EAC Meeting Spring 2013
Research Sub-Committee

Associate Dean for Research Office
College of Engineering & Applied Science

April 25, 2013
Agenda

1:35  CEAS Research Update (Kurt Maute)

2:00  CU Boulder Initiative: Industry Office (Tricia Rankin, AVCR)

2:25  Update on Manufacturing Initiative (Jeff Sczechowski)

2:35  Strategic opportunities for CEAS in manufacturing related research

   2 breakout groups:  • mechanical and electronics

   • chemical and material synthesis

3:00  Adjourn
Research Update

• Current and Past Performance Metrics

• Competitiveness

• Proposal Development Pilot

• Strategic Hiring & Collaborations

• Research Infrastructure
Past Performance

Awards

FY06  FY07  FY08  FY09  FY10  FY11  FY12

$35M  $40M  $43M  $58M  $66M  $68M  $73M
Past Performance

CEAS Faculty Funding

Funding: Projects by start date with accumulated funds received to-date.
Current Performance

Awards Received in July - February

<table>
<thead>
<tr>
<th>Year</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY06</td>
<td>$23M</td>
</tr>
<tr>
<td>FY07</td>
<td>$26M</td>
</tr>
<tr>
<td>FY08</td>
<td>$24M</td>
</tr>
<tr>
<td>FY09</td>
<td>$40M</td>
</tr>
<tr>
<td>FY10</td>
<td>$44M</td>
</tr>
<tr>
<td>FY11</td>
<td>$41M</td>
</tr>
<tr>
<td>FY12</td>
<td>$49M</td>
</tr>
<tr>
<td>FY13</td>
<td>$53M</td>
</tr>
</tbody>
</table>
Current Performance

Awards Received by Department in July - February

FY06 FY07 FY08 FY09 FY10 FY11 FY12 FY13

AES ChBE CEAE CS ECEE ME
Current Performance

Proposals Submitted by Department

July - February

FY06 FY07 FY08 FY09 FY10 FY11 FY12 FY13

Admin ME ECEE CS CEAE ChBE AES
Funding Portfolio

New awards in FY 2012: $73M

- NSF 26.3%
- Dept. of Energy 4.5%
- Dept. of Defense 14.1%
- NASA 15.6%
- HHS(NIH) 3.3%
- Other Federal 7.5%
- Industry 14.5%
- Foundation & Other 12.5%
- State & Local Gov't 1.8%

CU Boulder ranks 14th in receiving NSF funding among universities.
Research Update

- Current and Past Performance Metrics
- Competitiveness
- Strategic Hiring & Collaborations
- Research Infrastructure
Comparison against Peers

Funding Rate in NSF/Eng Programs for Engineering Colleges

PAC 12

- Cal Berkeley
- Oregon State
- CU - Boulder
- Stanford
- Arizona State
- USC
- Washington
- UCLA
- Utah
- Washington State

FY10 FY11 FY12
Comparison against Peers

Funding Rate in NSF/Eng Programs for Engineering Colleges

Aspiration Group

CU - Boulder
Minnesota
Florida
North Carolina State
Ohio State
Virginia
Virginia Tech
UC Davis
UC Irvine

FY10 FY11 FY12
Comparison against Peers

Number of Awards in NSF/Eng Programs for Engineering Colleges

Aspiration Group

- CU - Boulder
- Minnesota
- Florida
- North Carolina State
- Ohio State
- Virginia
- Virginia Tech
- UC Davis
- UC Irvine
- Penn State

Year:
- FY10
- FY11
- FY12
Update on Large Proposal Development

New Pilot Program: Comprehensive Support for Proposal Development of 2013/14 ERC Competition

Goals:
- Better proposals
- Reduced burden on PIs
- Collect and document experience → Best Practice

Approach:
- Proposal development manager
- Professional editor and graphics
- ADR support for interfacing with OCG (CU and partners)
- Internal and external reviews
Update on Large Proposal Development

Current Status:

