke University
Carsten Kleiner, University of Applied Sciences & Arts (Hannover, Germany)
Glen Livesay, Rose-Hulman Institute of Technology
Judith Norback, Georgia Institute of Technology
Renee Rogge, Rose-Hulman Institute of Technology
Cameron Turner, Colorado School of Mines

ECCR 1B40

Session C: Capstone Project Management

Patsy Brackin, Rose-Hulman Institute of Technology (facilitator)
Jerry Crain, University of Oklahoma
Dean Knudson, North Dakota State University
Bahram Nassersharif, University of Rhode Island
Deborah O'Bannon, University of Missouri-Kansas City

DLC 1B60

Session D: Documenting Design Development

Denny Davis, Washington State University (facilitator)
Vikki Hazelwood, Stevens Institute of Technology
Jean Koster, University of Colorado Boulder
Jay McCormack, University of Idaho
Mark Steiner, Rensselaer Polytechnic Institute

5 - 5:30 p.m.   Working Group Overview Meeting (optional)

ECCR 245

The goal of the working group is to provide an on-going forum for engineering and applied science faculty to share experience, techniques and best practices in capstone design courses. As a first step toward the effort, we will prioritize and select topics for working group meetings during the conference. Possible topics include creating an on-line repository of course materials, integration of software tools, organizing and managing multidisciplinary projects, and organizing and managing industry sponsored projects.

5:30 - 7 p.m.   Reception — DLC Atrium

7 - 10 p.m.   **Short Courses**

DLC
1B70

2.1   Creating a Practitioner-Centric CE Capstone with Real CE Projects

Deb O'Bannon, University of Missouri-Kansas City
Thomas Kimes, HDR
Erich Schmitz, TranSystems
contact: obannond@umkc.edu

Short course participants will gain insight how to implement a practitioner-centric CE capstone design course which partners with clients to design right-sized projects with real-world deliverables on a schedule appropriate for college seniors. They will identify appropriate project partners, learn how to recruit other faculty, and capitalize on project benefits in preparing students for professional practice as well as in advancing local engineering programs.

ITLL
1B50

2.2   Organizing Project Teams with a Personality Questionnaire

Doug Wilde, Stanford University
contact: wilde@stanford.edu

This short course will familiarize participants with the principles and practices described in the author's book which employs a 20-item personality questionnaire to guide the assignment of members to roles on a project team. After hearing a short outline of psychiatrist C. G. Jung's theory of eight "cognitive modes" for solving problems, participants will complete the questionnaire, compute scores for their eight modes to find which they prefer, and then quickly form "casual" quartets based on previous acquaintanceships as well as mode information. Once formed, each team will assign each of its members to four out of the possible sixteen team roles defined for distribution of effort. Finally, the team will plan and build a model practice structure to experience the interactions between the members. This experience is intended to prepare faculty to decide to what degree teamology methods might be used in their project courses to improve student team performance and to better prepare students to work effectively on professional project teams.

DLC
1B60

2.3   Effective Management of Student Teams Using the CATME/Team Maker System

Richard Layton, Rose-Hulman Institute of Technology
Misty Loughry, Georgia Southern University
Matt Ohland, Purdue University
Hal Pomeranz, IT consultant
contact: layton@rose-hulman.edu

The goal of this workshop is to introduce participants to two tools that can help them manage teams in their classes effectively and efficiently. We review some of the factors that instructors may wish to consider when assigning students to teams and when administering peer evaluations. We review the literature and engage the participants in discussions about their own experiences and practices. We conduct interactive, hands-on, practical activities using the CATME and Team-Maker systems. However, this is not just a software demonstration—we help faculty understand how the systems support cooperative learning. Attendees with wireless-network-capable laptop computers will interact with both systems in real-time.

ITLL
1B10

2.4   myDAQ: Student-affordable Data Acquisition and Instrumentation platforms for Capstone Design

Mark Walters and Shekhar Sharad, National Instruments
contact: shekhar.sharad@ni.com

Capstone design project teams have a budget constraint while having several needs to fulfill including instrumentation and data acquisition (DAQ) for the system they are designing. Keeping this need in mind, National Instruments has designed a new student-affordable DAQ and Virtual Instrumentation platform that caters to the needs of students in Capstone design. In this course, attendees will have the opportunity to experience the new DAQ device and LabVIEW in a hands-on manner while conducting capstone design relevant exercises that include common measurements taken in a typical capstone design course. At the conclusion of the course, all attendees will receive an evaluation copy of LabVIEW to take with them.

8 - 8:30 a.m.   Continental Breakfast — Engineering Lobby

8:30 - 10 a.m.

MATH 100

Keynote: Industry Perspective of Senior Design Projects — Real World Design 101

Alice Phinney
Senior Engineering Manager, Ball Aerospace

Alice Phinney is a Sr. Engineering Manager at Ball Aerospace in Boulder, Colorado. She manages the Pointing, Tracking, and Sensors Technology group which is comprised of 290 mechanical, optical, thermal, structural, and detector engineers. She is responsible for the functional management of the group, which covers: providing the right people to programs at the right time, insuring the correct skill and experience within the discipline groups, balancing manpower with program needs (hiring and force reduction), professional development, salary management, and process improvement.

