

Summary and Recommendations from 4/21/06 Meeting of the
Engineering Advisory Council
Robert H. Davis, Dean

College of Engineering & Applied Science
University of Colorado at Boulder

1. Introductions

EAC Chair Peter Mannetti introduced newly-elected EAC members present: Barbara Bauer (Sun Microsystems), Paul Hamilton (Shell Global Solutions), and Frank Prager (Xcel Energy). Rob Davis also noted two newly elected members not able to attend: Geoff Slaff (Amgen) and Peter Teets (retired Undersecretary of the Air Force and retired Lockheed Martin President). He also recognized newly elected EAC members who have served on the Resource Development Committee (RDC): Dan Hernandez, Nan Joesten, Lanny Pinchuk and Al Sanders. Special recognition of EAC members was noted for Barbara Bauer (named to the Women in Technology International Hall of Fame), Sun Foundation (honored by the Foundation for a College Education) and Kristy Schloss and Jill Tietjen (featured in the book "Changing our World: True Stories of Women Engineers").

2. Investment in CU-Engineering (I-CUE)

Dean Rob Davis described a new initiative, Investment in CU-Engineering (I-CUE), designed to move the college forward in the current budget climate. A copy of his slides for the presentation, as well as those of other presentations, is available at: http://engineering.colorado.edu/overview/advisory_boards.htm.

He noted the needs to improve college rankings, prepare for a campus budget process, and energize faculty, staff and volunteers as motivations for I-CUE. A tripartite approach of reallocating college resources, requesting new campus resources, and enhancing private fundraising will be undertaken, focused on goals of enhanced student learning, growth in research and PhD programs, and improved facilities and infrastructure. Dean Davis provided data on the benefits brought to the college in terms of increased resources and rankings through recruiting and retaining top faculty with endowed chairs and professorships. The following recommendations were made:

- *For faculty with lower output, provide for reassignment of duties, incentives to retire, and phase-out roles*
- *Focus efforts on attracting and nurturing top faculty*

3. Campus Update

Interim Chancellor Phil DiStefano described three research initiatives aimed at improving the quality of life and improving CU's stature: 1) biotechnology, 2) sustainable and renewable energy, and 3) pedascale computing (proposal pending to partner with NCAR). He also described plans for new residential academic programs to enrich the undergraduate experience and mentioned a \$2 million earmark at the state level in matching for biotechnology grants and enhanced collaborations between CU-Boulder and the CU Health Sciences Center.

4. College Updates

4.1 Education Update – Associate Dean for Education John Bennett provided an update on prior recommendations from the education subcommittee, with a focus on recruitment and retention. Several activities (such as Admitted Students Day for prospective freshmen, Success Institute in summer for high-school students, visits to Colorado high-school math and science teachers,...) were noted, along with progress to evaluate the various programs to determine effectiveness. Challenges such as a limited pool of underrepresented students with interests and educational

preparation for engineering, and the need for increased scholarship and earn-learn endowments, were described. Plans include review of the book “The Engineer of 2020” and its congruence with our strategic educational goals, and the introduction of an Engineering Honors Program this fall. Recommendations from EAC members include:

- *Scott Donnelly recommends sending letters and web links to top students beyond Colorado, such as those receiving high ACT/PSAT scores*
- *Frank Figueroa recommends focusing on specific partnerships, such as with the Denver School of Science and Technology, to encourage minority students to major in engineering*

4.2 Research Update – Associate Dean for Research Victor Bright gave an update on research initiatives in response to prior recommendations. He gave statistics showing that grant proposals and funding went down this past year, noting that federal grant opportunities are becoming more competitive and application-focused, though grants from corporations to college faculty went up. He also described research initiatives in several theme areas (nanotech, biotech, energy, computational science) and challenges and progress related to technology transfer and intellectual property. The EAC recommended:

- *Track and encourage faculty participation in review and program panels of the National Science Foundation and other federal agencies*

4.3 Resource Update – Dean Rob Davis gave an update on the proposed biotechnology building. If it is associated with the Colorado Initiative in Molecular Biotechnology (CIMB), which involves research, teaching and technology development across multiple science and engineering disciplines. The building program plan has been approved by campus and is available at <http://fm.colorado.edu/planning/projects/biotechnology/biotechnology.html>.

