Hav ing just completed efforts related to the 1999-2004 Academic Plan, this past year all academic units in the University focused on the development of a fresh set of plans that look forward to 2009. This includes plans for all departments and colleges. These plans are available under Academic Planning Documents at http://uwadmnweb.uwyo.edu/AcadAffairs/.

One of the College’s many accomplishments resulting from the last five-year plan drafted in 1998-1999 is the increase in enrollment at the PhD level. In the fall of 2003 the College enrolled 70 PhD students compared to 23 in 1999. The 1999 plan set a goal of graduating 15 PhD students in engineering each year. Although we have yet to graduate 15 PhDs in a single year, we are in a good position to do so on a regular basis if we can maintain enrollment at the current level of around 70. This increase in PhD enrollment is attributed to the efforts of the faculty and leadership by the College’s department heads. Since the majority of our graduate students are supported by the research activities of the faculty, strong externally funded research programs are necessary to support, attract, and retain graduate students, especially at the PhD level. As you can see in the figure at the upper right, externally funded research neared an all-time high in Academic Year 2004 approaching the $8 million mark for the second time in the last five years. Our goal for 2009 is to reach $9.5 million.

Other areas of progress in the past five years include a successful accreditation visit for our six engineering programs, constant improvement in the design component of our curricula with more interdisciplinary projects and stronger efforts to improve teaming skills, and the initiation of an International Engineering option. Excellent teaching continues to be a part of the College culture as evidenced by the number of teaching awards, both internal and external, received by College faculty members. Recent awards include three ASEE Regional Outstanding Teaching Awards, and four Ellbogen Meritorious Classroom Teaching Awards, the highest UW award for teaching excellence.

Considerable effort has been devoted to recruiting and retaining faculty during the last five years. Over 40% of the College’s faculty joined the University in the last six years. Several are featured in this report. We are very pleased with the quality of the young faculty members that we have been able to attract.

Attracting an excellent student body is critical to the success of our College. Our incoming freshman has an ACT composite score of slightly over 25 and a high school GPA of over 3.3 compared to 23.2 and 3.42 for the University. The College’s scholarship program, which awards approximately $350K each year to 300 students, plays a critical role in maintaining a student body anxious to pursue the challenges of an engineering education. Ben FitzPatrick (page 7) and Kim Nicholas (page 3) are excellent examples of students who excel in the classroom and at the same time provide leadership and service to their peers.

We are very excited to initiate a search to fill the Roy and Caryl Cline Distinguished Chair in Engineering, Environment and Natural Resources this year. When this new endowed po-
sition is filled the College will be the home of three endowed chairs - the Cline Chair, the H.T. Person Chair (held by Professor Charles Dolan), and the University’s John and Jane Wold Centennial Chair in Energy (held by Professor Norman Morrow of Chemical and Petroleum Engineering). These endowed positions are made possible by private gifts and add immensely to the College’s ability to attract and retain outstanding senior faculty members.

Major action items in the College’s plan for 2004-2009 include maintaining undergraduate enrollment at around 1200 students and increasing graduate enrollment to 200 students. Maintaining undergraduate enrollments at this level will present a challenge with the number of high school graduates in the State expected to decrease by 25% by 2018. In addition, we desire to continuously improve undergraduate education through a series of actions including sustaining the Center for Excellence in Engineering Education, increasing participation in and sustaining the International Engineering Option, improving design education, and increasing undergraduate participation in research. Filling the Cline Chair and making a greater investment in graduate student recruitment and improving the quality of our graduate programs are also on the agenda.

I hope you enjoy reading through this report highlighting a few of the many accomplishments of students, faculty and staff in the past two years.

A significant achievement for the College is the creation of the Center for Excellence in Engineering Education (CEEED). This effort, directed by Professor Jerry Hamann of the Department of Electrical and Computer Engineering, is part of a $1.15M Engineering Schools of the West Grants Initiative provided by The William and Flora Hewlett Foundation. The primary focus is on working with students and teachers in grades K-12 to increase and maintain the high level of interest in mathematics and science necessary to be successful in studying engineering and science at the university level. The project will include developing hands-on engineering and technology models for teaching science and math in grades K-12.

Hamann is also working with College faculty and Wyoming community college faculty to enhance the first two years or core of the engineering curriculum to make it more attractive to students and assure that it is appropriate for engineers who will practice through the middle of the 21st century.
As indicated in the mission statement, undergraduate education continues to be the primary focus of the College of Engineering. This concentration of emphasis has allowed the College to attract high quality students. The Engineering Science (ES) Program and the integration of design throughout the curriculum are key components of the undergraduate experience at UW.

