Industrial Advisory Board Meeting

November 11, 2022
What We’ll Cover Today

• Department Updates, News, Numbers
• ECE Faculty Spotlight
• Engineer in Residence Program Update
• Breakout Session: Fostering a Creator Culture
• Endorse New VP
• Tour of Richardson Design Center
Welcome New Attendees

• Victoria Bohannon-Pea
  BSEE ’17
  Arrow Technologies

• Don Soltis
  BSEE ’84, MSEE ’88
  Intel
Personnel Updates

• My term as Department Head began 7/1
  – Tony remains on faculty

• Welcome Brandon Bailey, ECE Department Manager

• Two new faculty searches underway
  – Computer Engineering
  – Lasers and Optics

• Engineering Dean concludes term this summer
New Programs

• Biomedical Engineering + Computer Engineering Dual Degree

• Graduate Certificate in Aerospace: Satellites, Radars, and Remote Sensing
Recent News and Publicity
CSU lands grant to expand cyberinfrastructure

Led by ECE Professor Sudeep Pasricha, the new HPC system will help amplify research across campus
Haonan Chen receives competitive Powe Junior Faculty Enhancement award

The assistant professor is using artificial intelligence to predict severe weather events
Leading scientists converge at CSU to amplify laser research

The LaserNetUS Users’ Conference brought together leading researchers who are using the world’s most powerful lasers

• Led by Prof. Rocca, ECE is part of the LaserNetUS network
Chandra honored by American Meteorological Society

He received the Suomi Technology Medal for leadership in developing techniques to observe precipitation processes using dual-polarization and spaceborne radar.
CSU hosts science team meeting for satellite mission INCUS

ECE Professors Chandra and Reising are part of a team working on the $177 million NASA Earth Venture mission
Mahdi Nikdast named recipient of Rockwell-Anderson Professorship

The funding provides support for innovative teaching and research
Branislav Notaros recognized by IEEE Society for best paper of year

He received the award for authoring the top journal paper published in *IEEE Antennas and Propagation Magazine* in all of 2021.
CSU researchers funded by DARPA to demystify neural networks, improve cybersecurity

ECE research scientist Dr. Yajing Liu is an investigator on the project
Student Accolades
Senior design teams profiled as part of E-Days publicity

Thanks for helping judge E-Days last spring!

GoKart Team

RamBOTS Team
ECE grad student featured for work to fight mitochondrial diseases

Arya Mugdha is working with Professor Jesse Wilson to develop a noninvasive imaging tool to study mitochondria inside living cells.
Spring 2022 Outstanding Graduate: Calvin Tai

“When times were hard, I always convinced myself to pull through. This helped not only in computer engineering but also in my computer science major where continuous learning is essential.”
Share your stories with us!
National Undergraduate Enrollment by Discipline

- Mech Engr
- ECE
- Civil Engineering
- Chemical Engineering
- Biomedical Engineering
- Environmental Engineering
- Total All Disciplines

*ASEE by the Numbers*
Engineering Undergraduate Enrollment at CSU

Undergraduate Students

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

Includes BME dual degrees
ECE Undergraduate Enrollment Trends

- Fall 2013: 339
- Fall 2014: 347
- Fall 2015: 363
- Fall 2016: 433
- Fall 2017: 470
- Fall 2018: 439
- Fall 2019: 444
- Fall 2020: 435
- Fall 2021: 408
- Fall 2022: 388

ECE Undergraduate Primary Majors (includes BME)
Undergraduate Demographics (2022)

- 23% Non-traditional
- 20% First-generation
- 10% Female
- 18% International
- 36% Non-resident

*Does not include BME dual majors*
Freshman Enrollment

<table>
<thead>
<tr>
<th>ECE Students</th>
<th>Fall 2018</th>
<th>Fall 2019</th>
<th>Fall 2020</th>
<th>Fall 2021</th>
<th>Fall 2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomed + EE/LO</td>
<td>9</td>
<td>45</td>
<td>7</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Biomed + EE</td>
<td>43</td>
<td>30</td>
<td>44</td>
<td>32</td>
<td>42</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>49</td>
<td>35</td>
<td>35</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>Computer Engineering</td>
<td>34</td>
<td>42</td>
<td>32</td>
<td>45</td>
<td>42</td>
</tr>
</tbody>
</table>
Freshman Enrollment: ECE vs. CS