The biotechnology building will be located on CU-Boulder’s Research Park (just east of Colorado and 30th Street, about a 10-minute walk from the Engineering Center). The design calls for over 260,000 sq ft total, to house 60 tenure-track faculty and over 600 researchers including those from CIMB, Biochemistry, and Chemical and Biological Engineering. The cost is projected at \$113 million, to be funded by a combination of campus funds, indirect cost recovery, state funds, and private and federal contributions. A full-time development expert will be hired to lead the fundraising effort. The following recommendations were made by EAC member Vern Norviel:

- *Include industrial biotechnology, such as biomass conversion for renewable energy and chemicals, in addition to health-care applications*
- *Include some bench/lab space for the initial stage of technology transaction*

5. K-16 Engineering Education

Jackie Sullivan, Co-Director of the Integrated Teaching and Learning Laboratory gave a lunch-time presentation on K-16 engineering education (see http://engineering.colorado.edu/overview/advisory_boards.htm for a copy of the power-point slides). She noted that engineering is a creative field that benefits society, and that imparting and nurturing passion in engineering and technology needs to start before middle school and be sustained through college. Statistical data were provided showing relatively strong growth in engineering and science students in Asia, that BS degrees in engineering in the U.S. peaked about 20 years ago, and that participation of women and minorities is greatly underrepresented. The message needed is that engineering careers are rewarding, enjoyable, flexible, and benefit society. Jackie proposed a K-12 Engineering Corps, for engineering students to teach in K-12 schools, and also suggested a new engineering education department. She gave examples of CU-Engineering outreach to local schools with high minority enrollments, especially the Denver School of Science and Technology and Centaurus High School and elementary and middle schools in Lafayette, CO.

6. Subcommittee Meetings

After lunch, the three subcommittees met, and reports from the subcommittees were made later in the afternoon.

7. Solar Decathlon

A presentation on the 2005 CU solar house, which won the national competition in Washington, D.C., was made by one of the student leaders, Kristin Field. After the presentation, Kristin and faculty advisor Michael Brandemuehl led a tour of the solar house.

8. Subcommittee Reports

8.1 Education and Outreach Committee (EOC)

EAC participants: Jean Becker (Chair), Dan Hernandez, Mike Herriage, Jon Liebman, Peter Mannetti, Chuck Robertson, Roger Zimmerman, Barbara Bauer, Lucy Sanders

CU participants: John Bennett (CU Facilitator), Lelei Finau-Starkey, Scot Douglas, Zoya Popovic, Diane Sieber, Jim Sherman

- 1) The committee convened and reviewed progress on actions recommended at the Fall 2005 EAC meeting.
- 2) The committee reviewed recent progress and activities related to education, recruiting and outreach.
- 3) The committee received an update on the Honors Program, which will be piloted in Fall 2006. The first Industry Night, which will provide a forum for Honors Students and Fellows to interact with industry leaders, will be held on 28 September 2006, the night before the Fall EAC meeting. The time will be set so as to allow for attendance at dessert at the Davis house later in the evening.
- 4) The committee received copies of the Teach for Colorado "Attracting Rural Children to Undergraduate Engineering" engineering outreach proposal and copies of *The Engineer of 2020* and *Educating the Engineer of 2020*. These readings will inform the committee's discussions at the Fall 2006 EAC meeting.
- 5) Terry Mayes conducted a survey of EAC members regarding skills required of engineering graduates. The survey instrument and the results of this survey are available online at http://engineering.colorado.edu/overview/advisory_boards.htm.
- 6) The committee focused its discussion on the role of engineering education in high school, and in particular, how and why CU should be involved. One reason is to help increase the number of women and underrepresented minorities who study undergraduate engineering at CU. The following outline summarizes the discussion.