Alice came to engineering relatively late in life, graduating with her BS in ME from the University of Colorado, at 28. She worked for 5 years at Boeing, in Everett, Washington, on 767s and 747s prior to coming to Ball Aerospace. At Ball for almost 19 years, Alice has worked on a variety of programs including the mechanical lead for the Impactor Spacecraft (smashed into comet Tempel 1 for a science experiment). Alice also has a BA in Biology from the University of Colorado.

10 - 10:30 a.m.   Coffee Break — Engineering Lobby

10:30 a.m. - noon   **Panels**

ECCR 245

Session A: Teaching Entrepreneurial Capstones

Phil Weilerstein, National Collegiate Inventors and Innovators Alliance (facilitator)
Howard Davis, Washington State University
Joseph Morgan, Texas A&M University
Benjamin Yu, British Columbia Institute of Technology
Scott Zenier, Oregon State University

ECCR 265

Session B: Curricular Scaffolding for Capstones

Glen Livesay, Rose-Hulman Institute of Technology (facilitator)
Don Dekker, University of South Florida
Renee Rogee, Rose-Hulman Institute of Technology
Sarah Shackelford, California Polytechnic State University
Jack Zable, University of Colorado Boulder

ECCR 1B40

Session C: Industry Partnerships

Stephen Zahos, University of Illinois at Urbana Champaign (facilitator)
Thomas Barber, University of Connecticut
Mandi Falconer, ASRC Aerospace
Glenn Pope, John Deere
Gregg Warnick, Brigham Young University

DLC 1B60

Session D
Working Group — Meeting 1

The goal of the working group is to provide an on-going forum for engineering and applied science faculty to share experience, techniques and best practices in capstone design courses. As a first step toward the effort, we will prioritize and select topics for working group meetings during the conference. Possible topics include creating an on-line repository of course materials, integration of software tools, organizing and managing multidisciplinary projects, and organizing and managing industry sponsored projects.

noon - 1:15 p.m.   Lunch — Engineering Lobby

1:15 - 2:45 p.m.   **Panels**

ECCR 245

Session A: Teaming/Coaching Practices

Richard Layton, Rose-Hulman Institute of Technology (facilitator)
Stephen Laguette, University of California Santa Barbara
Marie Paretti, Virginia Polytechnic Institute and State University
Greg Speegle, Baylor University

ECCR 265

Session B: Capstone Teaching Material

David Klappholz, Stevens Institute of Technology (facilitator)
Rudy Eggert, Boise State University
Jay Goldberg, Marquette University
Fred Looft, Worcester Polytechnic Institute
Jay McCormack, University of Idaho
Matt Ohland, Purdue University

ECCR 1B40

Session C: Integration of Industry-Sponsored Capstone Projects into the Engineering, Computer Science and Technology Design Curriculum at CSULA and ASU Poly

Paul Jones, Corporate & University Relations Group (facilitator)
Lou Flamm, Honeywell Aerospace
John Larson, Pratt & Whitney Rocketdyne
Keith Moo-Young, California State University Los Angeles
*Chell Roberts, Arizona State University Polytechnic Campus*

DLC 1B60

Session D
Working Group — Meeting 2

The goal of the working group is to provide an on-going forum for engineering and applied science faculty to share experience, techniques and best practices in capstone design courses. As a first step toward the effort, we will prioritize and select topics for working group meetings during the conference. Possible topics include creating an on-line repository of course materials, integration of software tools, organizing and managing multidisciplinary projects, and organizing and managing industry sponsored projects.

Capstone Overview
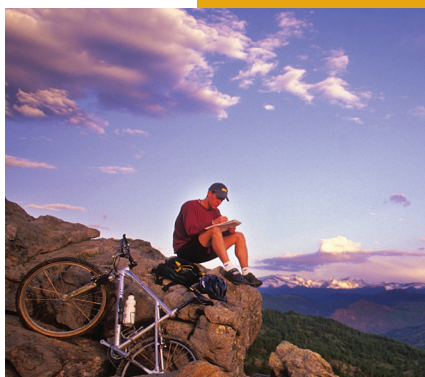
The goal of the Capstone Design Conference is to provide a forum for engineering and applied science faculty to share ideas about implementing and improving design-based capstone courses.

Over the long-term, we hope that the Capstone Design Conferences foster 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.

Our first working group is being established at the conference this year. We expect this and future working groups will be active between the biennial conferences thus providing continuity from one conference to the next.

Join us for the next Capstone Conference in 2012. Better yet, join a working group and continue the momentum between now and then. If you have a great idea, are interested in establishing a new working group or just want to get involved, send us email at capstoneconf@gmail.com.

2:45 - 3:30 p.m.	Transition to Poster Session in Stadium Club (see Campus Map, page 17)
3:30 - 4:30 p.m.	**Poster Session: Group 1**
4:30 - 5:30 p.m.	**Poster Session: Group 2**
5:30 - 6:30 p.m.	**Poster Session: Group 3**
	(see Poster Session, pages 14-16)

7 - 10 p.m.   **Short Courses**

ITLL 1B50

3.1 Designing and Delivering a Real Projects for Real Clients Capstone (RPRCC)

David Klappholz, Stevens Institute of Technology
contact: davidk6@gmail.com

The short course facilitator and a number of CS colleagues have developed a taxonomy of issues that must be dealt with in designing and delivering a CS RPRCC, capstone or otherwise. Virtually all of these issues are relevant to RPRCC capstones, and many of these issues are relevant to non-RPRCC courses in most engineering disciplines. The goal of the session is to broaden understanding of different ways that have been used to address the relevant issues, within their own disciplines and in others, so as to aid beginning instructors in choosing ways to address these issues and to suggest ways in which seasoned capstone instructors might improve various aspects of their courses.