Enrollment
Since the addition of the Department of Computer Science to the College of Engineering in the summer of 2001, both graduate and undergraduate enrollment has been relatively steady at around 175 graduate students and 1200 undergraduate students. In the Fall of 2003, the total on-campus enrollment in the College was 1363. In addition, approximately 60 students were enrolled, nation-wide, in the Surveying Certificate program. The goal of the College, along with the University as a whole, is to maintain a small but consistent growth in enrollment.

Quality of the Undergraduate Program
The quality of an undergraduate program can be measured by a number of indicators including job placement statistics, performance on standardized exams, and success of alumni. The performance by our seniors on the standardized Fundamentals of Engineering (FE) Exam has been consistently excellent over the past decade. This exam is a graduation requirement for all traditional engineering majors. This allows the College to use the results as an assessment tool.

Engineering Science Program
The Engineering Science (ES) program is a somewhat unique aspect of the undergraduate program at UW. Its goal is to coordinate the core classes that are offered to our freshmen and sophomore students by utilizing faculty from all disciplines in the College. The College is always looking for ways to improve the program. One assessment of the quality of the ES program is conducted via the FE Exam. Six of the primary ES topics (Statics, Dynamics, Mechanics of Materials, Electrical Circuits, Thermodynamics, and Fluids) are tested in the morning section of the FE Exam. As can be seen in the graph, in the October 2003 administration of the exam, UW students performed above the national average in all subjects. In addition, our most recent survey of graduating seniors indicated that the vast majority of the students felt prepared or very prepared in these core subjects.
Another College goal is to further improve the undergraduate design experience for each student. One effort in this direction has been to introduce the design process early in the curriculum. For the past four years, a design challenge has been part of ES 1000 (Orientation to Engineering). The most recent challenge involved the design of a miniature dune buggy. The requirements were that the dune buggy be able to cross about 20 feet of sand and water. Other classes in the curriculum continue to assist in strengthening our students’ design capabilities. However, the cumulating experience occurs during the senior design course. Each year, all of our graduating seniors complete a design project involving a mechanical device, a process design, an electrical circuit, a computer program, or a building design. For example, in December 2003, the Senior Design Symposium featured the oral presentation of projects such as The Production of a Mixed Alcohol Fuel from Synthesis Gas, Microgravity Aerobic Exercise Device, Star-Tracking Device for Astrophotography, Design of a Dwelling and Access Road on a Steep Slope, and A EuroEvents and Travel Customer Management System, just to name a few. While the students spend a great deal of effort on their projects, they consistently report this activity as one of the highlights of their undergraduate educational experience. One of the primary responsibilities of the H.T. Person Chair (Dr. Charles W. Dolan) is to assist the College in further enhancement of design education.

The College has a long-standing tradition of "students helping students." Tau Beta Pi provides tutoring; Peer Assistants are assigned to each section of ES 1000 (Orientation to Engineering); 3) Power Groups offer schedules that are designed to allow new freshmen students an opportunity to form study groups; and, 4) Engineering Floors in the residence halls have engineering students as Resident and Teaching Assistants, just to name a few. Kim Nicholas typifies the unselfishness of our students when it comes to helping others. She is the current Tutoring Coordinator for Tau Beta Pi, has worked as an ES 1000 Peer Assistant for the past two years and has been a volunteer for adult ESL classes in Spanish and Chinese. She is a College of Engineering Senator and was named the College’s Outstanding Junior in Spring 2004.
Atmospheric Science (ATSC) is a graduate degree-granting program (21 masters and four doctorates in the past five years). Currently, the curriculum is being broadened to include more emphasis on global change and earth-atmosphere interactions. An undergraduate degree in atmospheric science is also available as an option in the UW Physics program.

ATSC’s research strengths are in aerosol science, cloud physics, and boundary layer phenomena using aircraft- and balloon-based observations. Department investigators receive approximately $3.0M in external funding annually, making it one of the leaders on campus in research.

The Department’s major facilities include: 1) the King Air 200T (UWKA) aircraft; 2) the Wyoming Balloon Launch Facility, shared with the Department of Physics; 3) the Elk Mountain Observatory at 11,000 ft altitude; 4) the Wyoming Cloud Radar (WCR) for the study of cloud structure and composition; and 5) the Keck Aerosol Laboratory. The UWKA and the WCR are designated Lower Atmospheric Observing Facilities by the National Science Foundation (NSF).

Completion of the Keck laboratory and aerosol measurement upgrades to the Wyoming King Air, made possible with a grant from the W. M. Keck Foundation, significantly enhance the Department’s ability to make air-borne and surface based in situ aerosol measurements, and provide an opportunity to contribute scientifically to areas of research with major social implications.