K-12 Engineering Education:

- Focus on a few schools - Denver School of Science and Technology (DSST), and schools with pre-engineering programs (e.g., Centaurus in Lafayette); then branch out
 - DSST will graduate approximately 100 students per year beginning in 2008; we should seek to recruit one quarter of this class
 - Why? Self-selecting pool of students with interest in and qualified for undergraduate study in engineering.
- We should seek to build partnership with these schools, and with the Denver Public School District, the city of Denver (Michael Bennett), industry, etc.
- Market to the students and their parents – (Dan Hernandez agreed to help). The message:

- Why engineering? – Engineering is great preparation for many careers, including those not directly involving engineering, e.g., medicine (almost 10% of our graduates) and business leadership
- Why CU? – Unparalleled opportunities for hands-on, relevant, engineering education
- Recruit both the school and its students. Ideas:
 - Use DSST as the prototype for how to do this well
 - Determine how to change the anti-minority perception of CU in Denver Public Schools
 - Get seats to football and basketball games for DSST - un-rented boxes in the stadium should be filled up with students and parents - announce welcome future to CU engineering students
 - Learn from top-quality, high-integrity football programs how to recruit students - best practices
 - Significant engagement with college counselors at DSST
 - Bring high school teachers and counselors to CU
 - CU students mentor DSST team in FIRST competition
 - Sponsor an event for HS teachers, parents and students at which the speaker is a nationally visible under-represented minority engineer or scientist (e.g., Nobel laureate)
- Marketing - How to influence parents and students
 - Review current research - Jackie
 - Dan Hernandez' advertising team will assist by providing the process for marketing to the target market
 - Look at key influencers and market - Leeds School, EAC contacts
 - Survey parents
 - Parents will influence the students once they see the value
 - Engineering makes money
 - Engineering has social value
 - Engineering impacts life
 - Engineering prepares students for a variety of careers and lifestyles
 - Find outreach materials from other schools in the nation
 - Posters in schools demonstrating cool technology (iPods) that kids use and market how engineering makes these possible
- Scholarship and internships
 - Need scholarships in two years for the graduating class - where are the funds to support these scholarships?
 - Work with Board of DSST to help fund college for these students
 - Sources of funds: City of Denver, engineers who live in Denver, work-study program, Latin American Education Foundation, InRoads, foundations (Bill and Melinda Gates, Gates Rubber), etc.
 - Educate parents on how to save for and fund education
 - Matching funds from CU between demonstrated need and Financial Aid package
 - substantially reduces needed funds
 - Internships:
 - DSST students for engineering interns with local industries sponsored by CU Boulder - tie with Engineering Honors program industry night for internships
 - Have CU Engineering student as a mentor
 - 25 companies to take four kids and a mentor each for summer interns (20K for each company) and will put their logo on the promotional materials - need transportation - end of junior year

- Systems administration kids could work as desktop support for local companies in the summer
- Work for pay and future scholarship to CU (e.g., program participation could earn “scholarship credit” toward cost of attending CU)

Summary of Recommendations and Followup:

- *Hold Honors Program Industry Night in September 2006*
- *Prepare plan for engagement with DSST and Centaurus High Schools*
- *Prepare for Fall EAC discussion by reading “Attracting Rural Children to Undergraduate Engineering”, “The Engineer of 2020”, and “Educating the Engineer of 2020”*

8.2 Research and Corporate/Government Relations Committee (RCRC)

EAC participants: Kevin Coyne, Scott Donnelly (Chair), Pam Drew (Vice Chair), Fred Kitson, Merc Mercure, Frank Figueroa, Frank Prager

CU participants: Susan Avery, Victor Bright (CU Facilitator), Gerhard Fisher, Ken Porter, Ted Randolph, Stein Sture

Victor Bright presented a brief review of recent progress made on recommendations from the prior meeting. He then gave an update on the Discovery Learning Initiative, its status, and the charter of the Discovery Learning Task Force. In the limited discussion that followed, the RCRC members were asked for comments and recommendations on the organizational structure and resource requirements and possible incentives for the DLC participants. The RCRC members expressed opinion that the discovery learning initial concept should be somewhat relaxed and focus more on graduate students and industry relevant research. The feeling was that the undergraduate students would engage in the DLC automatically in time if the research is of high visibility and interest. The DLC was viewed by the RCRC members as a building with excellent laboratory space potential. Faculty should take advantage of the available/potential space, and special incentives to use the space may not be necessary. The focus should be on research that crosses schools and departments, and that have significant involvement from other schools and colleges on campus. The ITL management model was considered as a good example to follow.

Ken Porter, of the CU-Boulder's Tech Transfer Office, presented an update on TTO's function and recent initiatives, including current trends and statistics related to start-ups, innovation disclosures, background for university-industry research collaboration, confidentiality agreements, proof-of-concept (POC) funding for faculty, issues and concerns related to developing intellectual property agreements, federal and regents' patent policies, and IRS revenue patent code. The RCRC members commented that the POC initiative by TTO, both for start-up and for advanced research, is a very good idea; moreover, it is a step in the right direction to have the University invest in its intellectual assets through partial support to faculty for novel ideas.