• Received 3 white papers (Jan 12)
• Presentation of white papers & Feedback from faculty (Feb 22)
• Providing support for Pre-Proposals for 2 white papers:
  • “Engineering The Nanomaterials- Immunology Interface”
    led by Ted Randolph
  • “Center for Integrative Computational Optical Sensing and Imaging”
    led by Rafael Piestun
• Pre-Proposals due by End of July
Update on Large Proposal Development

Next Steps:

• Develop a set of external editors and graphics support
• Identify external & internal reviewers for proposed themes
• Hiring a Proposal Development Manager (for full proposal)
Strategic Hiring

Current approach:
- Departments hire based on their very own teaching and research needs
- Only infrequently broader themes guide the Departmental hiring strategy
- Often candidates are preferred with broad (fundamental) research over technology experts

Issues:
- Systematic gaps in multi-disciplinary areas
- Unwanted overlap in traditional areas
- Missing focused expertise in target (technological) areas
- Missing broad expertise mainly in “support-type” research
Shift in CEAS Funding?

Awards grouped by Award Size

<table>
<thead>
<tr>
<th>Award Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>$-</td>
</tr>
<tr>
<td>$5,000,000.00</td>
</tr>
<tr>
<td>$10,000,000.00</td>
</tr>
<tr>
<td>$15,000,000.00</td>
</tr>
<tr>
<td>$20,000,000.00</td>
</tr>
<tr>
<td>$25,000,000.00</td>
</tr>
<tr>
<td>$30,000,000.00</td>
</tr>
<tr>
<td>$35,000,000.00</td>
</tr>
<tr>
<td>$40,000,000.00</td>
</tr>
</tbody>
</table>


Legend:
- 2.5M<<5M
- 1M<<M2.5
- 0.5M<<1M
- 0.1M<<0.5M
- <0.1M
Shift in CEAS Funding?

Awards Relative to Total Awards grouped by Award Size

- 2004-2012

- 2.5M<<5M
- 1M<<M2.5
- 0.5M<<1M
- 0.1M<<0.5M
- <0.1M
Faculty Research Productivity

Number of Faculty grouped by Total Funding since 2004

- > $10M
- $5M < <= $10M
- $1M < <= $5M
- $0.5 < <= $1M
- <= $0.5M

Faculty Research Productivity

Average Annual Faculty Funding grouped by Total Funding since 2004

Engineering & Applied Science
UNIVERSITY OF COLORADO BOULDER
Faculty Research Productivity

Total Annual Faculty Funding grouped by Total Funding since 2004
# Collaboration Across CEAS

## Collaborations relative to total award of home department

<table>
<thead>
<tr>
<th></th>
<th>Single PI</th>
<th>Collaborations Inside Dept</th>
<th>Collaborations Other CEAS Dept</th>
<th>Collaborations Outside Dept</th>
</tr>
</thead>
<tbody>
<tr>
<td>AES</td>
<td>22%</td>
<td>61%</td>
<td>14%</td>
<td>17%</td>
</tr>
<tr>
<td>CEAE</td>
<td>71%</td>
<td>21%</td>
<td>6%</td>
<td>9%</td>
</tr>
<tr>
<td>ChBE</td>
<td>59%</td>
<td>28%</td>
<td>11%</td>
<td>13%</td>
</tr>
<tr>
<td>CS</td>
<td>28%</td>
<td>58%</td>
<td>12%</td>
<td>14%</td>
</tr>
<tr>
<td>ECEE</td>
<td>44%</td>
<td>41%</td>
<td>12%</td>
<td>15%</td>
</tr>
<tr>
<td>ME</td>
<td>9%</td>
<td>55%</td>
<td>30%</td>
<td>35%</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td><strong>39%</strong></td>
<td><strong>44%</strong></td>
<td><strong>14%</strong></td>
<td><strong>17%</strong></td>
</tr>
</tbody>
</table>

