Programs of education and research within the College of Engineering and Applied Science aim at the frontier challenges immediately facing Wyoming and the world. Its programs, moreover, seek a longer-range view toward challenges just beyond the frontier, some of which may still seem in the realm of science fiction. During the period covered by the present biennial report, the College has further developed the overall capacity of its programs to deal with the immediate and over-the-horizon challenges. With the benefit of prudent additional investments in faculty, staff, and facilities, the College will be better poised to address the challenges facing Wyoming and the world.

The frontier challenges extend beyond Wyoming, and arise from pressing concerns including:

- Changing economic base;
- Energy;
- Global sustainability;
- Infrastructure;
- Health;
- Poverty; and
- Security.

Challenges just beyond the horizon include fascinating notions such as life platforms off the planet earth and deep within it; the development and use of smarter and smaller devices of diverse description; and new forms of material and energy.

Viewed collectively the challenges imply substantial needs for more technology-educated people and technology innovation. The challenges also imply that technology education and innovation fuse with developments in other expertise areas (for example, business, health, agriculture, law, and education) to resolve the complex issues the challenges entail. Accordingly, the College’s education programs have increasingly acquired a broader or “systems” perspective aimed at helping students recognize how things are interconnected. This development is evident in the Earth System Science program that partners the College with other Colleges, but also in accreditation requirements for the College’s degree programs in engineering and computer science.

And yet, though the need for technology educated people increases, the total numbers of bachelor-level engineers and computer scientists graduated nationally are considerably lower versus where they were two decades ago. Also of present concern is
the recent, national decline in the numbers of women students pursuing degrees in engineering and computer science. This year, women comprise slightly less than 16% of the College’s undergraduate engineering students, and 12% of its computer science students; a useful reference statistic is that about 60% of the University of Wyoming’s undergraduate students are women. These statistics align with nation-wide numbers. Without doubt, a sustained effort is needed to draw more interest to careers in engineering and applied science. The College’s essential mission is to enable young people from Wyoming, and elsewhere, to embark upon stimulating careers in engineering, computer science, and earth-systems science.

Besides enhancing recognition nationally and internationally for the excellence of its education and research programs, the College envisions itself playing a 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:

1. The frontier challenges for Wyoming over the next 20 years;
2. Technology’s role in these challenges; and
3. How the College can work together with Wyoming’s constituencies to pursue these roles.

The ensuing sections of this biennial report briefly recap how each of the College’s six departments have developed their programs of education and research during the past two years. Additionally, the report summarizes College-wide developments regarding undergraduate and graduate programs, and the College’s activities associated with development and communication. A significant recent advancement for the College is the establishment of a Center for Student Services, staffed by three people whose work substantially boosts the College’s ability to recruit, advise, and job-place its students. Another significant advancement is the creation of the position of Associate Dean for Graduate Programs and Research position. This invigorated commitment began in earnest under the leadership of former Dean Gus Plumb, whose eight-year service as Dean was completed July 2007.

During FY2008, the College’s research awards exceeded $11 million, showing continued growth from prior years. The awards were from diverse funding sources, and reflected the range of frontier challenges pursued by the College’s faculty, staff, and students. The adjacent diagrams on these pages indicate the growth in research awards during recent years, the mix of research-funding sources, and the overall composition of funding sources. A useful observation is that the College’s research awards exceed the total amount of funds State of Wyoming allocates to the College.

During the past two years the College has forged relationships with the University’s two resource-related schools: Helga Otto Haub School of Environment and Natural Resources, and the School of Energy Resources. The relationships have provided opportunities for additional faculty lines in the College, research funding, and course offerings. The College anticipates continued and increasing relationships in the years ahead. It also anticipates building productive connections with the National Center for Atmospheric Research, which with Wyoming’s assistance will place a world-class supercomputer in Cheyenne.

This, the College’s fifth, biennial report offers an engaging snapshot of the College’s programs of education and research. The programs address the challenges facing Wyoming and the world. On a lighter note, it should also be said that the College’s students have fun. The many informal activities available through the College and the University help to ensure that students do more than pursue weighty societal challenges.
Undergraduate education remains the primary focus of the College. The College prides itself on its high-quality academic programs, talented faculty, and competitive research programs. Faculty are in the classroom at all levels of the curriculum. The College attracts high-quality students, and its graduates are in demand in the mountain west and beyond. Many opportunities exist outside the classroom for students to participate in extracurricular and co-curricular activities. Students from the College are active in student chapters of professional societies, student government, varsity and club sports, social and service groups, and many other organizations to help them balance their technical development with their growth as responsible, contributing members of society.

Enrollment

Over the last several years, enrollment in the College has grown significantly. With the booming energy sector, the reintroduction of petroleum engineering, and the outstanding support for higher education shown by the State legislature, enrollments have exceeded our expectations. In Fall 2005, enrollment in the College included 1128 undergraduates and 177 graduate students. In Fall 2008, those numbers increased to 1260 undergraduates and 195 graduate students, increases of slightly more than 10% in only three years. Particularly startling is the increase in the number of freshmen entering the College. In Fall 2005, we saw 279 new freshmen; Fall 2008 brings 377 freshmen (a 35% increase in class size over three years). Interestingly, some of our new students do not appear in these numbers as they come to us right out of high school with so much advance placement and community college credit that they enter as sophomores. The landscape for college-bound students is changing and we are looking to provide more opportunities for these top-quality students who can write their own tickets to an education and a career.

Center for Student Services

Our commitment to undergraduate education is more than just words. In Summer 2008, the College reorganized itself and established the Center for Student Services (CSS). The CSS continues the long tradition of personal attention to our students provided by the dean’s office, but it also has expand the range of services to help our students be successful in their academic programs and start
their careers with the greatest range of opportunities. With our advising coordinator and two academic professionals, the CSS expands our ability to recruit prospective students from the State and around the region, develop targeted internship and career opportunities for our students, implement new programs for improving communication skills, and generally support the broad range of services we offer to our students, both inside and outside the classroom.

