Fall Industrial Advisory Board Meeting

October 28, 2016
Introduction & Welcome
Agenda

• Department Update
• Industry Spotlight
• ECE Faculty Spotlight
• Break
• Trends in Engineering Education/Previous IAB Recommendations
• Breakout Session
• Report Results of Breakout Session
• Lunch
Welcome Guests/New Members

• Jason Fritz, Rincon Research Corporation
• Richard Troksa, Gold Aspen Consulting
• Alan Wang, Pelco by Schneider Electric
Department Update

Prof. Tony Maciejewski
Department Head
Electrical and Computer Engineering
Colorado State University
10 Years of Service – Thank You!

- Dan Ferguson
- Dana Kirchmar
- Scott Lukes
- Paul Monson
- Kurt Rentel

Photos taken at Spring 2007 IAB
Two Early Career Endowed Professorships Awarded to ECE Faculty

Lisa and Desi Rhoden Professorship in ECE

Rockwell/Anderson Professorship
Professors Menoni and Rocca Named CSU Distinguished Alumni Employees

Jorge Rocca, Ph.D. EE, ’83; Carmen Menoni, Ph.D. Physics, ’87
Chandra Knighted by Finnish Government
Faculty and Staff Honored at 2016
Celebrate! Colorado State Awards
Ceremony

Sudeep Pasricha
Monfort Professor

Melissa Reese
Outstanding Administrative Professional

Branislav Notaros
CSU Distinguished Teaching Scholar
Recent Online Features

• NSF-sponsored research aimed at keeping miners safe
  • Collaboration with Colorado School of Mines

• ECE research in early melanoma detection featured on Denver’s Channel 7

• Student feature: ECE freshman loves math and juggling

engr.colostate.edu/ece
Results of 2016 Best Paper Contest

• Winner is …. Signal Manipulation for the Hearing Impaired
  o Thanks for your continued support of the contest!
Industry-Student Engagement

• Engineer-in-Residence
  o Increased interactions with students
  o Growing interest in program from industry

• Keysight Mentoring Program
  o Unique pilot program to fill pipeline with talented students
  o Experimenting with “tech interactions” and product demos to replace tech talks
COE Research Expenditures FY16

- CIRA: 33%
- ATS: 20%
- ECE: 14%
- CEE: 19%
- ME: 11%
- CBE: 3%

College of Engineering: 46%
COE Research Expenditures

Year | CBE | ME | ECE | CEE
---|-----|----|-----|-----
2011 | $2,000,000 | $4,000,000 | $6,000,000 | $8,000,000
2012 | $2,000,000 | $4,000,000 | $6,000,000 | $8,000,000
2013 | $2,000,000 | $4,000,000 | $6,000,000 | $8,000,000
2014 | $2,000,000 | $4,000,000 | $6,000,000 | $8,000,000
2015 | $2,000,000 | $4,000,000 | $6,000,000 | $8,000,000
2016 | $2,000,000 | $4,000,000 | $6,000,000 | $8,000,000
ECE Research Expenditures

- 2001: $0
- 2002: $2,000,000
- 2003: $4,000,000
- 2004: $6,000,000
- 2005: $8,000,000
- 2006: $10,000,000
- 2007: $12,000,000
- 2008: $14,000,000
- 2009: $16,000,000
- 2010: $18,000,000
- 2011: $20,000,000
- 2012: $22,000,000
- 2013: $24,000,000
- 2014: $26,000,000
- 2015: $28,000,000
- 2016: $30,000,000
COE Student Credit Hours (‘15-’16)

- ECE: 18%
- ATS: 5%
- CEE: 27%
- CBE: 9%
- ME: 38%
- Intra-College: 3%

- ECE
- ATS
- CEE
- CBE
- ME
- Intra-College
ECE Student Credit Hours

- 2011-2012
- 2012-2013
- 2013-2014
- 2014-2015
- 2015-2016

Grad
Undergrad

Colorado State University
Department of Electrical and Computer Engineering
Freshmen Enrollment

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<th>Year</th>
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<td>40</td>
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</table>
ECE Freshmen Enrollment: Colorado Institutions

