
ECE department: Andrea Leland, Tony Maciejewski, Olivera Notaros, Sudeep Pasricha, and HJ Siegel.

Guests and new members: Ali Black, Intel; Robert Brooks, Oracle; Lisa Husby, Spirae; Steven Kommrusch, AMD; Art Lizotte, Keysight; John Lotz, Ultrata; and Kyle Tarplee, Numerica.

1. Introduction and Welcome IAB Guests (Scott Evans, IAB president)
Scott opened with the Latin phrase, "Quid quo pro." With the focus of the meeting to further engage board members and solicit their support, he talked about the importance of a reciprocal relationship between the IAB and the ECE department. Scott welcomed the new IAB guests (outlined above), shared the day's agenda, and then turned it over to Tony Maciejewski, ECE department head, for the department update.

2. Agenda and Department Update (ECE Department Head Tony Maciejewski)
Tony welcomed the meeting attendees and delivered an update on the department, touching on the following topics.
• New Faces in ECE
  - Jade Morton, new faculty member and recently appointed IEEE Fellow
  - Courtney Johnsrud, academic advisor
• ECE Faculty Honored by CSU
  - Carmen Menoni, University Distinguished Professor
  - Chandra, University Distinguished Professor
  - Branislav Notaros, Provost’s N. Preston Davis Award for Instructional Innovation
• Prof. Notaros Recognized for Teaching Excellence
  - 2015 IEEE Undergraduate Teaching Award
  - Colorado Professor of the Year
• Department News
  - New web site launched: www.engr.colostate.edu/ece
  - Event to honor Prof. Wilmsen underway; contact Andrea for details
• Student News
  - Winner of 2014 Best Paper Contest announced: Single Molecule Tracking
  - Check out new project videos online
• Charts and data
  - COE research expenditures
  - ECE research expenditures
- ECE indirect costs
- ECE research expenditures per tenured faculty member: CSU & Peer Institutions ('09-'13)
- ECE research expenditures per tenured faculty member: CSU & Top 10 US News and World Report Institutions ('09-'13)
- College of Engineering student credit hours ('13-'14)
- ECE student credit hours
- National enrollment trends
- ECE fall enrollment
- Undergraduate degrees awarded
- Enrollment trends by class
- Freshmen enrollment
- ECE freshmen retention rates
- ECE Colorado freshmen enrollment: Colorado institutions ('09-'13)
- ECE Colorado undergraduate enrollment: Colorado institutions ('09-'13)
- ECE total undergraduate enrollment per tenured/tenure-track faculty member: CSU & peer institutions ('09-'13)
- ECE total undergraduate enrollment per tenured/tenure-track faculty member: CSU & select top institutions ('09-'13)
- ECE total undergraduate enrollment per tenured/tenure-track faculty member: CSU & peer institutions ('09-'13)
- COE average, $58,383
- Women in engineering (FA14)
- Women in ECE
- Graduate degrees awarded
- Percent of international degrees awarded

- **First Destination Survey Results**
  - ECE graduates earned the highest starting salaries university-wide
    - EE, $64,663
    - CpE, $60,333
  - COE average, $58,383
  - 82% of CpE grads have employment related to their major
  - 93% of EE grads have employment related to their major

- **Proposal for M.S. and Ph.D. in Computer Engineering**
  - Received approval to move forward with proposal
  - 4.5 faculty (out of 25.5) currently in computer engineering
  - Requesting additional resources partially funded from enrollments in new degree programs
  - Gain endorsements from IAB to bolster proposal
  - Median first-year earnings in CpE by CO institution (CSU CpE students earned highest salaries)

- **NSF RED Proposal**
  Tony shared the department's proposal to the National Science Foundation to revolutionize engineering education. Tony is the Principal Investigator (PI), and CoPIs are Tom Chen (ECE faculty lead), Michael De Miranda (engineering education expert), and Zinta S. Byrne (social scientist). The senior project personnel are Gerhard Dangelmayr (Dept Head, Mathematics), Thomas J. Siller (Associate Dean, Engineering), Branislav Notaros (Professor, ECE), and Alma H. Rosales (Industry). Tony provided details of the proposal, summarized in the following overview:

**Overview of SINC:** From Stovepiping to Integration and Collaboration: Fundamentally Change Engineering Departments and Education.
The current engineering educational system fails in two fundamentally critical ways. First, students who have the desire and aptitude to become accomplished and productive engineers are abandoning this course of study in startling numbers. Second, students who graduate are frequently not prepared for the realities of their chosen profession and are switching careers at alarming rates. We propose a new organizational model that looks at the undergraduate degree as an integrated system, breaking down the stovepipes inherent in higher education structures and implementing novel pedagogical approaches that allow students of all backgrounds to see the utility value of their knowledge and connections to professional practice. At the pedagogical level, the SINC approach combines rigor and flexibility in engineering education to improve efficacy and content knowledge integration. At the organizational level, the SINC approach aims to energize faculty to increase collaborations through longitudinal and latitudinal content threads to achieve the pedagogical objectives. Different from traditional faculty teaching roles, key faculty will serve as ”thread champions” to weave important threads throughout the curriculum, while others will assume the roles of ”integration specialists,” utilizing a new learning model that connects disparate anchoring concepts and facilitates knowledge integration. Whether demonstrating the relevance of content through research or hands-on projects, ECE faculty will work as a multifaceted team to ensure that every educational component gives consideration to the big picture, while instilling a deep knowledge of the discipline.