**Opportunities for Enrichment**

The College supports more than twenty different professional, student government, and special interest society chapters and clubs. Each department contains at least one student chapter of a professional society. In addition, College-wide organizations and clubs include the Minority Engineering Program, the Society of Women Engineers, the Tau Beta Pi honor society, Engineers Without Borders, and several student government groups. Participation in these organizations helps students develop skills in leadership, teamwork, and service. Students also develop contacts with local and national professionals that can lead to career opportunities.

The UW chapter of Tau Beta Pi has twice in the last four years been recognized with the R. C. Matthews Outstanding Chapter Award, the highest award presented by the society. The award recognizes the chapter for its exemplary service to students in the College and the local community through blood drives, a free campus-wide tutoring service, and a variety of youth activities.

In early 2006, the International Engineering Club formed UW’s chapter of Engineers Without Borders (EWB-WYO). EWB-WYO is a service organization that partners with developing communities to implement sustainable solutions to quality-of-life problems. Typical projects include development of water supply systems, water and wastewater treatment, pedestrian bridges, and power systems. EWB-WYO provides the vehicle for students from the College, as well as those from across the UW campus, to develop technical and professional skills as they increase their awareness of their social and public service responsibilities. Over Christmas break 2007, the chapter completed its first project in Guatemala, where it built a vocational technical institute for a village that was devastated by mudslides caused by Hurricane Stan in October 2005. Expanding its reach to Africa, the chapter has established a relationship with the village of Mbita Kenya on the shores of Lake Victoria, where there is a desperate need for a clean water supply. As of this writing, project planning is underway.
Atmospheric Science (ATSC) has a graduate degree program (20 masters and 6 doctorates in the past 5 years), and provides an undergraduate degree concentration under the developing earth system science (ESS) major. The enrollment in the ESS program is now over 30, with 12 ESS majors in the various concentrations including ATSC and ESSE (ESS education) variant.

ATSC’s research strengths are in aerosol science, cloud physics, boundary layer phenomena, remote sensing, and airborne instrumentation. Department investigators receive approximately $3.5 M in external funded, peer-reviewed funding annually, making it one of the leaders on campus in research.

The Department’s facilities are: 1) the King Air 200T (UWKA) research aircraft with the Wyoming Cloud Radar (WCR) which are supported by the National Science Foundation (NSF) as national facilities; 2) the Wyoming Balloon Launch Facility; 3) the Elk Mountain Observatory at 11,000 ft. altitude; 4) a remote-sensing laboratory for radar and lidar development; and 5) the Keck Aerosol Laboratory.

RESEARCH, FACULTY and STUDENT HIGHLIGHTS

• Clouds and the climate system: Because of the importance of the cooling effect that they exert on global climate, low clouds in general and marine boundary layer clouds in particular, are an overarching theme of the departmental faculty, and are the subject of several recent field studies conducted by ATSC faculty, staff and students. The Department’s efforts continue to improve cloud observational capability, focusing on developing new integrated cloud observation capabilities from the UWKA, by combining cloud radar and lidar observations with data from in situ probes. Jeff Snider and David Leon recently studied forcing mechanisms for marine stratus off the coast of South America in an NSF-funded project using the NSF C-130 aircraft.

• Zhien Wang’s team of students and post-docs are doing research that contributes to giving scientists around the world confidence in using satellite observations in studies of clouds globally. Using the new generation of NASA satellite observations, they provided a first global view of drizzle in marine stratocumulus clouds; a step necessary for understanding why some clouds produce rainfall, while many do not.

• Boundary layer processes: We are studying boundary-layer circulations and precipitation formation in various environments including marine stratus, cumulus clouds and Antarctic surface flows. Thomas Parish’s and David Leon’s NSF-funded project studies the use of high-precision differential global positioning (with the cloud radar and cloud lidar) to determine pressure perturbations that occur within
growing cumulus clouds and which characterize pressure gradients that generate the low-level jet in the marine boundary layer off the coast of northern California. In a related project, Bart Geerts’ field campaign over the Santa Catalina Mountains near Tucson, Arizona documented how thermally-forced boundary layer circulations formed over the mountain and how they interacted with orographic convective development.

- Wintertime orographic precipitation processes: The team of Jeff Snider, Bart Geerts, Zhien Wang and David Leon continue their ongoing series of small campaigns over the mountains in SE Wyoming over the Medicine Bow Mountains in concert with Wyoming’s five-year Cloud Seeding Pilot Project funded by the Wyoming Water Development Commission. The purpose of the cloud seeding is to increase snowpack and the subsequent runoff. Based on NASA-funded observations near Laramie, there is strong evidence of surface sources of ice crystals in wintertime orographic clouds and strong aerosol scavenging in these clouds, which have important implications for weather modification in mountain regions.

- Atmosphere/biosphere interactions: The interest in biogenic aerosol and, more generally, in how vegetation forces cloud and precipitation processes is linked to the Department’s broadening focus to include research on interactions between the atmosphere and the terrestrial biosphere. Building upon Robert Kelly’s work on boundary layer surface interactions, the most substantial element of this broader focus is the new Wyoming Excellence Chair in Atmosphere-Biosphere Interactions, a joint position between ATSC and the Department of Renewable Resources.

- Tropospheric aerosol and clouds: Terry Deshler has several NSF-funded studies relevant to climate prediction. One focuses on comparisons of predicted and measured growth of aerosol particles to cloud drops in both maritime and continental environments providing new insights into the factors influencing particle activation and the inter-relationship of aerosol and cloud properties. Derek Montague with Deshler had a project which investigated the dependence of aerosol radiative and hygroscopic properties on aerosol chemical composition with measurements in Laramie and at the Elk Mountain Observatory. A new project is planned to document the fraction of black carbon in the local aerosol, and to investigate the influence of black carbon on the radiative and hygroscopic properties of aerosol.