Fall 2018  Fall 2019  Fall 2020  Fall 2021  Fall 2022

ECE Students:
- Fall 2018: 34
- Fall 2019: 45
- Fall 2020: 44
- Fall 2021: 35
- Fall 2022: 42

Computer Science Students:
- Fall 2018: 43
- Fall 2019: 49
- Fall 2020: 30
- Fall 2021: 32
- Fall 2022: 45

Graph showing enrollment trends for ECE and Computer Science over the years from Fall 2018 to Fall 2022.
ECE Freshman Enrollment: Colorado Institutions

Data does not include biomedical dual degrees

Sources: ASEE, CSU IR

Electrical & Computer Engineering Freshmen

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

Data does not include biomedical dual degrees

Sources: ASEE, CSU IR
Breakdown of Computer Engineering Undergrad Enrollment (2022)

Computer Engineering Major, 116

- Embedded and IoT Systems Concentration, 10
- Aerospace Systems Concentration, 5
- Networks and Data Concentration, 4
- VLSI and Integrated Circuits Concentration, 2
Breakdown of Electrical Engineering Undergrad Enrollment (2022)

- Electrical Engineering, 212
- Dual Degree and Concentrations
  - BME + EE Dual Degree, 26
  - Aerospace Concentration, 10
  - EE w/Lasers and Optics Concentration, 3
A Changing Landscape

• Demographers predict an “enrollment cliff” beginning in 2025, when the traditional college-age population will start shrinking for the foreseeable future

• As demographics shift, data suggest future students will be increasingly Latinx

• ECE enrollments dropping nationwide

* NPR: “The college enrollment drop is finally letting up. That’s the good news.” – 10/20/22

“We’re not seeing a return of what we might call the lost freshmen of fall 2020 and fall 2021 ....There's not a lot of evidence in these numbers that they're coming back now.”*

– Doug Shapiro, National Student Clearinghouse
ECE Retention and Persistence

Persistence within Department and Cohort Size by Cohort Term
First-Time Full-Time Students
Graduation within ECE Department

Graduation within Department and Cohort Size by Cohort Term
First-Time Full-Time Students

Graduate within 4 years: Green
Graduate in 5th year: Yellow
Graduate in 6th year: Orange
Cohort Size: Black
ECE Graduate Enrollment

*Includes RI & non-RI; all campuses
Master’s Enrollment

*Includes RI & non-RI; all campuses

M.S. Electrical Engineering
M.S. Computer Engineering
Ph.D. Enrollment

*Includes RI & non-RI; all campuses
Declining International Students

• The total number of international students at U.S. universities **dropped by 15%** 2019 to 2021

• The number of new international students enrolling in U.S. universities **dropped by 45.6%** in that time frame

• China and India sent **14.8% and 13.2% fewer students**, respectively, in that time period

*U.S. News & World Report – 11/15/21*
### Table 1: U.S. and Canadian International Student Enrollment

<table>
<thead>
<tr>
<th>Country</th>
<th>Change in International Student College/University Enrollment 2016-17 to 2019-2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>-7%</td>
</tr>
<tr>
<td>Canada</td>
<td>+52%</td>
</tr>
</tbody>
</table>

### Table 2: Indian Students Enrolled in U.S. Master’s-Level Science and Engineering Programs

<table>
<thead>
<tr>
<th>Country</th>
<th>2016-17 Academic Year</th>
<th>2019-20 Academic Year</th>
<th>Decline 2016-17 to 2019-20</th>
</tr>
</thead>
<tbody>
<tr>
<td>India - Master’s Degree Students in Science and Engineering</td>
<td>83,610</td>
<td>51,810</td>
<td>-31,800 (-38%)</td>
</tr>
</tbody>
</table>

*Forbes: “U.S. International Student Enrollment Dropped As Canada’s Soared,” March 2022*
Plummeting Visas for Chinese Students

The number of visas recently issued to Chinese students for the 2022-23 academic year dropped by nearly 40,000 from the same period last year.