Questions and comments from IAB about SINC vision/proposal:

- **Is there a project focus related to this proposal, e.g., is there a course where students focus on design verification?**
  - Tony: This is one good example of a thread that will be woven throughout the curriculum.

- **Have you studied other educational models like this?**
  - Tony: Yes, we haven’t seen anything like this at the engineering level.

- **People in this room (industry) support this vision. Getting faculty to change is the concern. As a board, we could help with that.**
  - Tony: Yes, this is a cultural shift, which is why we need a social scientist on the team. The National Science Foundation wants to see how we can make the shift. Industry feedback is important, and there will be an advisory team associated with this proposal. We will propose that the changes will be overseen by many people in this room.

- **If awarded, what is the duration of the project and when will it go into effect?**
  - Tony: Three years, starting in FA15. Three thread champions plus integration specialists will be named. Their jobs will be to look at interfaces between existing courses as well as interfaces across multiple sequence courses.
  - IAB comment: This seems like something that should last 8 years. How can you really evaluate after three years? Will NSF continue funding after the initial three years? This is a huge shift.
  - Tony: I suspect the NSF will fund related continuation proposals.

- **Would this change have to occur at the university level?**
  - Tony: One constraint is that we can’t change the university rules and structure. We think our vision will be successfully realized and sustained because we have a plan that can accommodate the existing higher-education structure and build on its strengths. As an example, we can make sure core courses are in sequence (in a block), and that there are sections of math devoted to engineering students. We have taken some steps already, and the math department head has been very supportive of our efforts.

- **How does Computer Science fit in?**
  - Tony: We will continue to maintain close ties with Computer Science. Many of our courses are cross listed, but CS is not a focus in terms of foundations. However, CS coursework fits into the creativity thread of the proposal.
• Do you find some of your professors pushing this, specifically the senior professors – do they wish students learned project skills earlier on?
  o Tony: We tried the Tiger Team a few years ago, and we learned that our faculty believe in these ideas, but no one has been held accountable for implementation, and there wasn’t anyone handling the integration of knowledge. The proposed model addresses these concerns.

• There was a time when physics was applied to biology, but the big picture was missing. If you focus too much on interfaces, don’t lose sight of the big picture.
  o Tony: The goal IS for everyone to look at the big picture. The entire undergraduate degree is the “system” that allows students to obtain a degree in engineering. My thought is that these connections will enable the big picture. It relates to now, how it affects future learning, and the students’ careers. The mode of continuous education is facilitated.

• I see this as a tool to help them understand which area of ECE they want to go into. It will show the breadth of the field. It will help guide them toward research, sales, etc., or whatever area interests them.
  o Tony: I’m all about giving the students the info they need to succeed. I’m concerned that some people really don’t realize what they’re going to be doing with a degree in electrical or computer engineering. I think the new structure will change this.

• Make sure requirements and stakeholders are clearly defined, much like systems engineering.

Update on spring action items:
• **Action item:** Develop best practices guide for corporate sponsors of senior design.
• **Status:** Using examples from Wolf Robotics and Woodward to create materials.
• **Action item:** Encourage students to identify where their projects fall on the spectrum of technology in industry.
• **Status:** Need industry mentors with technical expertise to help with this. Any interest?
• **Action item:** Address the issue of students not being able to explain WHY their projects are important.
• **Status:** Established new requirements for student project plans: 1) project summary (200 words); 2) statement of why project is important (75 words)
• **Action item:** Help students improve communication and marketing skills, e.g., project posters.
• **Status:** Ed Minnock and Susan Hunter will touch on this as part of their efforts to help students with project planning and risk mitigation.
• **Action item:** Hold future IAB meetings in conjunction with Engineering Days.
• **Status:** Spring meeting coincides with E-Days: April 17, 2015

3. **Overview of Pilot Project with Senior Design (Susan Hunter, Propel Labs, and Ed Minnock, Minnock and Associates)**

Susan and Ed talked about their experiences with the smart, enthusiastic senior design teams. They discussed their general perceptions of the process and said it seemed beneficial for them as well as the students. Susan believes that the senior design program has improved over the years due to IAB inputs. Ed and Susan also shared weaknesses identified by students: understanding industry needs, presenting/quantifying results, lack of clearly defined products, time management, understanding the customer, problems in team dynamics.

Specific examples of how industry can help the teams:
1) Having students talk with chip company about dealing with connector speed challenges
2) The cyber security project team could benefit from IT professionals worried about security
4. **Research Spotlight: ECE Professor Jade Morton**
ECE Professor Jade Morton, who joined the department in the fall, delivered an interesting and engaging talk on her work in Global Position Systems, sharing satellite navigation challenges and opportunities.