* averaged for 2002-2012 received project funding

** only tenure track (incl. budgeted elsewhere) and research professors considered.
## Collaboration Matrix

Collaborations relative to total award of home department

<table>
<thead>
<tr>
<th></th>
<th>AES</th>
<th>CEAE</th>
<th>ChBE</th>
<th>CS</th>
<th>ECEE</th>
<th>ME</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AES</strong></td>
<td>61%</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
<td>3%</td>
<td>9%</td>
<td>3%</td>
</tr>
<tr>
<td><strong>CEAE</strong></td>
<td>1%</td>
<td>21%</td>
<td>1%</td>
<td>1%</td>
<td>0%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td><strong>ChBE</strong></td>
<td>1%</td>
<td>1%</td>
<td>28%</td>
<td>0%</td>
<td>1%</td>
<td>9%</td>
<td>1%</td>
</tr>
<tr>
<td><strong>CS</strong></td>
<td>2%</td>
<td>1%</td>
<td>0%</td>
<td>58%</td>
<td>8%</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td><strong>ECEE</strong></td>
<td>3%</td>
<td>0%</td>
<td>1%</td>
<td>5%</td>
<td>41%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td><strong>ME</strong></td>
<td>14%</td>
<td>5%</td>
<td>7%</td>
<td>1%</td>
<td>3%</td>
<td>55%</td>
<td>5%</td>
</tr>
</tbody>
</table>

* does not include single PI projects

** only tenure track (incl. budgeted elsewhere) and research professors considered.
Does Collaboration become more Important?

Funding relative to total CEAS Awards grouped by Number of PIs

- 1
- 2
- 3
- 4
- 5

- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
- 2012
Recent Hires

<table>
<thead>
<tr>
<th></th>
<th>Hires before 2002</th>
<th>New Hires since 2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>AES</td>
<td>$309,537.64</td>
<td>$288,509.28</td>
</tr>
<tr>
<td>CEAE</td>
<td>$169,292.70</td>
<td>$214,687.20</td>
</tr>
<tr>
<td>ChBE</td>
<td>$516,924.51</td>
<td>$310,583.21</td>
</tr>
<tr>
<td>CS</td>
<td>$161,038.92</td>
<td>$143,740.60</td>
</tr>
<tr>
<td>ECEE</td>
<td>$205,731.97</td>
<td>$252,469.18</td>
</tr>
<tr>
<td>ME</td>
<td>$254,854.53</td>
<td>$345,266.10</td>
</tr>
</tbody>
</table>

Note: only tenure track (incl. budgeted elsewhere) and research professors considered.
# Recent Hires

## Difference between Dept and new hires

<table>
<thead>
<tr>
<th></th>
<th>Single PI</th>
<th>Collaborations Inside Dept</th>
<th>Collaborations Other CEAS Dept</th>
<th>Collaborations Outside Dept</th>
</tr>
</thead>
<tbody>
<tr>
<td>AES</td>
<td>21%</td>
<td>-6%</td>
<td>-12%</td>
<td>-14%</td>
</tr>
<tr>
<td>CEAE</td>
<td>-4%</td>
<td>1%</td>
<td>6%</td>
<td>3%</td>
</tr>
<tr>
<td>ChBE</td>
<td>12%</td>
<td>-4%</td>
<td>-7%</td>
<td>-8%</td>
</tr>
<tr>
<td>CS</td>
<td>-4%</td>
<td>4%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>ECEE</td>
<td>5%</td>
<td>-22%</td>
<td>16%</td>
<td>17%</td>
</tr>
<tr>
<td>ME</td>
<td>3%</td>
<td>-15%</td>
<td>13%</td>
<td>12%</td>
</tr>
<tr>
<td>Mean</td>
<td>5%</td>
<td>-7%</td>
<td>3%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Note: only tenure track (incl. budgeted elsewhere) and research professors considered.
# Recent Hires 2010-2013

