# University of Wyoming

College of Engineering and Applied Science

Dean's Office

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# **COLLEGE OF ENGINEERING and APPLIED SCIENCE** *Working for Wyoming and the World*

# COLLEGE PLAN 2009-2014

April 2009



Core space defunct



Core space renovated for contemporary education and research (Example sketch; credits to Dr Tony Denzer and CAE students Kendra, Tyler, and Alex)

### University of Wyoming, College of Engineering and Applied Science Summary of College Plan, 2009-14

#### Vision

The College will be recognized nationally and internationally for the excellence of its education and research programs, and for its central role in the economic and social development of Wyoming and surrounding region. Wyoming and the College will thrive when they partner together to address –

- The frontier challenges facing Wyoming over the next 20 years
- The roles of technology in addressing these challenges
- Collaboration with Wyoming's constituencies to pursue these roles

#### **Necessary Developments**

The College must make the following necessary developments if indeed it is to have the capacity to realize its Vision:

- 1. Deliver accredited contemporary programs of education that equip its students to lead projects integrating expertise from multiple disciplines and backgrounds;
- 2. Extend visible, synergistic partnerships with other University of Wyoming units, as well as with key state and national agencies and laboratories, industries, and other universities;
- 3. Increase undergraduate student numbers and diversity during the next five years;
- 4. Grow, in both size and quality, programs of research and graduate study;
- 5. Broaden and increase funding sources to provide the College greater fiscal capacity;
- 6. Configure and foster the College's faculty and staff resources to facilitate growth in student numbers and expanded research and programs of graduate study; and,
- 7. Build up the College's physical functionality and professional ambience to facilitate research and education addressing the frontier challenges.

#### **Strategic Prominence**

**Goal:** While enhancing all aspects essential to the College's vision, especially invigorate areas holding high promise for strategic regional, national, and international prominence.

#### Actions

- **SP-1**: Identify and support areas of strategic relevance to the frontier challenges and UW's mission.
- **SP-2**: Ensure that the education and research activities of departments effectively relate to areas of prominence.
- SP-3: Position each department to take advantage of the education and research opportunities offered by the NSF-UW supercomputer (managed by NCAR) to be located in Cheyenne.SP-4: Increase the College's value to UW, Wyoming, the Mountain West region, and the nation.

#### Access

**Goal:** Provide access to a comprehensive education experience that emphasizes intellectual growth and rigor, promotes teamwork and connectivity of expertise, and leads to the graduation of professionals well prepared for career success.

#### Excellence

**Goal:** Working together with expertise in other UW units, build and enhance regionally, nationally, and internationally recognized programs of education and research directly addressing the frontier challenges facing Wyoming and the world, while also anticipating the challenges just beyond the frontier.

#### Leadership

**Goal:** Be a leading source of the professionals critical to the future of the state, region, and the nation, and provide national-level research expertise needed for addressing frontier and beyond-frontier challenges.

#### Actions

- A-1: Recruit an enlarged, talented, and diverse undergraduate student population.
- A-2: Increase student retention and likelihood of career success.
- A-3: Engage the College, its faculty, staff, and students productively with other UW colleges and units, and with external constituencies (secondary education, community college, employers).
  A-4: Increase the recruitment and graduation rate of an enlarged, talented, and diverse graduate student population.

A-5: Enable faculty and staff to pursue engaged productive career paths at UW.

#### Actions

E-1: Conduct productive, relevant research and creative scholarship focusing the College's expertise, leveraging interdisciplinary expertise, tapping UW fiscal resources, and facilitating productive collaboration across units.

- **E-2**: Deliver world-class, contemporary programs of undergraduate education and graduate education with continuing commitment to the career success of students.
- **E-3**: Accelerate development and communications activities to broaden corporate, foundation and individual gifts enabling the College to advance.
- **E-4**: Create a college culture that expects, facilitates, and supports the national and international distinction of its faculty and research staff, develops a sense of teamwork, and whose productivity matches the nation's leading engineering and applied science departments.

E-5: Provide the appropriate faculty workload, support infrastructure, staffing, and facilities needed to enable excellence.