5. **Industry Spotlight: Precision Biopsy (John Nichols, VP of Product Development)**
Longtime board member John Nichols shared an overview of his company, Precision Biopsy, a start-up company with five full-time employees plus consultants and design partners. The company was formed in partnership with Allied Minds to develop and commercialize novel technology for the accurate diagnosis of prostate cancer.

6. **Preparation and Background for Panel Discussion (Tony Maciejewski)**
To prepare for the breakout session, Tony outlined the purpose of the board, along with goals and tactics for industry engagement and workforce development.

7. **IAB Panel Discussion and Breakouts (Tony Maciejewski)**
Tony led a panel discussion with the following panelists:
   - Scott Evans, Arrow Electronics
   - Jason Gentry, Avago Technologies
   - Jim Greener, Hewlett Packard
   - Lance Guymon, Wolf Robotics
   - Art Lizotte, Keysight Technologies

The panel responded to the following questions:
   I. *What role do you play in your company, and at what level are you currently involved with ECE? Give us a snapshot of your interactions?*
   II. *How do you gain executive buy-in for department initiatives?*
   III. *Are you a hiring manager and/or do you interact with your company’s HR team to make recruitment and hiring decisions?*
   IV. *When you are working with colleagues in the business community, do you promote ECE at CSU?*
   V. *How do you believe we can maximize industry support to advance the department’s reputation?*
   VI. *What have you gained from your relationship with the department and its students?*
   VII. *From a department perspective, what can we do to encourage deeper industry engagement?*

After the panel discussion, the board split into groups to discuss the above questions. The summary below provides highlights and important points of both the panel discussion and the breakouts.

**Summary of Panel and Breakouts:**
- The panel members share a commitment to ECE education and believe their relationship with the department is important. They have all given back to the department, from hiring ECE graduates to delivering classroom lectures.
- According to the panel, relationship building is the key to gaining buy-in from senior management for department initiatives. It is also important to show executives the ROI.
  - Tactical ideas include hosting more department events that attract business executives, such as piggybacking a Northern Colorado business meeting and/or IEEE meeting or hosting a special event at a CSU football game.
• As a rule, the board interacts with HR to write job descriptions and handle hiring logistics, but they manage most of the recruiting themselves, leveraging their relationships with the department and/or the university to find the best talent.

• The board thought it would be beneficial to have a PR packet about the department to help IAB members promote ECE within their organizations and to the external world.

• The IAB suggested expanding the department’s LinkedIn presence to advance its reputation and enable connections among alumni.

• Panel members touched on the professional and personal benefits of their membership on the IAB, including connections to the local business community and the ability to hire quality engineers. Lance Guymon noted, "Our retention is 100% for CSU students who participated in our internship program at Wolf."

• The IAB would like to see more faculty engagement and would like to learn more about their research and teaching needs; in turn, they would like to educate faculty about what’s going on in industry.
  o The board suggested having faculty participate in an upcoming meeting. One idea is to have a faculty member at each table for the breakout sessions, where they could share their research and perhaps provide lab tours afterwards.

• The board would like to see more department involvement with the IEEE. Specific ideas for events between the IEEE, IEEE student chapter, IAB, and ECE department include:
  o Mixer at a local establishment (CB&Potts, for example)
  o Event to help students develop and manage their LinkedIn profiles (Scott Lukes offered to help with this)
  o Event or lecture that outlines for students the typical company hiring and resume review process

• Some IAB members expressed interest in receiving additional communications from the department about grad exams, upcoming lectures, faculty talks, etc. Andrea will create a separate distribution list for board members interested in receiving such information.

• Several board members want to help the senior project teams. They suggested creating a directory of IAB members and their technical bios to serve as a resource for senior design students when they need help understanding industry standards and trends, perhaps making it available through LinkedIn.

• There may be adjunct teaching opportunities in the department for industry partners. Tony encouraged the board to contact him with suggestions of technical experts who may be interested. Likewise, the board likes the idea of asking faculty to serve as guest speakers on special topics of interest in their companies.

8. **Closing Remarks (Tony Maciejewski)**

Tony wrapped up the meeting and thanked the board for their participation. He encouraged the board to contact him or Andrea with additional ideas or comments regarding the meeting topics.

**ACTION ITEMS:**
• Create a PR packet about the department to help IAB members promote ECE within their organizations and to the external world.
• Expand the department’s LinkedIn presence to advance its reputation and enable connections among alumni.
• Have faculty participate in an upcoming meeting to share their research and possibly offer lab tours.
• Increase involvement with IEEE (e.g., mixer, LinkedIn seminar, or resume/hiring seminar)
• Find out if board members want to receive additional communications from the department, like grad exams, lectures, etc., and create a separate distribution list for such announcements.
• Create a directory of IAB members and their technical bios to serve as a resource for senior design students, perhaps making it available through LinkedIn.

The spring IAB meeting is scheduled for Friday, April 17, 2015.