- Stratospheric aerosol and ozone: The last stratospherically important volcanic eruption occurred more than a decade ago. Thus, stratospheric aerosol loading has fallen to historic minima. Deshler’s team continues to make balloon-borne measurements from Laramie to capture these historic minima and provide tests for models of the processes that maintain that aerosol, as well as providing stratospheric aerosol size distributions useful for satellite data retrieval algorithms. The team’s zone measurements above Antarctica continue as the maximum in halogen abundance in the stratosphere passes. These measurements have helped to establish the baseline for minimum ozone due to halogen loading. The emphasis now is on understanding why the first half of the 2000s did not show as much ozone loss as the last half of the 1990s, which was the expectation, and on continuing ozone profile measurements above McMurdo Station. Our research efforts in these areas are supported with funding from the NSF. The 21st UW expedition to McMurdo Station, Antarctica (78º S latitude) has just been completed, making another set of balloon-borne measurements of the ozone hole. These measurements have been supported by the National Science Foundation since 1986.

This year, the Department began its 21st year in a cooperative agreement between UW and the National Science Foundation for operation of the UW King Air research aircraft as a national lower atmospheric observing facility, and a new agreement has been approved to extend this relationship through 2013. UW is one of the very few universities to house such a world-class observing facility, which provides unique opportunities for our faculty, students, and staff. The UW research and transportation aircraft are housed at the Donald L. Veal Research Flight Center located at the Laramie Regional Airport.

Professor Jeff Snider and graduate student Bujidmaa Borkhuu are seen here collaborating on a hotplate snow measurement system, one of four different snow rate instruments being compared by Bujidmaa in her studies of wintertime precipitation in the Medicine Bow Mountains. The research work is supported by the State of Wyoming and the US Geological Survey (courtesy photo).
The Department expanded rapidly, doubling to nearly 200 undergraduate and 40 graduate students. Much of the growth was associated with the reinstatement of the undergraduate Petroleum Engineering Program, which produced its first 12 graduates in Spring 2008. The return of this undergraduate degree marks a significant milestone for the Department and University in maintaining and increasing prominence in energy. Energy and life science are the Department’s focus areas.

Both undergraduate programs have active professional society student chapters. Our students competed successfully at regional and national levels in the American Institute of Chemical Engineers (AIChE) ChemCar Contest, involving design of a model car driven by a chemical reaction. The Society of Petroleum Engineers (SPE) chapter sponsored a trip by 20 students to Shell’s Drilling and Production School in New Orleans.

The Department would like to recognize major gifts ($100,000 plus) from a number of individuals and companies, including Thomas R. and Darlis Fuller, F. E. “Tut” and Diane Ellis, Marathon, ConocoPhillips, EnCana USA, BP America, and Baker Hughes.

RESEARCH, FACULTY, and STUDENT HIGHLIGHTS
• Department faculty published 50 journal articles per year from research funding approaching $3 million per year. Several research and teaching excellence highlights follow.
• Biochemical engineering: Adjunct Professor Youqing Shen and Assistant Professor Patrick Johnson studied design and synthesis of polymers as biomaterials for drug delivery, gene delivery, and CO2 separation.
• CO2 separation and capture: Assistant Professor Hertanto Adidharma, Associate Professor and Department Head Morris Argyle, Professor Maciej Radosz, and Youqing Shen, of the Soft Materials Laboratory, are investigating carbon dioxide (CO2) separation and capture using ionic liquids, polymer nanocomposite membranes, and sorbents/reactants.
• Coal conversion: Argyle, Associate Professor David Bell, and Professor Brian Towler are developing clean coal conversion technologies to produce value-added products (fuels, chemicals, electricity). Wyoming and General Electric are partnering to build a pilot scale coal gasifier to develop and test these technologies with Wyoming coals.
• Core flooding studies: Assistant Professor Vladimir Alvarado is developing a Chemical Flooding Unit and lab, funded by the UW Enhanced-Oil Recovery Institute (EORI).
• EnCana Three-Phase Flow in Porous Media Laboratory: Assistant Professor Mohammad Piri, funded by a gift from EnCana, commissioned a unique laboratory to study three-phase flow in porous media via computed tomography (x-ray imaging) to enhance recovery of petroleum from reservoirs.
• Petrophysics and low salinity waterflooding: Professor Norman Morrow’s Petrophysics and Surface Chemistry group studied projects on imbibition and application of coalbed methane water to improved oil recovery to increase worldwide oil reserves.
• Morrow was the 2006 UW President’s Speaker Series lecturer and received the UW 2006 Presidential Faculty Achievement Award and the UW Distinguished Graduate Faculty Mentor Award.
• Morrow and Shen each received the UW College of Engineering and Applied Science Samuel B. Hakes Graduate Outstanding Research and Teaching Award.
• Two of Shen’s students, Peisheng Xu and Shijie Ding, won UW Outstanding Ph.D. Dissertation Awards.
• Radosz was named an American Institute of Chemical Engineers Fellow.
• Lamia Goual, specializing in petroleum fluid/water/solid interactions, joined the Department in 2007.
• Johnson received a four-year $485,000 grant from the U.S. Department of Transportation with $50,000 in matching funds from the UW School of Energy Resources. The grant is through the 2007 North Central Sun Grant Regional Competitive Grant Program.
• Michael Basden, a chemical engineering major from Kemmerer, Wyoming, received the College’s 2008 Tau Beta Pi Outstanding Sophomore award.
• Nicholas Stuckert, chemical engineering major from Casper, Wyoming, received the 2008 Past President’s Scholarship from the Wyoming Engineering Society. In addition, Derek Schreinert, chemical engineering major from Dayton, Wyoming, and David Brinkerhoff, petroleum engineering major from Powell, Wyoming, were honored as scholarship recipients by the Wyoming Engineering Society at their convention in spring 2008.
civil & architectural engineering

The Department has focused the considerable breadth of expertise of its faculty toward the goals of educating the engineers needed to design, build, operate, and manage sustainable human habitat, and identifying and developing the technical solutions needed to support sustainable human habitat. The Architectural Engineering Program, one of only 16 ABET-accredited bachelor’s programs in the United States, offers undergraduate study in two options: structural engineering and mechanical engineering. Recent curriculum changes in this program now provide all students with the fundamentals of sustainable building design and performance, with an emphasis especially on decreasing building energy consumption. In 2007, Tony Denzer, assistant professor in the Department, became a Leadership in Energy and Environmental Design (LEED) Accredited Professional through the U.S. Green Building Council and brings this expertise into our architectural engineering classrooms. Additionally, Department faculty have taken the lead in implementing Building Information Modeling (BIM) into the classroom. BIM is a powerful tool for streamlining building design and construction and also optimizing building performance. Denzer and Keith Hedges, assistant lecturer in the Department, were recognized in May 2008, for their leadership in introducing BIM to students by the American Institute of Architects (AIA) award in the “Academic Program or Curriculum Development” category for their innovative design curriculum facilitated by BIM.