- Colorado School of Mines
- Colorado State University
- University of Colorado Boulder
- University of Colorado Colorado Springs
- University of Colorado Denver


Number of Students:
- 0
- 20
- 40
- 60
- 80
- 100
- 120

Graph showing the enrollment trends over the years for each institution.
ECE Undergraduate Enrollment: Colorado Institutions

- Colorado School of Mines
- University of Colorado Boulder
- Colorado State University
- University of Colorado Denver
- University of Colorado Colorado Springs
ECE Freshmen Retention to 2nd Fall

Cohort Size of First-Year ECE Students

Persistence Rates of First-Year ECE Students through the 2nd Fall

Persistence Rates Within Department by Cohort Department and Cohort Term

- Dot com bubble
- “The World is Flat”
- The Great Recession
ECE Freshmen Retention to 6th Fall

Cohort Size of First-Year ECE Students

Persistence Rates of First-Year ECE Students through the 6th Fall

Persistence Rates Within Department by Cohort Department and Cohort Term
Women in Engineering (FA16)

Undergraduate

- CEE, 28%
- ME, 17%
- ECE, 8%
- Intra-College, 32%

Graduate

- CEE, 38%
- AS, 15%
- ECE, 23%
- BME, 9%
- ME, 7%
- Intra-College 4%
- CBE, 5%
Undergraduate Degrees Awarded

Number

BSCpE
BSEE

Full Year

2010-11
2011-12
2012-13
2013-14
2014-15
2015-16

Colorado State University
Department of Electrical and Computer Engineering
Graduate Degrees Awarded

Number

Full Year


MS  Ph.D.  Online ME in ECE
Percent of International Degrees Awarded

- Ph.D.
- MS
- Online ME in ECE
- Total

Full Year

- 2010-11
- 2011-12
- 2012-13
- 2013-14
- 2014-15
- 2015-16

- 0%
- 10%
- 20%
- 30%
- 40%
- 50%
- 60%
- 70%
- 80%
- 90%
- 100%
Career Outlook for ECE Majors

- Among the **top 10 majors in demand** for B.S., M.S., and Ph.D. degrees*

- In 2015, **100% of ECE graduates had employment related to their major**
  - CSU average is 75%**

- ECE graduates earned the **highest starting salaries** in the College of Engineering**

*National Association of Colleges and Employers Annual Job Outlook Reports
**CSU First Destination Study, 2015
Average Starting Salaries for Recent CSU Bachelor’s Grads

2015 First Destination Survey Results

• Electrical Engineering – $71,125
• College of Engineering average – $60,497
• CSU average - $47,039
Current Status of RED Project

• Delivering junior-level Learning Studio Modules and Knowledge Integration activities for FA16

• Conducting formative assessment of new active learning components

• Graduate Teaching Fellow designated to interface with Math department

• Implemented cohort teams in freshmen and junior years
RED Next Steps

• Break up sophomore-level curriculum
• Deliver junior-level LSMs and KIs for SP17
• Develop dedicated web site for the project
• Conduct analyses, submit to conferences and journals, and continue data collection
• Focus on broader dissemination
• Continue to solicit IAB feedback about the project
Status of M.S. & Ph.D. in Computer Engineering

- Approved on campus – awaiting final approvals
- Recruitment for new faculty member in progress
New ECE Certificates Available

Available online and on-campus:
• Computer Systems Engineering
• Embedded Systems
• Power and Energy
Update on Spring Action Items

• **Action item:** For next year’s E-Days judging, implement the following:
  – allow for “n/a”
  – provide prompting questions
  – allow for .5 scoring

• **Status:** These ideas will be added to the judging form

• **Action item:** Share results of SP16 E-Days judging
IAB Assessment of Professionalism in Senior Design Projects (SP16)

Averages per category

0 - Unacceptable
1 - Developing
2 - Exceptional

Global & Cultural Awareness
Ethics & Professional Responsibility
Leadership
Teamwork
Communication
• **Action item:** Consider IAB’s ideas for instilling professionalism