Scott Donnelly then presented a draft of the working paper being developed by the RCRC, under Scott's leadership. The paper, entitled “Industrial Research Collaboration: Technology Transfer as a Competitive Advantage,” is aimed at addressing barriers perceived by the RCRC with the University in establishing, licensing, and transferring intellectual property as related to industry contracts. The discussion that followed focused on the encouragement for TTO to take a more proactive role in moving disclosures to licensing. A recommendation was made that the typical six-month process be reduced so that “no opportunity is missed”. A suggestion was made that the TTO needs to take a more proactive role and market itself and the technologies it has to offer. IP should be considered as a competitive advantage in recruiting companies to participate in the University's research programs. The TTO should provide a user-friendly environment.

Interim Provost Susan Avery presented progress on hiring a full-time advocate to act on behalf of the college and campus with government agencies and corporations to advance major research

funding opportunities. Progress has moved slowly, as the nature of this position is still being defined. The discussion that followed was focused on the role and duties of this person. The RCRC members encouraged that this person should focus on federal agencies and less on the State of Colorado. An additional focus on large corporations and forming strategic alliances locally with government labs and industry is a must. A possibility of forming a task force of business leaders to work with this individual was brought up.

In summary, action items and recommendations from the subcommittee include:

- *The DLC Task Force will finish its job over the summer and present its recommendations at the next EAC meeting.*
- *The RCRC will finish the white paper for TTO, and the TTO will review it and provide comments at the next EAC meeting.*
- *RCRC members will facilitate contacts with individuals within their companies who interact with government agencies.*
- *The Interim Provost will talk to the University of Michigan and other universities that employ an advocate for government agencies, to guide a decision in defining such a position for CU.*

8.3 Resource Development Committee (RDC)

EAC/RDC Participants: Enid Ablowitz, Bruce Buckland, Art Dawson, Paul Hamilton, Gary Jacobs, Joe Negler, Jim McAnally, Lanny Pinchuk, Al Sanders, Greg Smith, Jill Tietjen

CU/CUF Participants: Rob Davis (Co-Facilitator), John Mabley (Co-Facilitator), Emily Muller, John Quigley, Ann Scott, Pat Sullivan, JoAnn Zelasko

Resource Update: Dean Rob Davis noted there are three new faculty, including two women, this semester. The College now has 20 endowed chairs and professorships, including four new ones to be filled next year. The goal is 35 endowed faculty positions, to support the top 20% of the faculty. He noted that the passage of Ref. C is expected to increase state funding by 12-13% next year, though on a relatively small piece (6%) of the overall budget. Tuition (which accounts for 29% of the overall budget) will likely increase only 2.5% for resident undergraduates, and the second step of the proposed engineering tuition differential will be set aside once again, hampering the college's ability to move forward on initiatives. The campus is estimating a \$10 million loss in tuition revenue next year, due to lower overall enrollments. A positive step is that graduate students on appointment (RA or TA) will be granted in-state tuition starting next year, allowing us to recruit more nonresidents and foreign students.

Development Update: John Mabley gave a development update. John provided a sheet with engineering fundraising targets for FY07, totaling \$6.3 million for faculty and student support, the Dean's Fund, and the biotechnology building. He also cited a consultant report describing needed improvements in the annual giving program and its importance in building the donor base. This led to discussions that CU could do more with alumni relations, class and reunion giving, etc., but does not have sufficient staff to coordinate efforts. John further noted that the next CU capital campaign is probably 1-2 years away, though the Boulder campus is more ready than the others. Pat Sullivan cited some near-term opportunities for corporate and foundation giving, including scholarships to attract top students from the Denver School of Science and Technology and additional grants for our Rural Engineering Education outreach program. A survey questionnaire on RDC member willingness to assist the college with development was distributed and collected. The survey results show broad interest of RDC members volunteering in different areas and ways, with the most cited including Engineering for Developing Communities, accompanying a development staff person to solicit a prospect, strategizing with development staff on preferred

approaches to selected prospects, reviewing solicitation proposals and sending thank-you notes to donors.