The Department plans to introduce a graduate program (Master’s) in architectural engineering within the next two years. We are delighted to welcome Ahmed Megri as a new faculty member in architectural engineering. He joins us from the Illinois Institute of Technology where he was the director of their Architectural Engineering Program. His expertise includes thermal comfort, building load and energy modeling, and zonal modeling of air movement and temperature in rooms.

The Civil Engineering Program provides undergraduate and graduate training (master’s and Ph.D.) in five key areas of civil engineering: environmental, geotechnical, structural, transportation and water resources. To enhance our teaching and research in environmental engineering, we are delighted to welcome Jonathan Brant as a new faculty member. He joins the Department from HDR Engineering, Inc. and brings expertise in advanced membrane
processes for water treatment which is directly applicable in the Department’s efforts to reclaim and reuse water for sustainable supply. In water resources engineering, we are delighted to welcome Gi-Hyeon Park as a new faculty member. He joins the Department from the University of California, Irvine, where he was working on the California Hydrologic Forecast system.

RESEARCH, FACULTY and STUDENT HIGHLIGHTS

The Department conducted over $2 million worth of research with a strong emphasis on sustainable human habitat. The following is a small collection of recent examples.

• Fred Ogden, the Roy and Caryl Cline Distinguished Chair of Engineering, Environment and Natural Resources, continued his efforts to better understand the hydrology of tropical forests. Supported by funding from the Smithsonian Tropical Research Institute, he has been instrumenting the Panama jungle near the canal zone to understand the effects of reforestation and, specifically, to determine whether there will be sufficient water for the expanded Panama canal to operate effectively in the dry season.

• The Department’s Undergraduate Program Director David Mukai, working in collaboration with Trent McDonald of Western Ecosystems Technology, Inc., received National Science Foundation (NSF) funding to develop better methods to teach statistics to engineers. Mukai began implementing these methods in our undergraduate civil engineering materials class which has a strong laboratory component to provide numerous opportunities to work with statistical principles.

• Assistant Professor Jennifer Tanner initiated research to evaluate the risk of the alkali-silica reaction (ASR) in Wyoming. This project, funded by the Wyoming Department of Transportation, will investigate multiple ASR evaluation methods.

• H.T. Person Professor Charles Dolan and colleagues David Mukai and Jennifer Tanner, completed their study examining the durability of bonded carbon fiber reinforced plastic used to strengthen concrete. This work was supported by the National Cooperative Highway Research Program.

• To learn how to better protect wildlife and drivers on Wyoming’s rural highways, Associate Professor Rhonda Young obtained funding from the Wyoming Department of Transportation to examine the effectiveness of animal detection systems.

• Young was selected to receive the 2008 Transportation Professional of the Year award from the Colorado/Wyoming Section of the Institute of Transportation Engineers.

• Nawa Pradhan, a post-doctoral researcher in the Department, was awarded the young author excellent paper award by the Japan Society of Hydrology and Water Resources.

• Ashley Spears, a top graduate in architectural engineering in December 2007, received scholarship offers from Stanford and Berkeley. Ultimately she accepted the offer from Cornell in addition to receiving an NSF fellowship to pursue her graduate studies at that institution.

• Architectural engineering majors, Douglas Owens and Danielle Babione, received National Tau Beta Pi Scholarships.

• Matthew Scarborough, received the 2008 Wyoming Engineering Society Student of the Year Award.

• Kendra Heimbuck, an architectural engineering major from Green River, Wyoming, was a 2008 UW Gold candidate.

The UW Architectural Engineering Program received a national award for its innovative design curriculum facilitated by Building Information Modeling (BIM). The American Institute of Architects (AIA) honored UW for its work in the “Academic Program or Curriculum Development” category of the fourth annual BIM Awards. The award was presented to faculty members Keith Hedges and Anthony Denzer in a ceremony at the AIA national convention in Boston. Demonstrating BIM in a UW laboratory are, from left, senior Jeremy Chuhralya, Cheyenne; architectural engineering faculty members Keith Hedges and Anthony Denzer; and graduate student Daniel Charbonneau, Lander (courtesy photo).
The Department of Computer Science has undertaken several personnel changes during the past two years. John Mayer joined the Department as an assistant lecturer from Spring 2006, to Spring 2008. Mayer holds a B.A. from Harvard College and a Ph.D. in Computer Science, with specialization in artificial intelligence, from the University of Michigan. He held previous faculty appointments at Carnegie Mellon University and Southern Polytechnic State University, and has worked as a software engineer with the Whitehead Institute for Biomedical Research.

Kim Buckner joined the faculty as an assistant lecturer in Fall 2008. Buckner has a Ph.D. from the University of Tennessee-Knoxville and has most recently worked in the Nuclear Astrophysics Group at Oak Ridge National Laboratory. His research interests are focused on distributed computing, grid computing and fault tolerance.

In December 2007, Jeff Van Baalen stepped down as head of the Department after facilitating an effective transition to the College of Engineering and Applied Science, and serving eight years in that role. Tom Bailey served as interim head for the Spring 2008, semester. Dean Robert Ettema appointed Jerry Hamann, associate professor in the Department of Electrical and Computer Engineering, to assume the department head position as of July 2008. Hamann has been a faculty member at UW since 1993 and has worked collaboratively with several Department faculty and graduate students, most recently in the Distributed Robotics Laboratory in cooperation with Diana Gordon-Spears and William Spears.