  – Short course on business
  – Emphasis on small and big teams, teambuilding exercises
  – Leadership training
  – Professional skills mentoring
  – Etiquette training
  – Multi-national experiences
  – Allow students to “feel” different workplace scenarios
  – Share case studies/storytelling
  – Book of Knowledge
  – Gate Modeling (fail fast, fail often)
  – Logical vs. emotional risk value
• **Status:** Team created to advise and assist with professionalism thread

**Industry Professionals**
- Pramit Rajkrishna
- Jason Fegley
- Jim Greener
- Dan Ferguson
- Richard Troksa
- Lead: Alma Rosales

**CSU**
- Tony Maciejewski
- Tom Siller
- Zinta Byrne
- Olivera Notaros
- Alistair Cook (grad student)
- Kelly Cave (grad student)
Foci of Professional Formation Team

- Leadership
- Teamwork
- Communication
- Cultural Adaptability
- Ethics

RED Professional Skills Focus Areas
Professional Formation Team’s Completed Actions

StrengthsFinder administered:

✓ Freshmen: Aug 19
✓ Juniors: Aug 30
✓ Faculty and staff: Sept 24

Team Charters established:

✓ Freshmen: Aug 13
✓ Juniors: Aug 13
Professional Formation Team’s Activities in Progress

Teamwork (Rajkrishna)
• Working with Kelly Cave to identify teamwork activities
• Goal is to roll out two team activities for freshmen per month
• True Colors (Spring 2017)

ePortfolios (Siller)
• Rolled out on a small scale in SP17

Social Communities (Greener, Troksa)
• Identifying plans for SP17

Cultural Adaptability (Maciejewski)
• Submitted NSF proposal with PUC in Santiago, Chile

Research (Byrne)
• Professional Learning Institute (PLI) attitude survey week of Sept 19

Ethics (Ferguson/Greener)
• Identified 12 ethics case studies
• Ethics speaker will be scheduled SP17

Communications (Fegley)
• Located relevant online resources
• Identified speaker evaluation forms

Leadership (Greener)
• Speaker from HP is scheduled on 10/24 to discuss conflict resolution
Industry Spotlight

Ball Aerospace

Jacob Sauer
Director of Advanced Systems
ECE Faculty Spotlight

Professor Branislav Notaros
University Distinguished Teaching Scholar
IEEE Undergraduate Teaching Award Recipient
Break
Engineering the Future:

Trends in engineering education and IAB recommendations over the last decade
Visions of Engineering in the 21st Century

2004
What will, or should, engineering be like in the 21st century?

2007
Actions to maintain global competitiveness in the 21st century

2010
“Rapidly approaching category 5” – innovation a promising avenue

2016
Preparing young people to solve “grand challenges”
NAE: The Grand Challenges

1. Advance personalized learning
2. Make solar energy economical
3. Enhance virtual reality
4. Reverse-engineer the brain
5. Engineer better medicines
6. Advance health informatics
7. Restore and improve urban infrastructure
8. Secure cyberspace
9. Provide access to clean water
10. Provide energy from fusion
11. Prevent nuclear terror
12. Manage the nitrogen cycle
13. Develop carbon sequestration methods
14. Engineer the tools of scientific discovery
Trends in Engineering Education

• Women in undergraduate engineering has remained mostly unchanged in the last decade

• Enrollments and bachelor’s degrees have increased for last 10 years
  – Mechanical enrollments are soaring
  – Dropout rates still higher than desired

• International student enrollment in the U.S. has increased considerably at undergrad and grad levels
  – Increase in public/private partnerships
  – Global student mobility
CSU Engineering Enrollments