#### Actions

- L-1: Play a visible vital role in addressing selected aspects of the frontier challenges.
- L-2: Cultivate faculty and staff leadership.
- L-3: Stress leadership as a career expectation for students.

#### 1. MISSION

The University of Wyoming's College of Engineering and Applied Science (College) will provide excellent education, research, and service in chosen fields of engineering and applied science. The College emphasizes connectivity with society, an attitude of life-long learning, and provides its graduates with the essential problem-solving and collaborative skills needed to address the frontier challenges facing Wyoming, the nation, and the world.

#### 2. VISION

The College will be recognized nationally and internationally for the excellence of its education and research programs, and for its central role in the economic and social development of Wyoming and surrounding region. Wyoming and the College will thrive when they partner together to address –

- The frontier challenges for Wyoming over the next 20 years
- The roles of technology in these challenges
- How the College can collaborate with Wyoming's constituencies to pursue these roles

The frontier challenges extend beyond Wyoming, and arise from pressing concerns regarding *regional and national economies, energy, infrastructure, health, climate change processes, poverty and security, and sustainability of natural and built environments.*<sup>1</sup>

Viewed collectively, the challenges imply substantial needs for more technology educated people, technology innovation, and a "systems" approach. The challenges also imply that technology education and innovation fuse with developments in other expertise areas (e.g., business, health, agriculture, education) to resolve the complex issues the challenges entail.

#### **3. NECESSARY DEVELOPMENTS**

To realize its Mission and Vision, the College will pursue the following development actions:

- 1. Deliver accredited contemporary programs of education that equip its students to lead projects integrating expertise from multiple disciplines and backgrounds;
- 2. Extend visible, synergistic partnerships with other University of Wyoming units, as well as with key state and national agencies and laboratories, industries, and other universities;
- 3. Increase undergraduate student numbers and diversity during the next five years;
- 4. Grow, in both size and quality, programs of research and graduate study;
- 5. Broaden and increase funding sources to provide the College greater fiscal capacity;
- 6. Configure and foster the College's faculty and staff resources to facilitate growth in student numbers and expanded research and programs of graduate study; and,
- 7. Build up the College's physical functionality and professional ambience to facilitate research and education addressing the frontier challenges.

The developments are structured below in terms of Goals and Actions aligned in accordance with the five interconnected planning themes expressed in UW's <u>Creation of the Future 3<sup>2</sup></u> – building depth versus breadth; reinforcing and refining areas of distinction; access; excellence; leadership. In this plan, the first two themes are merged as one theme, strategic prominence. A list of key metrics linked to the College's Goals and Actions (Section 6) quantitatively summarizes accomplishments during the College's 2004-09 College Plan and indicates target accomplishments for the present Plan.

<sup>&</sup>lt;sup>1</sup> The challenges can be articulated in several ways; e.g., the National Academy of Engineers' <u>Grand Challenges for Engineering</u> (published in 2008) delineates 14 specific challenges encompassed by the concerns cited here.

<sup>&</sup>lt;sup>2</sup> The University of Wyoming, March 2009.

#### **4. IMPLEMENTATION**

The Plan outlines four broad goals under the themes *strategic prominence, access, excellence, and leadership*. The cornerstone ideas linking these intersecting themes are quality and productivity of the College's activities.

The College's programs of education and research are of central importance in addressing the challenges, but they alone cannot resolve the challenges. Therefore, a key implementation action expressed throughout the Plan is *the College's engagement with relevant expertise in other UW units and beyond*.

Primary responsibility for general implementation of the College Plan lies with the Dean. In consultation with the College's Administrative Council, appropriate faculty and staff representatives, senior UW administration, college and department advisory boards, and with student input, the Dean will make resource decisions consistent with the Plan. Additionally, the Dean will make *annual progress reports* to the faculty, staff, UW's Administration, and the College's National Advisory Board. Concerted actions toward the goals will strengthen the College's reputation regionally, nationally, and internationally. The rate of advance toward each goal depends on resources available to the College: faculty, staff, facilities, budget, and sizes of undergraduate and graduate student bodies.