Faculty in the Department have been actively and successfully pursuing funded research opportunities with external entities including the National Science Foundation, Lockheed Martin, Harbor Branch Oceanographic Institute, the Office of Naval Research and NASA. Faculty and graduate students have presented their research findings at forums as diverse and geographically disparate as Seattle, Lisbon Portugal, and Sydney, Australia.

Computer Science undergraduate degree offerings have been enhanced through the development of two options: business and international engineering. The first provides interested students with an understanding of business fundamentals essential to careers in applied computing science in a business environment. The international engineering option provides computer science students an opportunity to study culture and foreign language at the same time they pursue traditional computer science topics.
During the past two years, the Department has become increasingly active in the Annual UW Undergraduate Research Day. In Spring 2008, ten students presented four projects in a judged competition. The winning project was entitled, “Laramie Valley Chapel Online Information System,” by Michael Shirley and Joshua Becker.

RESEARCH, FACULTY, and STUDENT HIGHLIGHTS

• Associate Professor James Caldwell, spent the Spring 2008 semester on sabbatical visiting the Computer Science Department at the University of St. Andrews in the Kingdom Fife, Scotland. At St. Andrews Caldwell joined the Computational Logic Research Group, expanding work in the areas of formal program synthesis and system verification.

• Associate Professors Ruben Gamboa and Caldwell collaborated to obtain a grant from the National Science Foundation to investigate software design comprehensibility. The project, “SoD-HCER: Comprehensibility as a Design Criterion,” funded for two years beginning September 2006, has sought to automate the process of evaluating software designs via an objective description of what we commonly believe to be a subjective quality, the goodness of comprehensibility.

• Assistant Professor Liqiang (Eric) Wang was selected as a representative on the Program Committee for the Second and Third IEEE International Workshops on Scientific Workflows. He is working with twenty colleagues to solicit and evaluate papers and presentations for this exciting new research forum.

• Adjunct Associate Professor William Spears has continued his work on evolutionary algorithms and swarm robotics. Spears and a Ph.D. student, Suranga Hettiarachchi, shared honors in receiving the Yasuhiko Dote Best Paper Award for their paper “DAEDALUS for Agents with Obstructed Perception,” presented at the IEEE Mountain Workshop on Adaptive and Learning Systems (SMCals).

• Lucas Shaw, one of Spear’s graduate students, was recognized by the UW Graduate School as one of three campus recipients of the 2008 Outstanding Master’s Thesis in Physical and Life Sciences for his thesis “A Computational Framework for Modeling the Spread of Pathogens and Generating Effective Containment Strategies in Weakly Connected Island Models.”

• Assistant Professor John Hitchcock has combined efforts with researchers from Rutgers, University of Florida, Notre Dame, University of Chicago, Iowa State University, North Texas State University, University of Connecticut, Penn State and UC-Berkeley to obtain a National Science Foundation grant to investigate Algorithmic Randomness.

• Adjunct Associate Professor Diana Gordon-Spears served as a program committee member on the 2006, 2007, and 2008 International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS). Her research team at the University of Wyoming has focused on multi-agent solutions to applications as diverse as chemical and biological plume tracing, with funding obtained through the National Science Foundation and the Harbor Branch Oceanographic Institute.

• Cowles and Gamboa collaborated in the development of graduate course materials used locally at UW as well as with the broader audience of Applicative Common Lisp (ACL2) users. ACL2 is used for modeling computer systems as well as proving properties of those models.

• Anton Rebguns received first place in the “best student paper” competition for “Using Scouts to Predict Swarm Success Rate” at the 2008 IEEE Swarm Intelligence Symposium.

• Graduate student Sunil Kothari presented a paper on “Extending Wand’s Type Reconstruction Algorithm to Handle Polymorphic Let” at the Conference on Computability in Europe in Spring 2008.
It has been an exciting time for the Department of Electrical and Computer Engineering. Under the leadership of Department Head Mark Balas, the Department has energetically moved forward with a number of initiatives to improve undergraduate and graduate education, scholarship and research, assessment and service.

The high point of the past biennium was renaming the bioengineering option and its associated laboratory in honor of Francis M. Long, Ph.D. Long came to Laramie in 1956 as an instructor in the Department. He left to complete his Ph.D. and returned to UW in 1961, where he remained a professor for 36 years until his retirement in 1995. At UW, he founded the country’s first accredited baccalaureate program in bioengineering and served as department head from 1977 to 1987. He passed away in January 2007. The bioengineering option continues to be popular with students seeking careers in clinical systems engineering, medical device development as well as those seeking an applied engineering path to subsequent professional programs in medicine.

The Department has completed a number of initiatives to maintain a high level of undergraduate education with a balance between theoretical and practical hands-on education. A number of courses have been revised with new textbooks and new laboratory exercises. We are also offering new course work in a number of elective, cutting-edge topics including network centric controls, 3D computer vision, industrial control, advanced classical controls, and multivariable control. A new course in electronic imaging and Fourier optics is in the works for the coming academic year.

Practical laboratory experience continues to be a hallmark of our undergraduate education program; this is one of a number of reasons why our students remain in great demand within industry. The Department has set a goal of renovating all of our laboratories in the next five years. Much of our critical, highly-used laboratory equipment is dated and unsupported. To kick off this effort we have spent approximately $134,500 on equipment upgrades and laboratory furniture. Our senior design program continues to enjoy strong support from an endowment established by Mike Volpi and Toni Cupal in honor of Jerry Cupal who served the Department with distinction for many years.