Number of Students by Department and Year

- **Chem & Bio**
- **ECE**
- **Civil & Env.**
- **Mech**

Department by Year:
- **2012**
- **2013**
- **2014**
- **2015**
- **2016**

Ph.D.
M.S.
B.S.
Biomedical Dual Majors

Number of Students

Department by Year

Bio Eng w/EL
Bio Eng w/EE
Bio Eng w/CB
Bio Eng w/ME

National Persistence in Engineering

Persisted to 2nd year
Degree within 6 years
Degree within 4 years

Percent
# Share of Women by Discipline in Last Decade

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<td>41.4%</td>
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<td>18.2%</td>
<td>45.9%</td>
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<td>36.3%</td>
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<td>Engin. Science and Eng. Physics</td>
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<td>Nuclear Engineering</td>
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<td>Petroleum Engineering</td>
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<td>16.9%</td>
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<tr>
<td>Computer Science (Inside Engineering)</td>
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<tr>
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Share of Women by Discipline in Last Decade

- Environmental up 9%, biomedical up 5%
Share of Women by Discipline in Last Decade

- Environmental up 9%, biomedical up 5%
- Total engineering up 3%
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- Environmental up 9%, biomedical up 5%
- Total engineering up 3%
- Mechanical and ECE up about 2%
Bachelor’s Degrees Awarded to Women in Engineering (2015)

Percentage of Bachelor’s Degrees Awarded to Women by Discipline: 19.9% of Total
Bachelor’s Degrees Awarded to Women in Engineering (2015)

- Bio & environmental disciplines have largest share of women
Bachelor’s Degrees Awarded to Women in Engineering (2015)

- Mechanical, electrical, and computer still unacceptably low
Women’s Share of S&E Bachelor’s Degrees by Field (2000-2013)
International Students Enrolled in U.S. Institutions, S&E Fields

Number of Students

- Undergraduate
- Graduate

First University S&E Degrees by Country (2000-2012)
Previous IAB recommendations (2005)

Questions

• What curricular changes should be made to address the changing face of engineering?
• How can we reach the right students and encourage their pursuit of engineering?
• What should the relationship with industry look like?

IAB Recommendations

• Do not abandon the fundamentals
• Provide wider range of continuing education opportunities for industry
• Continue to engage industry, particularly through senior design
• Idea of Best Paper Contest introduced
ECE’s Response to ’05 Suggestions

• Lectures, seminars shared with IAB; online courses and certificates now offered through department

• Deeper IAB engagement in all aspects of program – from serving as adjunct faculty to delivering lectures to securing equipment/funding

• Best Paper Contest launched to emphasize and assess communication skills

Zach Blackwell, Inaugural Recipient of ECE Best Paper Contest
Previous IAB recommendations (2011)

Questions

• What programmatic changes should be made? How do we plan for 2015, 2020, and beyond?
• How would you design the ECE curriculum, and what are the skills needed for future engineers?
• What should the relationship with industry look like?

IAB Recommendations

• More collaboration with Math department
• Spark interest in ECE earlier in curriculum
• Partner with industry (e.g., IEEE) to generate interest in engineering
• Modernize teaching methods
• Work on K-12 outreach strategies to help engineering students enter the university better prepared
ECE’s Response to ’11 Suggestions

- Math collaboration strengthened
  - Special calculus recitations for ECE students
  - Math Foundations Thread established

- Student projects introduced at freshman and sophomore levels to spark interest in ECE

- Increased emphasis on industry engagement
  - Engineer in Residence program created in partnership with IEEE
ECE’s Response to ’11 Suggestions (cont’d)

• Active teaching and assessments are being implemented, e.g., flipped classroom approach

• Social media outlets utilized to share information with students
  – However, recent survey of ECE students indicated low preference for social media for communicating department-specific info

• K-12 recruitment efforts bolstered
  – ECE recently received competitive institutional grant to educate high school counselors about ECE
What’s Next?
Breakout Session

Facilitators:
Steve Martin and Art Lizotte
Realizing the Visions of Engineering in the 21st Century

• Do industry trends align with current issues in higher education?

• How are we doing in our efforts to generate globally-engaged engineers?

• Are you hiring CSU ECE students? Why or why not?

• How do our students compare to our peers nationwide?

• How can industry and ECE come together to address the grand challenges of our profession and the needs of our global economy?

• Are the needs and tactics different for undergraduate vs. graduate students?
Facilitators:
Steve Martin and Art Lizotte
Closing Remarks
Call to Action