Department Gap Analysis

CEAS Department Chairs
April 24, 2015
**GOALS FOR 2020+ // AEROSPACE ENGINEERING**

<table>
<thead>
<tr>
<th>Year</th>
<th>2014</th>
<th>2020+</th>
<th>change</th>
<th>college</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.S. students</td>
<td>494</td>
<td>618</td>
<td>25%</td>
<td>35%</td>
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<tr>
<td>M.S. students</td>
<td>129</td>
<td>168</td>
<td>30%</td>
<td>35%</td>
</tr>
<tr>
<td>Ph.D. students</td>
<td>127</td>
<td>241</td>
<td>90%</td>
<td>95%</td>
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<tr>
<td>Grant/gift expend.</td>
<td>15.2M</td>
<td>28.1M</td>
<td>85%</td>
<td>85%</td>
</tr>
<tr>
<td># Tenure-line fac</td>
<td>29</td>
<td>42</td>
<td>45%</td>
<td>50%</td>
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<tr>
<td>U.S. News grad rank</td>
<td>9</td>
<td>7</td>
<td>2</td>
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</tr>
<tr>
<td>College grad rank</td>
<td>34</td>
<td>20</td>
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<td>14</td>
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</table>

**Other Goals**
1. Aerospace Building on East Campus + Wind Tunnel
2. 4-5 faculty in the NAE/NAS (Forbes, Scheeres, other + new hires)
3. Fluids/struct & materials center focused on predictive performance
4. Grad and undergrad rankings **solidly** in the top 10
5. Endowed chairs and professorships to retain & recruit excellent faculty
6. Improved retention of undergraduate students
Faculty Demographics and Growth

- 31 Tenure-track faculty (3 female professors)
  - 19 Professors, 5 Associate, 7 Assistant
- 5 Instructional Faculty (2 female senior instructors)
- 5 Research Professors (1 female professor)

- Current search hopefully will yield 3-5 new faculty at the assistant prof level
- Need to improve gender and URM diversity of faculty!
- Some senior faculty members very research active, others are scaling down

- Undergraduate Student Growth – Class sizes of 150-200 students
- Graduate Student Growth – MS class sizes of 30-70 students
- Online courses and student support

- Space & new facilities required for faculty research, students, & classrooms
- Staff growth required to support new faculty & students
Critical need for
Aerospace Engineering Sciences Building
• Program plan complete: $75M, 140K GSF
• Challenge to raise $35M in private funds*
  *Endowments for people & programs count

Benefits:
• Supports growth of grad & ugrad programs
• Enhances research collaborations and enriches education
• Fosters multidisciplinary partnerships with science depts, research institutes & industry
• New specialized facilities for cutting-edge research
• Creates a clear presence for aero/space activities on the Boulder Campus by collocating AES with LASP, CASA and ATOC
Campus SPACE GRAND CHALLENGE

• Grand Challenges are ambitious, achievable goals that harness science, technology, and innovation to solve national and global problems impacting our daily lives.
• CU-Boulder working to make Colorado the leader in how space, technology and society converge to change the world

• Opportunities for AES collaboration, visibility, and impact
• Expanded connections with industry and state stakeholders
• Take on large-scale challenges in UAS, sustainable space, big data, and exploration
• Need for ongoing outreach, marketing and PR.

• These opportunities may lead to great things in the long run, but take time from teaching & core research areas in the short term
• Research facilities inadequate to take on large, multidisciplinary efforts
• Teaching facilities needed for expanded enrollments and new courses/students
RESEARCH CENTERS – Supporting growth and research leadership

Fluid-Structures-Materials Research Center
• CAS will expand to include fluids faculty recognizing the strong and broad expertise in fluid-structure interaction
• Expect to add faculty with experimental and theoretical interests

CCAR
• Very large, highly successful center with many TT and research professors
• Additional growth with ASV hire and expected small sat hire

BioServe/Bioastronautics
• Increase in tenure-track faculty from 1 to 3 (4) in recent and upcoming years
• Will allow for increased curriculum and research opportunities
• Leadership in human space exploration

RECUV
• Faculty growth in AES + CS, ECEE and ME
• Will allow for increased curriculum and research opportunities
• Leadership in national priority area & campus Grand Challenge
GOALS FOR 2020+ // ELECTRICAL, COMPUTER & ENERGY

<table>
<thead>
<tr>
<th>Year</th>
<th>2014</th>
<th>2020+</th>
<th>change</th>
<th>college</th>
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</thead>
<tbody>
<tr>
<td>B.S. students</td>
<td>380</td>
<td>475</td>
<td>25%</td>
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<tr>
<td>M.S. students</td>
<td>160</td>
<td>208</td>
<td>30%</td>
<td>35%</td>
</tr>
<tr>
<td>Ph.D. students</td>
<td>113</td>
<td>215</td>
<td>90%</td>
<td>95%</td>
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<tr>
<td>Gift/grant expend.</td>
<td>10.2M</td>
<td>18.9M</td>
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<td>85%</td>
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<tr>
<td># Tenure-line fac</td>
<td>35</td>
<td>42</td>
<td>20%</td>
<td>50%</td>
</tr>
<tr>
<td>U.S. News grad rank</td>
<td>34</td>
<td>20</td>
<td>14</td>
<td>--</td>
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<tr>
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<td>14</td>
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Other Goals