The Department instituted a new B.S./M.S. program in electrical engineering in 2005. The purpose of the program is to entice our most promising undergraduate students to stay at UW for a
Graduate students in the Department (pictured left to right) include Geoff Luke, John Benson, and Kim Creaser, shown below conducting research on a fly-eye-inspired sensor (courtesy photo).

graduate degree. The program allows students to use six hours of 5000 level electives toward both their undergraduate and graduate degrees. This will allow students to complete their M.S. degree requirements in one calendar year beyond the B.S. degree. The College graduated the first B.S./M.S. electrical engineering students in May 2007. A sizeable number of our students are electing to remain at UW for their graduate studies rather than immediately entering the work force.

The Department conducts extensive annual assessments of its programs. The next onsite accreditation visit is scheduled for September 2009. With the upcoming visit in mind, Department faculty met with the Department Advisory Board to review recent curriculum developments and assessment results. Advisory board members will provide a vital role as the Department prepares for its ABET/EAC onsite visit.

RESEARCH, FACULTY, and STUDENT HIGHLIGHTS

• Professor John McInroy has led a team of researchers to develop a large proposal for the Wyoming Robotics Initiative Supporting the Joint Ground Robotics Enterprise. The pending proposal will provide $1.7M in baseline research with an additional $2.7M of research options.

• Research team members for the grant include McInroy, Associate Professors Steven Barrett, Robert Kubichek, Cameron Wright and Suresh Muknahallipatna, Assistant Professors John O’Brien and Margareta Stefanovic, Research Scientist Scott Morton, Computer Science Department Head and Associate Professor Jerry Hamann, Department Head Mark Balas, and Department of Mathematics Professor Farhad Jafari.

• Balas and John Naughton (mechanical engineering) received a $2 million donation in September 2007, from BP America that will be matched by Wyoming’s state endowment fund to establish a center dedicated to wind energy research.

• The UW Board of Trustees approved the first phase planning process for a building to house a large, closed-loop wind tunnel in support of the research.

• In recognition of outstanding graduate research and teaching, Balas won the Sam D. Hakes Outstanding Graduate Research and Teaching Award from the Tau Beta Pi Engineering Honor Society.

• Barrett had a textbook published this past year by Morgan-Claypool and a second edition of an earlier textbook released by Pearson Prentice Hall.

• Professor David Whitman is president-elect of the National Council of Examiners for Engineering and Surveying.

• Professor Emeritus Raymond Jacquot received the 2008 Tau Beta Pi Wyoming Eminent Engineer Award. The award recognizes Jacquot’s lifetime commitment to engineering education, service, and the State of Wyoming.

• Barrett received the National Society for Professional Engineering Education Excellence Award for demonstrating the ability to link engineering education with professional practice.

• Electrical engineering major, Julie Sandberg received the 2007 Scholar of the Year award from the American Council of Engineering Companies which included a $10,000 scholarship for the 2007-08 academic year.

• John Benson, Ph.D. candidate and Gavin Philips, M.S. candidate were recognized for their research at the 45th annual Rocky Mountain Bioengineering Symposium held in the spring of 2008. Benson earned 3rd place honors in the poster category and Philips took second place honors for his written paper on next generation wheelchair concepts.

• Margret Paul joined the Department as an office associate in 2007. She was recognized by the student chapter of the IEEE as the 2007 ECE Outstanding Staff Person.

• The IEEE recognized George Janack, master technician as the 2008 ECE Outstanding Staff Person.

• Rebecca “Becky” Meza joined the Department as an accounting associate senior and the Department added Victor Bershinsky as a senior engineer.

Graduate students in the Department (pictured left to right) include Geoff Luke, John Benson, and Kim Creaser, shown below conducting research on a fly-eye-inspired sensor (courtesy photo).
The Mechanical Engineering (ME) Program has prospered during the biennium, with quite a number of recent success stories to illustrate this fact. The Department has grown consistently since year 2000 such that we are now the largest undergraduate program in the College, and the 7th most popular major at UW as measured by undergraduate enrollment (287 undergraduate ME students). Faculty in the department continue to maintain one of the most rigorous academic standards of any unit on campus which is reflected by our students’ performance on the Fundamentals of Engineering Exam (FE), a nationwide exam that is the first hurdle to becoming a licensed professional engineer. ME seniors have passed the exam at a rate of 96% over the last decade, which is 11 percentage points higher than the national average (85%) for ME’s. For the last two FE exams (Fall 2007 and Spring 2008), all 39 ME students taking the exam passed.

Our undergraduates have also distinguished themselves in national competitions this year with two noteworthy senior design projects. One ME team finished 4th place among 23 entries in NASA’s “Great Moon Buggy Race”, and also earned the “Most Improved Team” award. A second design team composed of 11 ME students and 10 students from other engineering disciplines won the “Disappearing Road Competition,” a national competition sponsored by Halliburton that examines minimization of environmental impact on oil drilling operations. The award carried a $20,000 honorarium for the students.

M.S. and Ph.D. programs in the Department have also been strengthened in recent years. A Plan B (non-thesis) M.S. program was implemented in 2005. The Plan B program has five students currently enrolled, and recently recognized its first graduate. Overall graduate enrollment is 31 students, 14 of whom are Ph.D. students. The Department has aggressively pursued enhancements to stipends for Ph.D. students, and developed the Marino Fellowship with the goal of attracting exceptional Ph.D. students. The fellowship carries a nationally competitive stipend of $30k/year (plus tuition). Our first Marino Fellowship recipient, Nick Burgess, began his studies this summer.

Graduates of our program utilize their education through professional employment at over 600 different companies in all 50 states. Boeing is the single largest employer of ME students from UW, with 40 Department alumni employed.
The Department has been considering the feasibility of implementing two undergraduate curricular innovations related to our discipline’s role in energy-related engineering. The first is an “Energy Conversion Option”, which is a variation of the standard ME degree that broadens the scope of existing energy-related elective courses. The second initiative is a proposed degree program in “Energy Systems Engineering”, which would have about 80% of its coursework in common with the conventional ME degree while the other 20% of student coursework would be chosen from electives offered in seven other academic departments. If adopted, this program will be a fully-accredited engineering degree intended to appeal to a diverse audience of students. The Energy Systems Engineering degree has been proposed as a cornerstone academic program for the School of Energy Resources. Both curricular initiatives have been flushed out and presented to various administrators, with approval and implementation pending the allotment of additional faculty resources.