<table>
<thead>
<tr>
<th>Name</th>
<th>Dept.</th>
<th>Title</th>
<th>Appt. Date</th>
<th>Research Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pavol Cerny</td>
<td>ECEE</td>
<td>Asst Prof</td>
<td>Jan-13</td>
<td>Computer-aided verification, reliable software.</td>
</tr>
<tr>
<td>Eric Keller</td>
<td>ECEE</td>
<td>Asst Prof</td>
<td>Aug-12</td>
<td>Reliable and secure networked systems</td>
</tr>
<tr>
<td>Thomas Yeh</td>
<td>CS</td>
<td>Asst Prof</td>
<td>Aug-12</td>
<td>Human-centered computing, computer vision, software</td>
</tr>
<tr>
<td>Aaron Clauset</td>
<td>CS</td>
<td>Asst Prof</td>
<td>Aug-10</td>
<td>Probabilistic models, complex networks, biological systems dynamics,</td>
</tr>
<tr>
<td>Lijun Chen</td>
<td>ITP</td>
<td>Asst Prof</td>
<td>Jan-12</td>
<td>Complex networked systems; energy-aware network design; optimization</td>
</tr>
<tr>
<td>Anushree Chatterjee</td>
<td>ChBE</td>
<td>Asst Prof</td>
<td>Jan-13</td>
<td>Synthetic biology, systems biology, metabolic engineering,</td>
</tr>
<tr>
<td>Andrew Goodwin</td>
<td>ChBE</td>
<td>Asst Prof</td>
<td>Aug-12</td>
<td>Colloid and interface science, drug delivery, cancer research</td>
</tr>
<tr>
<td>Mark Borden</td>
<td>ME</td>
<td>Asst Prof</td>
<td>Aug-10</td>
<td>Biofluids, biomaterials, colloids, imaging, drug delivery, microbubbles</td>
</tr>
<tr>
<td>Joel Kaar</td>
<td>ChBE</td>
<td>Asst Prof</td>
<td>Aug-10</td>
<td>Protein structure and function at material interfaces</td>
</tr>
<tr>
<td>Jennifer Cha</td>
<td>ChBE</td>
<td>Assoc Prof</td>
<td>Aug-12</td>
<td>Nanoengineering, biomaterials, surface science, self-assembly</td>
</tr>
<tr>
<td>Prashant Nagpal</td>
<td>ChBE</td>
<td>Asst Prof</td>
<td>Aug-12</td>
<td>Nanoscale optoelectronics, nanoparticles assemblies, Plasmonics</td>
</tr>
<tr>
<td>Peter Hamlington</td>
<td>ME</td>
<td>Asst Prof</td>
<td>Aug-12</td>
<td>Turbulent flows, reacting flows and combustion, CFD</td>
</tr>
<tr>
<td>Paul Goodrum</td>
<td>CEAE</td>
<td>Prof</td>
<td>Aug-12</td>
<td>Construction Management, productivity trends and industry measurement</td>
</tr>
<tr>
<td>Sideh Dashti</td>
<td>CEAE</td>
<td>Asst Prof</td>
<td>Jan-11</td>
<td>Geotechnical earthquake engineering, innovative sensing technologies</td>
</tr>
</tbody>
</table>
Need for CEAS-wide Strategic Hiring?

- Data is non conclusive
  - CEAS faculty are very competitive for small grants
    - Single-PI grants dominate but are somewhat in decline
  - Recent hires follow old patterns
- Increasing number of faculty lines are allocated for campus-wide initiatives

**Next Steps:**
- CEAS coordination committee
- “CEAS Hiring Summit”
Research Infrastructure

• Increasing Problems to Operate and Maintain Research Infrastructure
  o Increased matching requirements
    ▪ from campus
    ▪ from state
  o Increased compliance requirements

Example:

Nano-Characterization Facility was not sustainable, merged with
Colorado Nano-Fabrication Laboratory (supported by NSF-NNIN)
Research Infrastructure

• Increasing Problems to Operate and Maintain Research Infrastructure
  o Increased matching requirements
    ▪ from campus
    ▪ from state
  o Increased compliance requirements

Example:

Nano-Characterization Facility was not sustainable, merged with Colorado Nano-Fabrication Laboratory (supported by NSF-NNIN)
Research Infrastructure

- NNIN Base Funding (Year 8)
- User Fees (Program Income)
- University Operating Support (average since 2004 (or 2009), not including buildings)
Research Infrastructure

Challenges: How to generate (and collect) funds to operate/maintain/replace research infrastructure?

One possible approach:

- CU operates/uses shared user facilities
- National Labs
- Local Industry
- CU/CEAS