DLC 1B60

3.2 Coaching Your Design Teams to Victory

Rudy Eggert, Boise State University
contact: reggert@boisestate.edu

This short course will provide participants with tools for coaching design project teams. Short presentations will introduce topics for roundtable discussions including how to: plan the course, form project teams, build teamwork skills and coach dysfunctional teams. Attendees are encouraged to send an email to reggert@boisestate.edu to have a particular problem considered for discussion.

DLC 1B70

3.3 Effective Management of Student Teams Using the CATME/Team Maker System

Richard Layton, Rose-Hulman Institute of Technology
Misty Loughry, Georgia Southern University
Matt Ohland, Purdue University
Hal Pomeranz, IT consultant
contact: layton@rose-hulman.edu

The goal of this workshop is to introduce participants to two tools that can help them manage teams in their classes effectively and efficiently. We review some of the factors that instructors may wish to consider when assigning students to teams and when administering peer evaluations. We review the literature and engage the participants in discussions about their own experiences and practices. We conduct interactive, hands-on, practical activities using the CATME and Team-Maker systems. However, this is not just a software demonstration—we help faculty understand how the systems support cooperative learning. Attendees with wireless-network-capable laptop computers will interact with both systems in real-time.

8 - 8:30 a.m. Continental Breakfast — Engineering Lobby

8:30 - 10 a.m. **Keynote Panel: International Teams**

MATH
100

Facilitator: **R. Keith Stanfill**
Director of Integrated Product and Process Design Program, University of Florida

Panelist: **Alan Parkinson**
Dean, Ira A. Fulton College of Engineering and Technology,
Brigham Young University

Alan R. Parkinson is a professor of mechanical engineering and currently serves as dean of the Ira. A. Fulton College of Engineering and Technology at Brigham Young University. The college is home to 3300 students in 11 programs. Previous to his appointment as dean he was an associate dean from 2003 to 2005 and chair of mechanical engineering from 1995 to 2001. He received his PhD and MS degrees from the University of Illinois, Urbana, and BS and MBA degrees from Brigham Young University.

During his tenure as dean, the college has implemented numerous international programs, including technical study abroad programs, international capstone projects, international internships, and a chapter of Engineers Without Borders. He is currently conducting research on cross-cultural virtual engineering design teams. Other areas of research interest include design automation, optimization methods and robust design. In 2003, he received the Design Automation Award from the American Society of Mechanical Engineers for his work in robust design and design optimization. Prof. Parkinson was elected to Fellow status in the American Society of Mechanical Engineers in 2004.

Panelist: **David Wilson**
Director of Academic and University Relations,
National Instruments

David Wilson has always been a proponent of hands-on project based learning in Engineering Education. In his role as Director for Academic Marketing at National Instruments, he ensures that National Instruments continually delivers technologies that enable educators to do engineering with real-world experiments. He also mentors students in his spare time with senior design/capstone projects that are innovative and representative of hands-on project based learning. Wilson has been with NI since 1991 where he has held the positions as the Michigan-area district sales manager, the director of data acquisition marketing, the international sales director for Japan, and in 2005, director of International Marketing. Wilson holds a BS degree in applied physics from the State University of New York at Geneseo.

10 - 10:30 a.m. Coffee Break — Engineering Lobby

10:30 a.m. - noon **Panels**

ECCR 245

Session A: Teaching Multidisciplinary Capstones

Thomas Barber, University of Connecticut (facilitator)
Eryn Ammerman, Colorado School of Mines
Carlee Bishop, Georgia Institute of Technology
Jay Goldberg, Marquette University
T. Gordon Smith, Colorado State University
Keith Stanfill, University of Florida

ECCR 265

Session B: International Design Projects: Expanding 40 Years of Interdisciplinary Project Experience into the Capstone Environment

Fred Looft, Worcester Polytechnic Institute (facilitator)
Fred Hart, Worcester Polytechnic Institute
Jeanine Plummer, Worcester Polytechnic Institute
Yiming (Kevin) Rong, Worcester Polytechnic Institute
Alex Wyglinski, Worcester Polytechnic Institute

ECCR 1B40

Session C: Diverse Models for Incorporating Service Learning in Capstone Design

Angela Bielefeldt, University of Colorado Boulder (facilitator)
Bruce Berdanier, South Dakota State University
Ganesh Bora, North Dakota State University
Kurt Paterson, Michigan Technological University

DLC 1B60

Session D
Working Group — Meeting 3

The goal of the working group is to provide an on-going forum for engineering and applied science faculty to share experience, techniques and best practices in capstone design courses. As a first step toward the effort, we will prioritize and select topics for working group meetings during the conference. Possible topics include creating an on-line repository of course materials, integration of software tools, organizing and managing multidisciplinary projects, and organizing and managing industry sponsored projects.

noon - 2:30 p.m. Closing Plenary and Lunch

MATH 100

Lunch will be provided during the closing plenary session as we capture the highlights of the conference, weaving together the threads of this conference and laying the foundation for continued collaboration. Panel facilitators will recap main discussion points and working group organizers will report out initial actions and future plans.