- Increased nominations and awards for successful faculty, to help with ranking increase
- Non-incrementally improved undergraduate enrollment
- Review of our recent curriculum revision and mid-course correction
- Strategic plan developed for new faculty recruiting
1. Challenge: Undergraduate enrollment
   • ECEE enrollment has increased by 14% since 2009. But the college as a whole has increased faster (30%).
   • Demand for our EE and ECE graduates, as measured by postings at Career Services, is greater than any other department in the college (1053 vs. 591 college average for 2014)
   • Action: Non-incremental action is needed to increase undergraduate enrollment. The ECEE Curriculum Committee is developing a proposal for a new Electrical and Energy Engineering (EEE) degree.

2. Challenge: Embedded systems certificate program
   • This popular graduate certificate program has lost its two key instructors (from industry)
   • Action: New Professional Master’s degree program in Embedded Systems Engineering has been proposed and will start in Fall 2015. This will generate revenue that will allow us to hire new Senior Instructors to staff this program. We hope to turn this problem into an asset.
3. **Challenge: Department ranking**
   - Department ranking continues to slowly erode
   - **Actions:**
     - Hiring: build around strong faculty, to build world-class research groups in selected areas
     - Awards: need to revitalize awards committee
     - Graduates: develop new degree programs (see #1&2)

4. **Challenge: Lack of leadership by faculty**
   - Inability to elect a new Chair last Spring, and to recruit faculty to fill some other roles
   - **Action:** New two-year Chair rotation has succeeded in recruiting strong faculty to serve as Chairs for next four years. Additional team-building activities have been initiated. It will be necessary to continue to develop the able and willing faculty to assume leadership roles.

5. **Challenge: Space and startup funds**
   - Lack of space for materials faculty, including clean-room facilities and fume hoods. This impacts our ability to hire new faculty in this area. High cost to hire in this area
   - **Action:** Re-examine current use of clean room space. Develop plan with college.
Other Goals

- Diverse and top quality faculty and students
- Improved graduate research and education ranking in top 10
- Enhanced research: Large projects, interdisciplinary and centers
- Improved laboratory space and maintenance
- Increased cross-department collaboration in research and education
SEEC Building and East Campus

- Environmental Engineering and Water Resources groups move to SEEC Building
  - (> 1/3rd) of faculty
- Split along ‘Wet’ (water and environmental) and ‘Dry’ (structural, geotechnical, building systems and construction management)
- Managing the split location and maintain identity in two ‘homes’
- Should SEEC be expanded later to accommodate the rest of the department?
Overlap of Program Curricula

• Great deal of overlap between the curricula of Civil, Environmental and Architectural Engineering
  • Especially Civil and Architectural
• Environmental Engineering – graduate degree
• Should the Dept. make distinction between the tracks?
• Provide more degree minors for clarity
  • Enable students to acquire expertise in more than one areas
  • Dual degrees
• Help with recruiting and retaining good quality students
Three Departments or One?

- Three separate degree tracks (CVEN/AREN/EVEN)
  - Divisions within department
  - Faculty unique to each track and not flexible for teaching

- Environmental graduate degree and the move of ‘wet’ to SEEC exacerbates this division
  - Faculty and resources

- Vision for a combined department going forward
GOALS FOR 2020+ // MECHANICAL ENGINEERING

<table>
<thead>
<tr>
<th></th>
<th>Year</th>
<th>2014</th>
<th>2020+</th>
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<th>college</th>
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<tr>
<td>B.S. students</td>
<td></td>
<td>894</td>
<td>1118</td>
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<td>35%</td>
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<tr>
<td>M.S. students</td>
<td></td>
<td>80</td>
<td>104</td>
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<tr>
<td>Ph.D. students</td>
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<td>182</td>
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<td>95%</td>
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<td>44</td>
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<td></td>
<td>34</td>
<td>24</td>
<td>10</td>
<td>--</td>
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<tr>
<td>College grad rank</td>
<td></td>
<td>34</td>
<td>20</td>
<td>--</td>
<td>14</td>
</tr>
</tbody>
</table>

Other Goals

- Faculty size of 44 gives ugrad/tt ratio of 25; peer figure is 15-20.
- Innovation in managing/supporting enrollment, eg college instructor pool
- Improved alignment of educational & research activities
- Stronger role of areas/centers; larger projects
Faculty recruitment
- Flexible recruiting mandated by Dean Davis is helping
- Startup funding is a challenge
- Need a suitable mechanism for shared equipment in offers
- Authorization for a new instructor will help handle enrollment

Space
- Both faculty offices and lab space will be very tight until AES building arrives

Graduate recruiting
- We’ve made incremental gains this year. Need more.