*Metrics marking progress* with the Plan will be evaluated relative to performance metrics of a peer group of colleges. Similar evaluations will be done at department and program levels. An initial implementation task is to define the College's peer groups, and track and evaluate meaningful sets of metrics.

**Planning and implementation comprise a continuous process** involving the College's faculty, staff, and advisory boards. The present Plan will be reviewed annually by the College's Administrative, Faculty, and Staff Councils, ensuring planning consistency among the College, its departments, research units, and UW. Proposed adjustments to the Plan, including annual priority of actions, will be carried through appropriate departmental, faculty, and advisory-board review stages.

## 5. GOALS AND ACTIONS [Strategic Prominence, Access, Excellence, Leadership]

# STRATEGIC PROMINENCE

Goal: While enhancing all aspects essential to the College's vision, especially invigorate areas holding high promise for strategic regional, national, and international prominence.

Action SP-1: Identify and support areas of strategic relevance to the frontier challenges and UW's mission.

- Delineate areas of strategic advantage, including those with long-term prospects, notably energy, environment, computational science and numerical simulation, mechatronics, and health technologies.
- Recruit and retain faculty and research staff with exemplary research and scholarship expertise and potential in these areas.
- Position the College's expertise and facilities for productive partnering with UW Colleges and units (including SER<sup>3</sup>, ENR<sup>4</sup>, and WRI<sup>5</sup>) and other organizations in pursuing areas of strategic prominence.

Action SP-2: Ensure that the education and research activities of departments effectively relate to the areas of prominence.

- Strengthen energy and environment related content of undergraduate and graduate (and cross-department) curricula in each department.
- Include significant energy and environment (natural and built) components in each department's research portfolio.
- Expand research and education associated with climate-change processes and their impacts on natural and built environments.
- Expand research and education programs associated with water-resources science and engineering.
- Build up the College's engagement in biomedical and health-science education and research.
- Support the College's efforts in selected areas of mechatronics, such as robotics.

**Action SP-3**: Position each department to take advantage of the education and research opportunities offered by the NSF<sup>6</sup>-UW supercomputer (managed by NCAR<sup>7</sup>) to be located in Cheyenne.

- In each department, build up faculty expertise, along with programs of education and research, in computational science and numerical simulation.
- Identify and develop research and education synergies with NCAR.

Action SP-4: Increase the College's value to UW, Wyoming, the Mountain West region, and the nation.

- Graduate students equipped to meet the pertinent critical workforce needs of the state, region, and nation.
- Promote awareness of important regional and national achievements by the College's faculty, staff, and students.
- Aid other UW and state units achieve strategic initiatives also benefiting the College.
- Develop technology and science courses for majors outside the College.
- Increase the intellectual property assets (patents and income) created by faculty and staff.
- Selectively engage College expertise in workshops and short course benefitting practicing professionals and the public.

<sup>&</sup>lt;sup>3</sup> School of Energy Resources

<sup>&</sup>lt;sup>4</sup> Haub School, and Ruckelshaus Institute, of Environment and Natural Resources

<sup>&</sup>lt;sup>5</sup> Western Research Institute

<sup>&</sup>lt;sup>6</sup> National Science Foundation

<sup>&</sup>lt;sup>7</sup> National Center for Atmospheric Research

# ACCESS

Goal: Provide access to a comprehensive education experience that emphasizes intellectual growth and rigor, promotes teamwork and connectivity of expertise, and leads to the graduation of professionals well prepared for career success.

Action A-1: Recruit an enlarged, talented, and diverse undergraduate student population.

- Advocate the critical importance of technology and science education, and market the College as an education destination for high-quality undergraduate and graduate learning.
- Enhance and expand the College's visibility and appeal to high-school and community college students in Wyoming, the region and the nation, while maintaining appropriate standards for admittance to the College.
- Offer contemporary curricula that motivate students and meet society's workforce needs.
- Ensure curricula involve up-to-date teaching laboratories.
- Provide effective course-delivery and articulation links with regional community colleges.
- Grow undergraduate student enrollment (an important AY2014-15 target is 1,350 engineering, 150 computer science, 50 ESS, students).
- Increase the number of underrepresented students (an important AY2014-15 target is BS enrollment to be at a minimum of 25% women).
- Explore the viability of enabling qualified high-school students to enter at the sophomore level and graduate at the Master-degree level.