2:30 p.m. **Conference Ends**

WEDNESDAY, JUNE 9
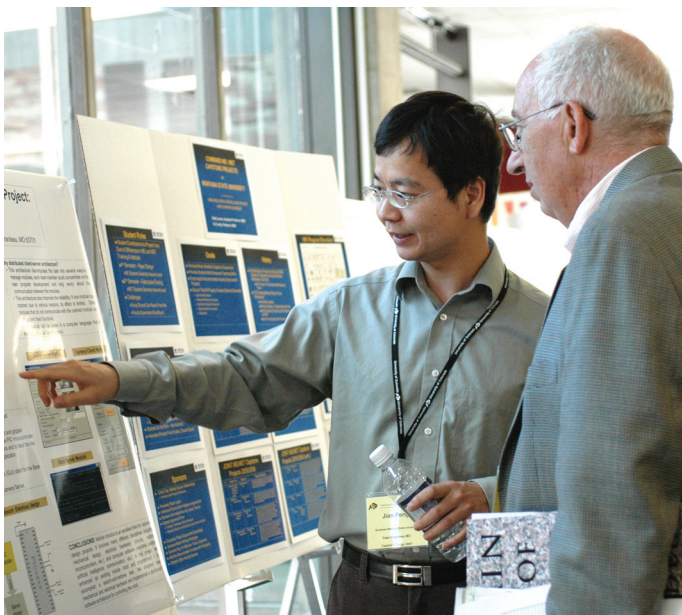
Contributed Posters

alphabetical by first author

|	Authors	Poster Title
A	Robert Adams and Jamal Alsabbagh (Grand Valley State Univ.)	CS Capstone: Lessons from the Field
	Waddah Akili (Geotechnical Engineering)	On Capstone Design: Perceptions, Reflections, and Practices
	Waddah Akili (Geotechnical Engineering)	Teaching Civil Engineering Design using Project-Oriented Industry Driven Capstone Course
B	John Bergendahl and Tahar El Korchi (Worcester Polytechnic Institute)	Advising a Costa Rica Capstone Design Project by Distance
	Carlee Bishop and Tommer Ender (Georgia Tech Research Institute)	Capstone Projects: Key to the Lifecycle Development of the Systems Engineer
	Martin Bollo (British Columbia Institute of Technology)	Planning for Success — Effective Student Proposals for Civil Engineering Capstone Design Projects
	William Butler, Janis Terpenny and Richard Goff (Virginia Tech)	Using Technology to Bring Realism, Improved Learning and Motivation to Capstone Design
C	Kevin Caves (Duke Univ.), Richard Goldberg (Univ. of North Carolina Chapel Hill) and Larry Bohs (Duke Univ.)	Projects for People with Disabilities in a Capstone BME Design Class
	Alan Cheville and Steven Welch (Oklahoma State Univ.)	A Functional Decomposition Test for Formative/Summative Evaluation of Capstone Design
	Wayne Chudyk (Tufts Univ.)	Leveling the Field
	Jerry Crain and Cliff Fitzmorris (Univ. of Oklahoma)	Fostering Sponsor and Mentor Partnerships in the Capstone Design Course at the University of Oklahoma School of Electrical and Computer Engineering
	Ed Crawley (MIT), Robert Niewoehner (United States Naval Academy), Jean Koster (Univ. of Colorado) and Peter Gray (United States Naval Academy)	North American Aerospace Project: A Template for Preparing Portable Design/Build Projects
D	Nickolas Dalbec and Jennifer Nielsen (Univ. of St. Thomas)	Shea Butter Manually Operated Mixer
	Don Dekker, Stephen Sundarrao and Rajiv Dubey (Univ. of South Florida)	Sustainability and Commercialization of Capstone Projects
	Anthony Denzer (Univ. of Wyoming)	Long-Distance Multidisciplinary Collaboration: Some Lessons Learned
	Gene Dixon and Paul Kauffmann (East Carolina Univ.)	Vetting Industry Based Capstone Projects Considering Outcome Assessment Goals
F	Gregg Fiegel and Jay DeNatale (California Polytechnic State Univ.)	Design Teams in a Civil Engineering Capstone Course: Formation, Preparation, and Performance
G	Jay Goldberg (Marquette Univ.), Pascal Malassigne (Milwaukee Institute of Art & Design), Mary Beth Privitera (Univ. of Cincinnati)	Engineering/Industrial Design Collaboration in Capstone Design Projects
H	Sharon Hall, Vernon Bryant, Mary Randolph-Gips and George Collins (Univ. of Houston-Clear Lake)	Industry Partnerships for Quality Programs
	Nancy Hayden, Mandar Dewoolkar, Donna Rizzo and Maureen Neumann (Univ. of Vermont)	Incorporating Service-Learning Projects Dealing with Sustainability within the Civil and Environmental Engineering Capstone Design Course
	Vikki Hazelwood, Antonio Valdevit and Arthur Ritter (Stevens Institute of Technology)	A Model for a Biomedical Engineering Senior Design Capstone Course, with Assessment Tools to Satisfy ABET "Soft Skills"
	Noe Vargas Hernandez and Gabriel Davila Rangel (Univ. of Texas at El Paso)	Improving Engineering Design Education: A Pedagogical Method-Objective Model
	Pete Hylton (Indiana Univ.-Purdue Univ. Indianapolis)	Designing outside the Capstone Box: An Innovative Capstone Course for Technology Students
J	Latif Jiji (The City College of New York)	Capstone Interdisciplinary Team Project for Master of Science in Sustainability
	Shraddha Joshi and Joshua Summers (Clemson Univ.)	Investigating Information Loss in Collaborative Design: A Case Study with Capstone Design Project
	Paul Jones (Corporate & University Relations Group), Chell Roberts (Arizona State Univ. Polytechnic Campus), Keith Moo-Young (California State Univ. Los Angeles), John Larson (Pratt & Whitney Rocketdyne), Lou Flamm (Honeywell Aerospace)	Integration of Industry-Sponsored Capstone Projects into the Engineering, Computer Science and Technology Design Curriculum at CSULA and ASU Poly
K	Junichi Kanai (Rensselaer Polytechnic Institute)	Integrating Safety into Capstone Design Courses at Rensselaer
	Carsten Kleiner and Arne Koschel (Univ. of Applied Sciences Hannover)	Success Factors in Making your Capstone in Software Engineering Productive and Appealing
	Daniel Knight, Daria Kotys-Schwartz and Gary Pawlas (Univ. of Colorado)	Triangulation: An Effective Assessment Tool for Capstone Design Program Evaluation
	Dean Knudson and Alex Radermacher (North Dakota State Univ.)	Project Management and Software Development Processes for Computer Science Capstone Projects
	Jean Koster (Univ. of Colorado)	Project Teams and Challenges in Fair Grading