Source: Chronicle analysis of visa data collected by the U.S. Department of State. • [Get the data] • Created with Datawrapper
International Students in ECE

Number of International Students

Fall 2013: Undergraduate 10, Graduate 170
Fall 2014: Undergraduate 10, Graduate 170
Fall 2015: Undergraduate 10, Graduate 220
Fall 2016: Undergraduate 10, Graduate 170
Fall 2017: Undergraduate 10, Graduate 170
Fall 2018: Undergraduate 10, Graduate 170
Fall 2019: Undergraduate 10, Graduate 170
Fall 2020: Undergraduate 10, Graduate 170
Fall 2021: Undergraduate 10, Graduate 170
Fall 2022: Undergraduate 10, Graduate 170

Undergraduate | Graduate
Women in Engineering
Bachelor’s Degrees to Women (2021)

- Environmental and bioengineering disciplines have largest share of women

Source: ASEE by the Numbers, 2021
Bachelor’s Degrees to Women (2021)

Source: ASEE by the Numbers, 2021
Women in Engineering (FA22)

Undergraduate:
- Mech: 17%
- CBE: 14%
- CEE: 31%
- Engr. Intra-College (incl. BME): 33%
- ECE: 5%

Graduate:
- Systems: 24%
- ATS: 18%
- SBME: 7%
- Mech: 9%
- ECE: 12%
- CEE: 28%
Women in ECE

Does NOT include BME

Percentage of Women in ECE

Number of Women

Undergrad

Grad

Total Undergraduate Women

Total Graduate Women

% Women Undergrad

% Women Grad

Does NOT include BME
Undergraduate Degrees Awarded

Number of Graduates

- Electrical Engineering
- Computer Engineering
- Electrical Engineering/Lasers and Optical Engineering
- Aerospace

Years:
- 2013-14
- 2014-15
- 2015-16
- 2016-17
- 2017-18
- 2018-19
- 2019-20
- 2020-21
- 2021-22
ECE Research Areas of Strength

- Biomedical Engineering
- Communications and Signal Processing
- Computer Engineering
- Controls and Robotics
- Electromagnetics and Remote Sensing
- Lasers and Photonics

www.engr.colostate.edu/ece/research
CSU RESEARCH EXPENDITURES 2013-2022

RESEARCH EXPENDITURES HAVE INCREASED 46% IN 10 YEARS

<table>
<thead>
<tr>
<th>Year</th>
<th>Millions of Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>$313</td>
</tr>
<tr>
<td>2014</td>
<td>$308</td>
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<tr>
<td>2015</td>
<td>$317</td>
</tr>
<tr>
<td>2016</td>
<td>$332</td>
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<tr>
<td>2017</td>
<td>$338</td>
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<tr>
<td>2018</td>
<td>$375</td>
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<td>2019</td>
<td>$398</td>
</tr>
<tr>
<td>2020</td>
<td>$407</td>
</tr>
<tr>
<td>2021</td>
<td>$447</td>
</tr>
<tr>
<td>2022</td>
<td>$457</td>
</tr>
</tbody>
</table>
CSU RESEARCH EXPENDITURES BY COLLEGE

- Warner College of Natural Resources: $145.9M
- Walter Scott Jr. College of Engineering: $87.2M
- College of Vet Med and Bio Sciences: $75M
- College of Ag Sciences: $51.4M
- College of Nat Sci: $41.7M
- Other: $37.2M
- HHS: $14.2M
- CLA: $3.6M
- COB: $0.5M

Total: $456.9M
COE Total Research Expenditures

- 2017
- 2018
- 2019
- 2020
- 2021
- 2022

CBE
CEE
ECE
ME
ECE Total Research Expenditures

- 2006: $8,000,000
- 2007: $9,500,000
- 2008: $11,000,000
- 2009: $12,000,000
- 2010: $13,000,000
- 2011: $14,000,000
- 2012: $14,500,000
- 2013: $14,000,000
- 2014: $13,000,000
- 2015: $12,000,000
- 2016: $11,000,000
- 2017: $10,000,000
- 2018: $9,000,000
- 2019: $8,000,000
- 2020: $7,000,000
- 2021: $6,000,000
- 2022: $5,000,000