Action A-2: Increase student retention and likelihood of career success.

- Establish and further develop an adequately staffed Center for Student Services to coordinate outreach and recruitment; advising, mentoring, and degree progress; internship, co-op, job placement.
- Coordinate support for Earth Systems Science programs related to major interest areas of the College (notably atmospheric science, and energy).
- Encourage all students to have experiential or service learning summer internships, and offer students support for participating in an organized national program, such as Engineers Without Borders.
- Provide a functional and appealing professional ambience of the College's facilities commensurate with the working environments in which graduates will conduct their careers.

Action A-3: Engage the College, its faculty, staff, and students productively with other UW colleges and units, and with external constituencies (secondary education, community college, employers).

- Link the College's developments to those of other UW Colleges and units (notably SENR, SER, WRI) to facilitate faculty, student, and staff access to education and research opportunities, and enable people from other units to engage in the College's activities.
- Encourage talented undergraduate students to pursue a degree minor in an area ancillary to their major.
- Host or participate in pertinent UW and regional workshops highlighting frontier challenges.

Action A-4: Increase the recruitment and graduation rate of an enlarged, talented, and diverse graduate student population.

• Via a set of efforts (e.g., offering competitive financial support, cutting-edge curricula, research topics, study ambience), increase graduate student enrollment (an important AY2014-15 target is 305 engineering, computer science, and atmospheric science, students).

- Increase the number of underrepresented students (an important AY2014-15 target is graduatestudent enrollment to be at a minimum of 35% women).
- Encourage and support student participation in conferences and workshops.

Action A-5: Enable faculty and staff to pursue engaged productive career paths at UW.

- Increase the number of underrepresented groups in faculty or staff (an AY2014-15 target is 15% women faculty in the College).
- Ensure effective college-wide faculty and staff mentoring.
- Better engage faculty and staff in the College's operation by developing and constructively engaging Faculty and Staff Councils.
- Energetically and frequently nominate faculty and staff for awards at UW, regional, and higher levels.

# EXCELLENCE

Goal: Working together with expertise in other UW units, build and enhance regionally, nationally, and internationally recognized programs of education and research directly addressing the frontier challenges facing Wyoming and the world, while also anticipating the challenges just beyond the frontier.

Action E-1: Conduct productive, relevant research and creative scholarship focusing the College's expertise, leveraging interdisciplinary expertise, tapping UW fiscal resources, and facilitating productive collaboration across units.

- Improve and extend the College's programs of graduate-student education and research.
- Increase the College's externally funded research to a level commensurate with the median of the College's appropriate peer group of colleges.
- Increase the number of external, prestigious graduate-student fellowships in the College.
- Increase scholarly output from research.
- Engage undergraduate students in research.
- Utilize the new NSF-UW computer facility to aid cutting-edge research.
- Ensure the College is well positioned for research excellence in areas associated with strategic prominence, notably the following areas:
  - Energy -- The College must strengthen and promote its existing energy-related research programs (extraction and processing of fossil fuels<sup>8</sup>; wind<sup>9</sup>; power-generation, power-control, and powertransmission systems, energy use), and investigate the merits of new programs (e.g., energy systems engineering). A near-term prospect for research productivity is the High Plains<sup>10</sup> Coal Gasification Project, whose progress should meaningfully engage the College.
  - Environment and climate -- Central efforts include those associated with the interactions of the atmosphere and biosphere, and environmental considerations associated with energy systems.
  - Water resources science and engineering Faculty will take a central role in forming a UW-wide graduate program revolving around the hydrologic, contaminant, ecologic, and hydraulics aspects of water.
  - Biomedical engineering, health, life -- Productive opportunities exist regarding several aspects of sensor-technology, imaging, biochemical engineering, nanotechnology, and information technology.
  - *Materials* -- The College has extensive expertise associated with the development of advanced materials for specified applications. This expertise will be expanded during the Plan period.