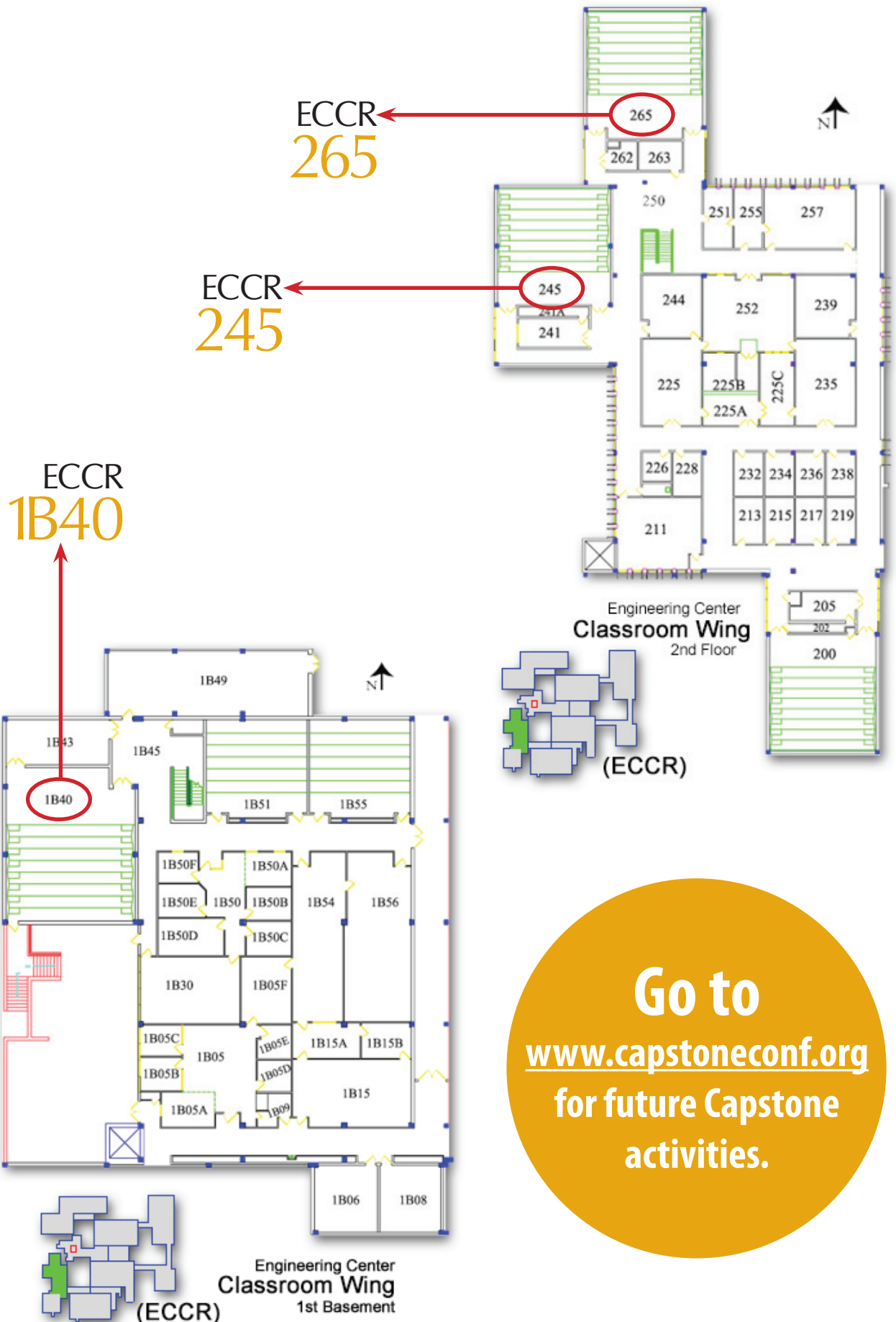|		
L	Stephen Laguette (Univ. of California Santa Barbara)	Development of High Performance Capstone Project Teams and the Selection Process
	Richard Layton, Thomas Adams and Corey Taylor (Rose-Hulman Institute of Technology)	Raising Expectations for the Quality of Graphical Elements in Reports and Presentations
M	Daniel McAdams and Julie Linsey (Texas A&M Univ.)	dDesign Education: A Globally Distributed Capstone Engineering Design Experience
	Jay McCormack (Univ. of Idaho), Denny Davis (Washington State Univ.), Steven Beyerlein (Univ. of Idaho), Phil Thompson (Seattle Univ.), Howard Davis (Washington State Univ.), Javed Khan (Tuskegee Univ.), Mike Trevisan (Washington State Univ.), Robert Gerlick (Washington State Univ.), Susannah Howe (Smith College), Paul Leiffer (LeTourneau Univ.) and Patsy Brackin (Rose-Hulman Institute of Technology)	Assessing Professional Skill Development in Capstone Design Courses
	Darren McKague and Thomas Zurbuchen (Univ. of Michigan)	Creating Real-World Experiences for Space Systems Students
	Beshoy Morkos and Joshua Summers (Clemson Univ.)	Implementing Design Tools in Capstone Design Projects: Requirements Elicitation through Use of Personas
N	Bahram Nassersharif (Univ. of Rhode Island)	Best Practices in Assessing Capstone Design Projects
	Kevin Nickels (Trinity Univ.)	Making "Realistic Constraints" More Real
O	Matthew Ohland (Purdue Univ.), Richard Layton (Rose-Hulman Institute of Technology), Misty Loughry (Georgia Southern Univ.), Hal Pomeranz (Deer Run Associates)	The Effective Management of Student Teams Using the CATME/Team-Maker System: Practice Informed by Research
P	John Parmigiani and Ben Sherrett (Oregon State Univ.)	Implementation of the House of Quality as a Guiding Tool for Students and Faculty in Senior Capstone Design Courses
	James Pembridge and Marie Paretti (Virginia Tech)	Andragogical Practices in Capstone Design Courses
	Christopher Pung (Grand Valley State Univ.)	Senior Capstone Design and Build: Comparing Product Design and Manufacturing Equipment Design
R	Alex Radermacher, Adam Helsene and Dean Knudson (North Dakota State Univ.)	Improving Capstone Courses with Content Management Systems and Virtualization
	Kenneth Reid and John Estell (Ohio Northern Univ.)	Incorporation of Poverty Alleviation in Third-World Countries in a First-Year Engineering Capstone Course
	Louis Reifschneider (Illinois State Univ.)	Lean Manufacturing Cell Capstone Project
	Mark Rentschler and Jack Zable (Univ. of Colorado)	Beyond Capstone Design — Developing a New Graduate Design Pedagogy and Program