Actual was $12,985,706

Number of faculty decreased while expenditures held steady

Actual was $7,782,847
# Proposal Activity FY22

## 22 ECE Faculty Submitted Proposals

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposals submitted*</td>
<td>71</td>
</tr>
<tr>
<td>Total amount of proposals</td>
<td><strong>$32.7M</strong></td>
</tr>
<tr>
<td>Highest proposal amount w/ECE as lead</td>
<td>$2.2M to US Department of Energy</td>
</tr>
<tr>
<td>Highest proposal amount w/ECE as collaborator</td>
<td>$2M to NSF with CEE</td>
</tr>
<tr>
<td>Primary funding agencies</td>
<td>DOD, DOC-NOAA, DOE, NASA, NIH, NSF</td>
</tr>
<tr>
<td>Collaborators</td>
<td>Biomedical Sciences, CIRA,CBE, Chemistry, Computer Science</td>
</tr>
</tbody>
</table>

*ECE faculty are PI or co-PI*
Career Outlook
Employment Outlook for ECE Majors

100% Employment related to Major
Top 10 Majors in demand for B.S., M.S., and Ph.D.
$ Highest starting salaries in CSU College of Engineering

State Economy

2nd Largest aerospace economy in nation
#4 Highest Projected STEM-Job Demand by 2028
#5 Innovative state in nation

WalletHub, “Most and Least Innovative States” – 2022
National Association of Colleges and Employers Annual Job Outlook Report, 2019
CSU First Destination Study, 2019-2020
https://www.choosecolorado.com/key-industries/aerospace/
Promising Future Trends in ECE

- Computer occupations are behind strong STEM employment growth in the 2019-29 decade.

- Demand for computer engineers is expected to surge over the next 10 years due to continued growth in the digital economy.

- As technology advances across sensors, connectivity, processing power, and AI, new opportunities will emerge in aerospace and defense industry.

*Bureau of Labor Statistics, Beyond the Numbers Jan. 2021
**"What’s Next for Aerospace and Defense: A Vision for 2050"
Focal Point of ECE Community: CHIPS and Science Act

- Building a diverse, career-ready workforce
- Creating solutions for the climate crisis
- Revitalizing American science and innovation
- Supporting American manufacturing

Source and photo credit: https://science.house.gov/chipsandscienceact
ECE Faculty Spotlight

Mahdi Nikdast | Assistant Professor
Electrical and Computer Engineering
Engineer in Residence
Update

Richard Toftness
Head of Engineer in Residence Program
Prep for Breakout Session

Edwin Chong | Jackie Bastardi
Electrical and Computer Engineering
IAB’s ideas from SP22 breakout session on recruitment and retention

• Important to focus on retention; build sense of belonging with emphasis on women
• Show depth and breadth of discipline and connections to ECE career paths
• K-12 outreach should involve current ECE students
• Need to reach middle school students
• Tie ECE programs to Spur campus
• Consider developing subcommittee on outreach
New Creatorspace Builds on IAB Input

• Secured funding to develop ECE creatorspace to:
  • Improve retention
  • Improve gender diversity, create culture of inclusion
  • Increase enrollments
  • Enhance hands-on learning
  • Foster meaningful outreach

• Hired Jackie to support outreach and creatorspace project
Hi, I’m Jackie Bastardi!

- B.S. in Mechanical Engineering from Rochester Institute of Technology (2013)

- Masters in Natural Sciences Education from Colorado State University (2022)

- Currently enrolled in the Ph.D. in Education and Human Resources program at CSU, with a specialization in Education, Equity and Transformation
• Worked at Curious-on-Hudson from 2014-2021
• STEAM Instructor, Curriculum Development Manager and General Manager
• Hands-on and experiential STEAM enrichment for students

• Pre-K to 12th grade
• After school, in-school, workshop, summer/break camp and expo programs
• Emphasis on low-cost, high impact activities that are accessible to a wide range of schools and partner programs
Inspiring the Next Generation

- Presented at SXSWedu on “You Go (Far), Girl!” Program

- Partnered with:
  - NY Power Authority
  - Regeneron
  - Intrepid Air, Sea and Space Museum
  - TEP Charter School
Breakout Session: Fostering a Creator Culture

Steve Pacheco | Lynda Allen
Facilitators
Questions for Consideration

• How can the board help engage current and prospective students in the excitement of engineering to reduce our student attrition rate and grow ECE enrollment?

• How can industry help us create a welcoming and inspiring creatorspace for students of all backgrounds?

• How might we collaborate to reach students sooner (e.g., middle school)?
Break, Lunch Begins
Discuss Results of Breakout Session

Steve Pacheco | Lynda Allen
Facilitators
Endorse VP, Closing Remarks
Optional Tour