<sup>&</sup>lt;sup>8</sup> Build on facility and people investments such as the EnCana Imaging Lab and Reservoir Simulation Lab

<sup>&</sup>lt;sup>9</sup> Develop the Wind Energy Research Center

<sup>&</sup>lt;sup>10</sup> A joint venture involving General Electric

- Mechatronics and MEMS -- Research activities associated with robotics, controls, micro-electro mechanical systems (MEMS) and related areas are being conducted at advanced levels with strong promise of national and international recognition.
- *Infrastructure* -- The College is positioned to for ongoing research to enhance several areas of the built environment, including information technology, building design, transportation systems.

**Action E-2**: Deliver world-class, contemporary programs of undergraduate education and graduate education with continuing commitment to the career success of students.

- Prepare students to graduate with the ability to use the knowledge and modern methods necessary for contemporary professional practice (in engineering, atmospheric science, computer science, areas of earth systems science), and with a breadth of education reflecting the connectivity of knowledge and methods. This effort includes considerable upgrade of the numerical modeling and measurement-instrumentation resources availed to students.
- Educate students to regard themselves as professionals, by engendering a culture of life-long learning and professional improvement; ethical, professional, and societal leadership; concern for the sustainability of built and natural environments; and, the importance of effective communication.
- Encourage more students to pursue the joint BS-MS degree path offered by departments.
- Ensure that the technical tenor of each undergraduate program is highly regarded nationally, and exceeds accreditation expectations.
- Establish a new BS program covering Energy Systems Engineering, based in the Mechanical Engineering Department with mutually beneficial connections to other departments in the College and UW units.
- Establish or enhance graduate programs in established and targeted areas: energy, environment, water, materials, environment (incl. atmospheric science), and numerical modeling. Engage the Graduate School to offer selected interdisciplinary programs.
- Work with several UW departments to strengthen the Earth Systems Science undergraduate program.

Action E-3: Accelerate development and communications activities to broaden corporate, foundation and individual gifts enabling the College to advance substantially.

- The College's Development and Communications Office will work with the Dean, Associate Deans, Department Heads and appropriate faculty and staff to determine the best prospects and approaches to encourage gifts to support excellence in addressing the frontier challenges.
- Participate in, and offer, joint seminars, events, and programs with other UW colleges and units to maximize the College's access to a broader donor base.
- Energetically and creatively market the College to all constituents including corporations, foundations, associations, College alumni, friends, faculty, staff and students, and to the Wyoming people.
- Provide the development and communications resources to support this goal.

Action E-4: Create a college culture that expects, facilitates, and supports the national and international distinction of its faculty and research staff, develops a sense of teamwork, and whose productivity matches the nation's leading engineering and applied science departments.

- Recruit, reward, and retain nationally competitive faculty. Development entails offering competitive salaries, named professorships, endowed professorships, and faculty fellowships for associate professors.
- Establish at least one visiting-professor fellowship to bring scholars to the College for periods of 1 to 6 months.

- Develop a set of tenure and promotion expectations commensurate with other public, research universities, with expectations reflecting a high level of research productivity.
- Recognize the accomplishments of faculty, staff, and students; notably, by encouraging nominations for university, state, and national awards; review faculty for possible nomination to National Academy of Engineering or Science.

Action E-5: Provide the appropriate faculty workload, support infrastructure, staffing, and facilities needed to enable excellence.

- Renovate and expand the College's physical facilities to provide the environment necessary to enable excellence in all areas.
- Diversify the College's income sources to support greater levels of activity in all aspects of the College's mission.
- Enlarge the Dean's Office staff to provide the support and leadership necessary to achieve greater levels of activity in all aspects of the College's mission.
- Configure the College's Faculty and Staff Councils to enable faculty and staff to work with the Dean's Office in enhancing the College's operation.
- Engage Advisory Boards comprising suitably diverse and engaged members.
- Identify and implement ways to strengthen technical support (post-doc., workshop, technician, and accounting personnel) of the College's overall research enterprise.
- Review (every six years) department programs of graduate-study and research. Work with UW's Graduate School and Research Office in conducting the reviews.