	Linda Riley (Roger Williams Univ.)	Using Competitions as Capstone Design Projects
	Fernando Rios-Gutierrez and Rocio Alba-Flores (Georgia Southern Univ.)	Mobile Robotics Based Capstone Design Course for Engineering Technology
S	Peter Schmidt, Nan Bousaba, Steve Patterson, Dan Hoch, Deborah Sharer, Gary Gehrig and Jim Conrad (Univ. of North Carolina Charlotte)	Implementation of a Capstone Senior Design Program Using Open Source Course Management Software
	Jie Sheng, Larry Wear, Orlando Baiocchi (Univ. of Washington Tacoma)	Computer Engineering and Systems Capstone Design Course at UW Tacoma
	Matthew Siniawski (Loyola Marymount Univ.) and Dhruv Patel (The Aerospace Corporation)	Participation in a Fuel Efficiency Competition for the Mechanical Engineering Capstone Design Experience
	Gordon Smith and Matt Kipper (Colorado State Univ.)	Product Design and Process Design in Chemical and Biological Engineering Capstone Courses
	Bridget Smyser and Gregory Kowalski (Northeastern Univ.)	Engineers as Writing Instructors for Capstone Design
	Greg Speegle (Baylor Univ.)	Designing a Capstone Course to Simulate the Industrial Environment
	R. Keith Stanfill and Ethan Blackwelder (Univ. of Florida)	Adapting Lightweight Source Control and Project Management Software for Use by Multidisciplinary Product Design Teams
	R. Keith Stanfill and Oscar Crisalle (Univ. of Florida)	Enhancing the Coach's Performance: Effective Propagation of Pedagogical Techniques, Resources, and Know-how
	Mark Steiner, Junichi Kanai, Cheng Hsu, Richard Alben and Lester Gerhardt (Rensselaer Polytechnic Institute)	A Holistic Approach for Student Assessment in Project-based Multidisciplinary Engineering Capstone Design
T	Joe Tanner and Scott Palo (Univ. of Colorado)	Project Based Learning at the Graduate Level
	William Thomas and Gerald Kruse (Juniata College)	A Capstone Course Sequence in Information Technology
	Cameron Turner, Candace Sulzbach and Jeff Schowalter (Colorado School of Mines)	Reinventing Capstone Design "On-the-Fly"
W	Gregg Warnick and Robert Todd (Brigham Young Univ.)	Importance of Providing Intellectual Property to Sponsoring Companies When Recruiting Capstone Projects
	Gregory Watkins and Anthony Arena (California State Univ. Chico)	Integrating a Manufacturing Technology Program into Engineering Capstone Design
	L. Wyard-Scott (Univ. of Alberta)	An Online Tool for Capstone Design Course Communication
Y	Benjamin Yu and Elsie Au (British Columbia Institute of Technology)	Innovation Requirement for Practicum Projects