Department identity
- ME, CEAE, and CS have related challenges--
- Diverse faculty interests, bridging role among many applications, spatial separation
- -- can we pool our knowledge?
GOALS FOR 2020+ // CHEMICAL & BIOLOGICAL

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<th>college</th>
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</thead>
<tbody>
<tr>
<td>B.S. students</td>
<td>695</td>
<td>869</td>
<td>25%</td>
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</tr>
<tr>
<td>M.S. students</td>
<td>2</td>
<td>3</td>
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<td>35%</td>
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<tr>
<td>Ph.D. students</td>
<td>104</td>
<td>198</td>
<td>90%</td>
<td>95%</td>
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<tr>
<td>Gift/grant expend.</td>
<td>13.4M</td>
<td>24.8M</td>
<td>85%</td>
<td>85%</td>
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<tr>
<td># Tenure-line fac</td>
<td>22</td>
<td>40</td>
<td>80%</td>
<td>50%</td>
</tr>
<tr>
<td>U.S. News grad rank</td>
<td>14</td>
<td>10</td>
<td>4</td>
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<tr>
<td>College grad rank</td>
<td>34</td>
<td>20</td>
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<td>14</td>
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</table>

Other Goals

- Top 10 US News ranking
- Major ($10M+) research center based in ChBE
- Increased highest level of faculty recognition (NAE members)
- Maintained high level of UG student success/placement
- Doubled annual giving and endowment
• Faculty recruitment: Improve success rate in competitive environment
  • Challenge: Competitive start-up offers in the $1M range
  • Challenge: Job prospects required for spouse/partner
  • Challenge: Imminent space shortage

• Research Center: Greater visibility from a signature research theme
  • Achievement: New research theme/group in campus-wide center
  • Challenge: Identify a theme for maximum competitiveness
  • Challenge: Incentivize and support proposal preparation
• Graduate Student Recruitment: Existing funding would support larger program
  • Achievement: Increased number of applications
  • Bottleneck: Success rate of 30% in competitive environment
  • Challenge: Only ~100 per year are qualified

• Space: Current plans will not accommodate envisioned growth
  • Challenge: New building is full; expansion will accommodate 4–5 new faculty
  • Opportunity: SEEC building and renovated EC are appropriate for ChBE research
  • Challenge: Planning is challenging given uncertainty and likely fragmentation
GOALS FOR 2020+ // COMPUTER SCIENCE

<table>
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<th>Year</th>
<th>2014</th>
<th>2020+</th>
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<tr>
<td>B.S. students</td>
<td>418</td>
<td>522</td>
<td>25%</td>
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<tr>
<td>M.S. students</td>
<td>115</td>
<td>150</td>
<td>30%</td>
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<td>Ph.D. students</td>
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<td>200</td>
<td>90%</td>
<td>95%</td>
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<td>5.3M</td>
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<td>27</td>
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<tr>
<td>College grad rank</td>
<td>34</td>
<td>20</td>
<td>--</td>
<td>14</td>
</tr>
</tbody>
</table>

Other Goals
- ABET reaccreditation 2015
- Diversity goals for undergraduate programs
  - 30% female by 2020 (currently 16%)
  - 20% URM by 2020 (currently 11%)
- Increased faculty/student entrepreneurship activities
- Increased outreach to college and campus for computational thinking
- Outreach to industry professionals and global learners
### Growth
- Undergraduate and masters programs are experiencing rapid growth. Both in terms of majors and in terms of overall student credit hours.
  - Both CEAS and A&S are looking to us for fundamentals in computation.
  - Difficult to predict future demand especially from A&S.

### Faculty Recruiting
- CS departments (and colleges) are growing rapidly across the country. Competition is fierce for new tenure track faculty.
  - Currently searching to fill 2 positions.
  - Also experiencing local competition for full-time instructors (from DU, Mines, CSU).

### Space
- **Research**: Research space is limited and fragmented and in some cases unappealing. Clear negative in faculty recruiting.
- **Educational**: Our ed labs are bursting at the seams. We are using a high-touch approach to grading and mentoring that does not scale with current space resources.

### Diversity
- Diversity with respect to gender and underrepresented groups remains a problem for us (and for the industry overall).
- BA in A&S has not had a significant impact to date on gender or URMs.
<table>
<thead>
<tr>
<th>GAP ANALYSIS // COMPUTER SCIENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Growth</strong></td>
</tr>
<tr>
<td>• College has been extremely responsive with additional full-time instructor positions and with TA funding. Nevertheless, it’s hard to get ahead of this growth curve.</td>
</tr>
<tr>
<td><strong>Faculty Recruiting</strong></td>
</tr>
</tbody>
</table>
| • We are in the process of issuing 7 offers for our nominal 2 slots this round.  
  • Currently confident in only 1 prospect.  
  • We’ll be in trouble with startup and space if more than 3 accept.  
  • Partnering with ATLAS, BioFrontiers, and CMCI for coordinated searches |
| **Space**                        |
| • Submitting a large renovation proposal to revamp some of our labs to provide additional faculty offices and improve how well we use our existing space.  
  • May require us to rob from educational space to accommodate research growth.  
  • Participating in design process for the revamp of the old Chem E wing. |
| **Diversity**                    |
| • Partnering with NCWIT on recruiting and retention issues. NCWIT has dedicated two researchers to CU to help with data gathering and analysis.  
  • Continuing efforts to engage/retain women in our intro sequences. |