## LEADERSHIP

# Goal: Be a leading source of the professionals critical to the future of the state, region, and the nation, and provide national-level research expertise needed for addressing frontier and beyond-frontier challenges.

Action L-1: Play a visible vital role in addressing selected aspects of the frontier challenges.

- Delivering sets of key education and research programs directly linked to the frontier challenges as they affect Wyoming, the U.S. and the world, in accordance with the College's vision.
- Expand the College's value and role as a productive mechanism for state economic development, by increasing partnerships with organizations that participate in Wyoming business recruitment and growth activities.
- Partner with external constituencies to facilitate the development of Wyoming and surrounding region.
- Engage with other UW colleges, schools, and units with the goal of including the College in their own plans.

Action L-2: Cultivate faculty and staff leadership.

- Define national peer groups for engineering, computer science, atmospheric science, and earth systems science programs
- Provide nationally competitive salaries.
- Promote faculty and staff participation in the College, UW and external committees, and in boards and professional organizations.
- Foster the College's newly established Faculty and Staff Councils so as to engage faculty and staff in governance of the College.
- Recognize and reward successful leadership, and mentoring of junior colleagues, as integral components of advancing the College.

Action L-3: Stress leadership as a career expectation for students.

- Increase students' communications abilities.
- Emphasize leadership as an outcome from BS, MS, and PhD programs.
- Encourage student involvement in student chapters of professional societies and in organized UW student activities.
- Cultivate research and scholarship as expressions of leadership.
- Provide graduate students opportunities for guided participation in teaching programs, so as to nurture education leadership early in their careers.

## 6. METRICS<sup>11</sup>

The table lists a set of metrics linked to the goals and actions Section 5 outlines. The metrics are intended to reflect as profile of the College's development during the period of the preceding College Plan and the forthcoming period of the present Plan.

<sup>&</sup>lt;sup>11</sup> Note: The College maintains a more extensive table of metrics as part of its operation

Metric	AY2004-05	AY2008-09	College Target (AY2014-15)
BS enrollment	1,148	1,260	1,550
(ENG/CS/ESS)	1,000 <sup>12</sup> /148/0	1,135/118/7	1,350/150/50
MS enrollment	91	104	170
(ENG/CS/AS)	62/15/14	82/12/10	130/20/20
PhD enrollment	73	91	135
(ENG/CS/AS)	55/13/5	66/16/9	100/20/15
Total faculty head count			
(tenure-track/ac.	79/12	81/14	95/15
professional)			
# of BS degrees	195 AY05	186 AY08	250 AY15
(ENG/CS/ESS-AS)	164 <sup>13</sup> /31/0	164/22/0	205/35/12
# of MS degrees	42	32 AY08	55
(ENG/CS/AS)	36/2/4	28/3/1	40/6/7
# of PhD degrees	9 AY05	17 AY08	30
(ENG/CS/AS)	7/1/1	14/3/0	20/5/3
Research grants, contracts	\$8.8M	\$11.3M (FY08)	\$15M per year
Gifts, Donations	\$2M (FY04)	\$4.6M (FY08)	\$4M per year
BS underrepresented	2.4% minority <sup>14</sup>	5.5% minority	7.5% minority
minority and women	15.2% women	15.6% women	25% women
enrollment			
MS underrepresented	4.4% minority	3.8% minority	7.5% minority
minority and women	23.1% women	31.7% women	35% women
enrollment			
PhD underrepresented	1.4% minority	3.3% minority	7.5% minority
minority and women	15.1% women	19.8% women	35% women
enrollment			
Underrepresented	NA <sup>15</sup> % minority	NA% minority	2% minority
minority and women on	10% women	10% women	15% women
faculty			

 <sup>&</sup>lt;sup>12</sup> In 1962, BS enrolment was 1,009
 <sup>13</sup> In 1962, CEAS graduated 161 BS engineers.
 <sup>14</sup> As defined by US federal agencies
 <sup>15</sup> Data not available