POSTER SESSION

Student Posters

alphabetical by institution

Institution	Student Authors	Poster Title
Arizona State University	Normarie Santos, Brianna Burns, Duncan Brown, Zane Cradic, Matthew Reeg, Daniel Petrakovitz	Optimization of Drinking Water Solutions for Rural Villages in Ghana
Binghamton University - State of University of New York	Ahna Shaffer, James Quinn	Using Panoramic Photography and Digital Imaging to Detect Foreign Object Debris on Runways
Boston University	Alex Ng, Juan Jhong, Gledis Mezini, Kevin Yu, Nicholas Zolnierz	VIP SYSTEM - Assistive Technology for Hybrid Vehicles
Brigham Young University	Sam Wilding, Robert Philbrick, Rob Moncur, Nathan Sharp, Brett Carter	First Response Disaster Rescue Lift
California Polytechnic State University	Joseph Anderson, Sarah Shackelford	Pump with a Purpose
Colorado State University	Jordan Jalving, Justin Nelson, William Buchanan, Todd Zurlinden, Peter Bowron, Sky Tyler	Carbon Capture and Sequestering
Drexel University	Jacqueline Bayer, Jeffrey Dowgala, Liam Hendricken, Lauren McNally	Retrofit of Historic Warehouse to New Medical Clinic in Tulsa, OK
Duke University	Ian Gong, Jing Guo, Michael Kotecki, David Tainter	Universally Accessible Contact Cement Applicator
Georgia Institute of Technology	Neil Shah, Brandon Fox, Rohan Trivedi	The EEGLE-EYE Anti-Drowsy Driving System
Lafayette College	Diana Hasegan, Bryan Hendrickson, Connor McGee	Sustainable Solutions: Sport Complex of Renewable Energy (SCORE) at Metzgar Field Athletic Complex in Forks Township, PA
Louisiana State University	Alex Mayeux	Alternative Energy Options for a "Green Lab"
Michigan Technological University	Isabel Wescoat	Consumer Product Manufacturing Enterprise: Keweenaw Brewing Company Depelletizer and 3M Vacuum Thermoformer
North Carolina State University	Graham Bruns, Stephen Pearsall	CAT Bus Maintenance and Operations Facility Design Raleigh, NC
Oregon State University	Megan Colbath, Max Broehl, Nick Cornilsen	S.W.A.T Reconnaissance Robot: Manipulator Arm
Oregon State University	Brent Hughes, Derek Sugiyama, Mary Beth Vanlue	Improvement in a Non-Profit Organization Process
Stevens Institute of Technology	Peter Backeris	The Digital Triage Assistant
University of Colorado	Daniel Ambrosio, Ryan Del Gizzi, Bobby Hodgkinson, Colin Miller, Jared Kirkpatrick, Julie Price, Tyler Thomas	CUBOAT: Colorado Underwater Buoyant Oceanic Acoustic neTwork
University of Colorado	Colin Apke, Alicia Harris, Mason Hauck, David Joy, Kelly Loving, Jared Russell, Dylan Smith, Matt Stephenson	DANTE: Demonstration of an Afterburner and Nozzle on a Mini-Turbojet Engine
University of Colorado	Christine Fanchiang, Taylor Donaldson, Chad Healy, Stephen Huhn, Ben Kemper, Jeffrey McCoy, Casey Griswold	Dream Chaser
University of Colorado	Yevgeniy Fedotov, Sara Little, Joshua Rust, Ian Trucco, Kryztopher Tung	Laparoscopic Surgery Simulator
University of Colorado	David Gerhardt, Drew Turner, Colton Dunlap, Laura Potter, Randall Myers, Sean Gale, Murali Nallamothu, Nick Tarasenko, Quntin Schiller, Corinne Vannatta, Abhishek Mahendrakumar	Colorado Student Space Weather Experiment
University of Connecticut	Ryan Simmons, Weston Kruse	Effects of Coil Design & Eddy Currents on Solenoid Actuator Performance
University of Rhode Island	John Logan, Michael Lee, Daniel Reinhard	Cylindrical/Spherical Near-Field Antenna Measurement System
University of South Florida	Francesco DiNatale, Guiseppe DiNatale, John Mercer, Donald Ray	A Computer Engineering Capstone Design Project: A Harvard Architecture Assembly Simulator
University of South Florida	Brandon Kruse, Graham Roach, Ben Nelson, Erin Moree	Scarles Laparoscopic Surgical Tool