Advancing Key Development Initiatives: Dean Rob Davis asked for input on how to do fundraising during this period between campaigns and how to move the college forward during this time of flat or declining resources. He also noted the need to move quickly on fundraising for the biotechnology building, including the hiring of a high-level fundraiser, forming a cabinet, and preparing communications materials. Some key recommendations include:

- *Jill Tietjen: Establish a reunion giving program and further cultivate the donor pipeline.*
- *Enid Ablowitz: View annual gifts as part of the continuum (annual gifts → major gifts → bequests), and establish a leadership giving level as a bridge.*
- *Jim McAnally and Enid Ablowitz: Think outside the box on resources: Consider eliminating or combining departments or functions to get economy of scale. If the college could start over, how would resources be allocated?*
- *Gary Jacobs: Identify and reach out to donors with \$25 million capacity. Find passionate faculty and staff (e.g., Jackie Sullivan) and take them to meet prospects. Ask the two governor candidates to visit with college and industry leaders in early fall and ask them to support major initiatives. Create a work-fund program, where students work in industry at low wage and company donates to college.*
- *JoAnn Zelasko: Market the Earn-Learn program as an opportunity for younger alumns to contribute.*
- *Lanny Pinchuk: Increase the size of the professional fundraising staff and cultivate younger alumns to build for the future.*
- *Paul Hamilton: Energy is currently an important issue, with considerable money in the Rocky Mountain area – seek partnerships and support from energy companies.*
- *Vern Norviel: CU's tech-transfer office has improved, but industrialization of concepts is still small. More faculty should start companies, with CU sharing in stock ownership.*

9. Business Meeting

The following members whose terms are ending were acknowledged and thanked for their great support and advice over the years: Enid Ablowitz, Tom Broyles, Hans Brunner (absent), Art Dawson, Tim Fritz (absent), Clancy Herbst (absent), Karl Larson (absent), Chuck Robertson, and Greg Smith. Chair Peter Mannetti urged support for the I-CUE concept.

10. Wrapup

Next year's meetings will be held on 9/29/06 and 4/20/07. Terry Mayes gave an overview of the EAC survey results on the skills needed for the graduating engineer of 2020. The full results, including charts and graphs, can be found under Items of Interest at the following website: http://engineering.colorado.edu/overview/advisory_boards.htm. Key findings include:

- The 5 most highly valued skills are: Ability to apply knowledge of math, science, and engineering principles, Ability to identify, formulate and solve engineering problems, Ability to analyze and interpret data, Strong analytical skills and High ethical standards.
- Ability to function on multi-disciplinary teams and Creative problem-solving also scored quite high.
- The 5 least valued skills are: Life-long learners, Strong presentation skills, Business skills, Knowledge of contemporary issues and Negotiation skills. Several EAC members noted that these skills could be taught on the job and are not as critical to teach in the engineering curriculum.
- Skills rated more highly by male respondents are: Ability to identify, formulate and solve engineering problems, Ability to use necessary techniques, skills and modern engineering tools, and Creative problem-solving.

- Skills rated more highly by female respondents are: Ability to understand impact of engineering solutions in global/societal context, Dynamism, agility, resilience, and flexibility (of mind), and Knowledge of contemporary issues.
- Skills rated more highly by those in the highest age grouping (over 60) are: Strong presentation skills, and Leadership skills.
- Skills rated more highly by those in the middle age grouping (between 40 and 60) are: Ability to design system, component or process within realistic functional and time constraints, Ability to identify, formulate and solve engineering problems, and Strong analytical skills.
- The biggest difference between engineers vs. non-engineers is that non-engineers rated 'Ability to design and conduct experiments' much higher than those identifying themselves as engineers and those identifying themselves as coming from both an engineering and non-engineering background.

EAC/RDC Attendees: E. Ablowitz, B. Bauer, J. Becker, T. Broyles, B. Buckland, K. Coyne, A. Dawson, S. Donnelly, P. Drew, F. Figueroa, P. Hamilton, D. Hernandez, M. Herriage, G. Jacobs, F. Kitson, R. Kolibaba, J. Liebman, P. Mannetti, J. McAnally, M. Mercure, J. Negler, V. Norviel, L. Pinchuk, F. Prager, C. Robertson, L. Sanders, A. Sanders, G. Sissel, G. Smith, J. Tietjen, R. Zimmerman