RESEARCH, FACULTY, and STUDENT HIGHLIGHTS

• The Department continues to strengthen its research productivity in a variety of measurable ways. Currently, department faculty have research grants from the NSF (2), NASA (3), AFOSR (3), USAF, Army Research Office, Idaho National Laboratory, Missile Defense Agency, DEPSCoR, Firehole Technologies, Wickman Spacecraft, and others. Notably, the DEPSCoR award is the 7th award secured from this agency by department faculty since year 2000. Research expenditures exceed $100K per faculty member, and are at the highest level in the history of the department.

• Department Head Demitris Kouris’ contributions to the profession were recognized in two substantial ways this year – first by his election to Fellow grade of the American Society of Mechanical Engineers, and second, by his appointment as an NSF Program Director in the Nano and Bio Mechanics program.

• Associate Professor Jonathon Naughton was named Director of the new Wind Energy Research Center (WERC) in recognition of his founding efforts and related research experience. The WERC was established with a $2M gift from BP America.

• Professor Dimitri Mavriplis was instrumental in discussions that lead to the selection of UW and Wyoming as primary partners in the National Center for Atmospheric Research (NCAR) Supercomputer Center. This new partnership between NCAR and UW will greatly enhance our access to state-of-the-art computational facilities, and will likely foster strong collaboration between UW, NCAR, and other front-range institutions in the important multidisciplinary area of computational science and engineering. In addition, Mavriplis has organized and championed a proposal for a cross-disciplinary computational sciences program at UW.

• Brian Lockwood, a new Ph.D. student, was awarded a prestigious DOE Computational Science Graduate Fellowship that carries a $32k/year stipend in addition to tuition and fees. Brian will be pursing computational fluid dynamics under the guidance of Professor Dimitri Mavriplis.

• From 2006-07, Andrew Hansen served in the position of founding Academic Coordinator for the new School of Energy Resources. In Spring 2008, he was appointed to the new half-time position of Associate Dean for Graduate Programs and Research for the College.

• Paul Dellenback was awarded the 2008 Tau Beta Pi Teaching Award from the College. He is serving as the acting department head during Professor Kouris’ appointment at the National Science Foundation.

A mechanical engineering senior design project undertaken by two students for NASA’s 2007 Great Moon Buggy Race, a national competition, is shown below. UW placed fourth among 23 collegiate teams at the 2007 NASA Great Moonbuggy Race, a half-mile stimulated lunar terrain course that includes craters, rocks, and lava (courtesy photo).
In January 2008, the College added an Associate Dean for Graduate Programs and Research. The charge for this position includes many exciting and daunting challenges related to strengthening the College’s graduate programs and the accompanying research enterprise. There is a strong interconnectedness of graduate education and research into the undergraduate mission of the College.

As a land-grant university, an overarching theme of the College is to provide outstanding educational opportunities for the people of Wyoming. To that end, the College is pleased to report that we have lived up to this mission. The College’s graduates find superb employment opportunities on a national scale and routinely make rapid advances in the companies where they choose to work. Moreover, those students that choose to attend graduate school are exceptionally well prepared for graduate education and there is a sparkling history of student success across the nation, including the most prestigious universities in the country.

While the delivery of outstanding undergraduate curricula is the highest priority, UW as a flagship research university, also has a mission to deliver graduate education and advance its fundamental knowledge of engineering and applied science. It is the graduate realm where the frontier challenges facing the state and the nation are confronted on a daily basis. The College addresses innovative problems in numerous areas ranging from, for example, computational science to atmospheric science, and materials science for high performance structures to biomedical innovations acting on the cellular level. Water resources and water quality represents another major area of research activity. In addition, let’s not forget the College’s vital contributions to energy research as it takes on the most pressing challenge facing humanity today, the delivery of reliable and environmentally friendly energy with keen attention to the global CO2 issues facing the planet.

Clearly, graduate education and research within the College play a direct and vital role in Wyoming’s future. A less tangible but extremely significant aspect of this enterprise is the profound impact it has on undergraduate education. In fiscal year 2008, the college research awards exceeded $11 million. It is significant to note that research awards exceed the state budget of $9.7 million.
If one were to subtract annual research expenditures from the budget, the College would be limited in its ability to provide excellence in education. Research dollars are used to build and maintain state-of-the-art laboratories, some of which are unique worldwide. Undergraduate students often have the opportunity to work in these research labs under the guidance of the College’s faculty. Summer internships are also made available for undergraduates interested in gaining valuable experience in their chosen field. Finally, the research enterprise is a major force in attracting outstanding faculty to UW from national and international locations. These people not only are superb researchers, they often make outstanding teachers. Moreover, the value of infusing the new technology and innovation they create into the classroom cannot be underestimated. It’s safe to say, the majority of the College’s outstanding faculty colleagues would not be at UW without the opportunity for intellectual inquiry in the form of research.

The importance of graduate education and research on its own merits, combined with the tightly woven connections to undergraduate education, provide compelling reasons to advance graduate education at UW. In academic planning, a clear focus is to increase the prominence of graduate education in the College. Increased student numbers with commensurate increases in research funding is certainly a priority. At the same time, the College would like to raise the profile of research and graduate education. National and international recognition of the outstanding work of the College is a centerpiece of the plan to advance the College and carry out its mission.
It has been an exciting and successful biennium as the College’s Development and Communications Office has worked to gain the visibility of the College to Wyoming and the world by working in concert with the Dean, faculty, staff, and students of the College. Gifts to the College continue to increase as a result of this visibility, through the support of alumni, friends, foundations, and corporations who recognize the value of providing excellence in education and research.

Major gifts from corporations have enabled the College to gain significant momentum in increasing the total value of the gifts received during this biennium and will continue to grow in the future as these corporations seek to hire our graduates and participate in joint research. The combined biennium giving to the College exceeded $6.143 million with an additional $1.8 million received in state matching funds. The energy industry has been a key contributor as indicated in the chart on the next page, but other major support has been received from the John P. Ellbogen Foundation for the Next Generation Program.