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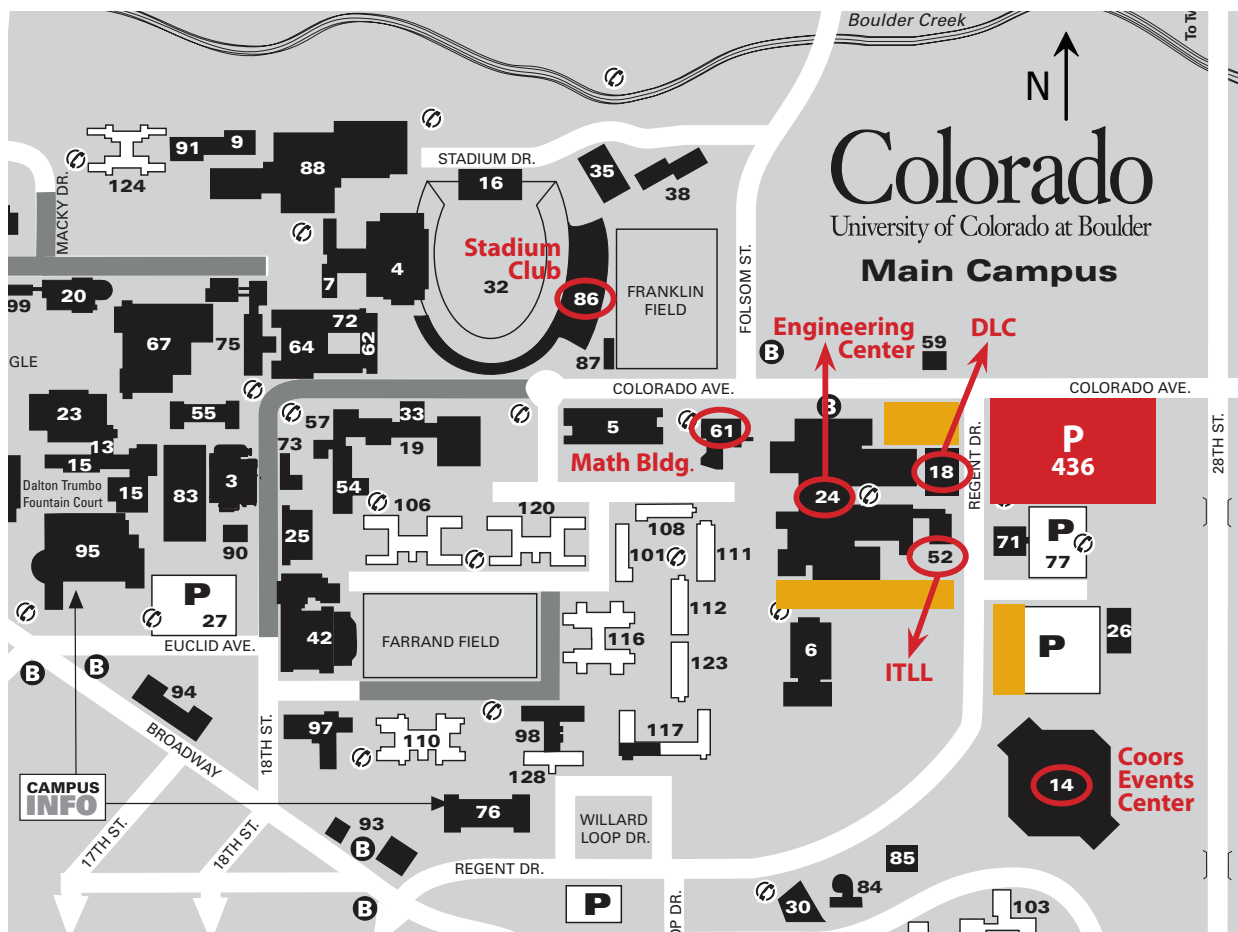
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■ **If you have purchased a parking pass available for the duration of the conference:** Park your car in lot 436, on the southeast corner of Colorado Ave. and Regent Dr., entering the lot from Regent Dr., proceed to the registration table located on the first floor of the Engineering Center **(24)** to register and receive your parking pass. Then fill out the parking pass as required, return to your car and hang it from your rear view mirror. This pass will allow you to park in lot 436 for the duration of the conference.

■ Registration and all conference sessions, excluding the plenary sessions, will be held in the Engineering Center **(24)** and the ITLL **(52)**. The registration desk is located on the first floor of the Engineering Center **(24)** near the revolving doors and elevators. If approaching from the east (parking lots or walking from hotels) cross Regent Dr. at the marked crosswalk and enter the Engineering Center **(24)** between the ITLL **(52)** and the DLC **(18)**. Continue to the west and enter the Engineering Center **(24)** through the double doors on the 1B level of the complex. Proceed up the stairs and head towards the revolving doors on the west side of the building. The registration desk will be located on your right as you head through the lobby.

■ The Monday afternoon, Tuesday and Wednesday morning keynote talks will be held in the Math Building **(61)**, the first building west of the Engineering Center.

■ The reception will be held in the DLC Atrium **(18)**.

■ The poster session will be held in the Stadium Club **(86)**.

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