The College has embarked on several development initiatives to support each of its departments, including interdisciplinary projects to promote teaming and project experience that emulates the working environment our graduates’ experience. Some key initiatives include:

**Endowed Excellence Funds**
- Next Generation Program—Recruiting/Retention/Quality
- Energy Systems Engineering Program
- CEAS International Program
- Earth System Science Program
- Departmental Excellence Funds

**Faculty and Student Support**
- H. T. Person Endowed Chair
- Faculty Professorships and Fellowships
- Graduate Fellowships
- Annual Fund – Student Professional Development

**Facility & Technology Enhancement**
- Renovation of 1926 College Facility
- King Air Facility Enhancement
- Departmental Laboratories and Facilities
Ways to Give

**Annual Gifts**

Each Annual Fund gift to the College and its departments is important because it has an immediate and tangible impact on students, faculty, academic programs and facilities.

**Corporate and Foundation Gifts**

The College focused on significantly increasing corporate and foundation giving in this biennium. Corporate and foundation giving to the College doubled in FY2007-08 over the previous biennium and momentum is growing to significantly exceed this growth in the next two years.

**State Matching Program**

Gifts qualify for the endowment match if they are in the amount of $50,000 or greater, if the donor already has a matching endowment established, if the gift is given by a group in memory of an individual, or through several planned giving scenarios. Facilities matching funds are available for approved UW projects in amounts of $25,000 or greater. Qualifying gifts may be paid over a five-year period. This program shows that the Wyoming Legislature is fully committed to higher education excellence in the State of Wyoming.

**Corporate Matching Gifts**

Many companies will match employees’ charitable giving with a gift of their own to institutions of higher education, and often even match charitable contributions made by retirees or board members.

**Planned Gifts**

The UW Foundation’s gift-planning staff assists donors in integrating charitable gifts into their financial, tax, and estate-planning objectives, maximizing benefits to both donors and UW, and these gifts may also be eligible for the state match (which is given to the College immediately).

Wyoming is the “energy state” with major sources of coal, natural gas, oil, uranium, wind, solar, geothermal and water energy. The energy industry is a key partner in solving current and future world energy issues through hiring its graduates and in joint research efforts. The College has received significant support from this industry, from alumni who work in energy, and from the State Matching Program as seen in the chart, below ($9,465M in major gifts from April 2006 through June 2008).

### Major Gifts to the College of Engineering and Applied Science
**for Energy Education and Research**

<table>
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<th>Endowment Gifts for the College of Engineering and Applied Science</th>
<th>Total Funds</th>
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<tr>
<td>Donor</td>
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<tr>
<td>Marathon</td>
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<td>Tom and Darlis Fuller</td>
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<td>ConocoPhillips</td>
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<td>Ellis Family Foundation</td>
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<td><strong>Total</strong></td>
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### Gift History FY2005-08

![Gift History Chart](chart_image)
Michael J. Sullivan

UW conferred its highest award, the honorary doctoral degree, upon former governor and ambassador to Ireland Michael J. Sullivan of Casper. Criteria for the award are: notable contribution to the health, education or general welfare of Wyoming citizens; outstanding accomplishment by alumni, either on a state or national level; or accomplishment so outstanding that it has received recognition on a national or international level.

At UW Sullivan was among the first recipients of the College’s petroleum engineering degree (B.S. 1961). He continued his education with a J.D. with honors (1964) from the UW College of Law. After 22 years of practicing law, Sullivan won the 1986 governor’s race and was re-elected to governor of Wyoming in 1990. In 1995 Sullivan returned to private practice and then spent a semester as a Fellow of the Institute of Politics at the Kennedy School of Government at Harvard University. President Bill Clinton named the Honorable Michael J. Sullivan as United States Ambassador to Ireland in 1998.

Sullivan has served on numerous boards, including the College’s National Advisory Board, and chaired or co-chaired many of them. Additionally, he served as a founding member of the RIENR board.

Among Sullivan’s many honors are the Wyoming National Guard’s Distinguished Service Medal, the Wyoming Heritage Society’s Award of Merit, the UW Outstanding Alumnus Award and membership in the UW College of Engineering and Applied Science Hall of Fame.

Francis M. Long (1929—2007)

The Department of Electrical and Computer Engineering Bioengineering Option Degree Program has been renamed to the Francis M. Long Bioengineering Program. The name change, which was approved by the UW Trustees, honors Francis M. Long who was the founder of the first Accredited Baccalaureate Program in bioengineering at UW. This ABET accredited program prepares students to design the next generation of medical diagnostic and therapeutic equipment, pursue graduate studies in biomedical engineering, or attend medical school.

Long was educated in parochial schools and later attained B.S. and M.S. degrees in electrical engineering from the State University of Iowa (now known as the University of Iowa). Between these two degrees Francis served in the U.S. Army in Korea. In 1956, Francis came to UW as instructor of electrical engineering following his mentor Ed Lonsdale. After several years Francis saw the need for more education and enrolled at Iowa State University where he obtained his Ph.D. in 1961. Returning to UW he decided that one wave of the future was in biomedical engineering so he, with Lonsdale’s help, started what was to be the first Accredited Biomedical Engineering Program in the country. Francis was well known across campus and within the Laramie community before his life was taken by pulmonary fibrosis in January, 2007.

The Francis M. Long Bioengineering Laboratory provides a new generation of students the ability to explore, in the experimental setting, the agreements and disagreements of engineering theory and practice.

Long’s daughter, Caitlin Long, receives a demonstration of the medical diagnostic equipment from electrical engineering graduate student Kari Fuller in the Francis M. Long Bioengineering Laboratory (courtesy photo).
Persons seeking admission, employment, or access to programs of the University of Wyoming shall be considered without regard to race, color, religion, sex, national origin, disability, age, veteran status, sexual orientation, or political belief. (10-2008/15M/NB)