Active areas of research include:

Cloud physics and dynamics

In a series of NASA, NSF, and DOD funded projects, the structure and evolution of several cloud types continue to be investigated using the millimeter wavelength WCR, installed on the UWKA research aircraft. By combining radar observations in both vertical and horizontal planes with complementary microphysical and air motion measurements along the flight track, internal cloud structures and velocities are derived with unprecedented detail. The capability for high quality observational data integration has made this airborne platform a prime choice for cloud research, both nationwide and internationally. External and internal financial support has allowed the WCR to be continually upgraded.

Marine stratocumulus measurements are yielding new insights into the persistent nature of these clouds, how they produce drizzle, and their impact on global climate. In another experiment funded by both NSF and NASA, WCR observations over the high plains depict, with previously unattainable detail, how growing cumuli interact with their environment, and diagnose
The Department this year began its 16th annual cooperative agreement with the National Science Foundation (NSF) for operating the UW King Air research aircraft as a national Lower Atmospheric Observing Facility. A substantial and long-term commitment by the ATSC faculty and staff, the College and the University has provided the means to upgrade the sensors and systems on this “flying laboratory.” The flight center was officially designated The Donald L. Veal Research Flight Center in October 2001, recognizing former UW President Veal’s role in building this research facility and the Department.

Earth System Science (ESS) initiative
ATSC is taking a lead role in the establishment of an undergraduate ESS program at UW, collaborating in this effort with many other departments on campus.

Stratospheric instrumentation
Work in progress, funded by NSF’s Major Research Infrastructure program, is focused on improving the Department’s capability to make in situ aerosol measurements from balloon-borne platforms. These measurements will contribute to our understanding of the global impact of stratospheric aerosol.

the initiation of precipitation, mostly through the intermediacy of ice crystals. For the first time, essential entrainment and detrainment mechanisms have been revealed. Maritime cumulus growth and precipitation studies are planned for winter 2004/05.

Tropospheric aerosol and clouds
NSF-funded studies relevant to climate prediction that focus on comparisons of predicted and measured growth of aerosol particles to cloud drops in both maritime and continental environments are providing new insights into the factors influencing particle activation and the interrelationship of aerosol and cloud properties. Related studies are exploring the dependence of aerosol radiative properties on chemical composition.

Stratospheric aerosol and ozone
Balloon-borne measurements are providing data to test models of ozone-loss chemistry and the stratospheric aerosol. The most recent efforts, primarily funded by NSF, include a comparison of ozone measurements with two global models for the time period 1989-2003, and an international campaign, involving nine Antarctic stations and 14 countries, that compared ozone in air parcels circling the continent with predictions from several global chemistry models.

Boundary layer
NSF funding has supported the novel use of measurements with the high precision GPS system of the King Air to characterize pressure gradients that generate the low-level jet in the marine boundary layer off the California coast. In a modeling study of surface winds in Wyoming, resource maps of seasonally varying wind power, essential for siting wind turbine generators, have been produced. Other ongoing modeling studies, funded by NASA and NSF, are examining the influence of sea ice, the terrain at the coastal margin, and cyclonic disturbances on boundary layer characteristics over the ice sheets in Antarctica.

Recently funded NSF analyses of aircraft and tower data from project LOESS focus on fluxes in the very heterogeneous environment of the night-to-day transition over complex terrain with varying snow cover. NREL-funded studies are characterizing turbulence during situations adverse to wind turbine operations and models to predict such adverse turbulent conditions are being developed.
Graduate student, Tiberiu Popa, assembles a plasma reactor used for methane conversion experiments.

Chemical Engineering students distinguished themselves at the Tau Beta Pi Engineering Honors Banquet this year. The Joint Engineering Council Outstanding Senior award went to Benjamin FitzPatrick who was also named UW’s top graduating male student. The Outstanding Junior award went to Kim Nicholas who interned with United States Senator Mike Enzi in Washington, D.C. this summer. The Outstanding Sophomore award went to Joseph Jording whom we are delighted to welcome to Chemical Engineering. In addition, Erik Edgar received an Outstanding Undergraduate Research Award from The Dow Chemical Company in recognition of his contributions to the Unicarb System for Spray Applications; he is working with Dr. Sharma. We are also proud of and grateful to our generous alumni such as Harold McCaskey (Chemical Engineering Option, 1947), Kacey McCaskey (Elizabeth McCaskey Memorial Scholarship) and Justin Boysen (Harold and Elizabeth McCaskey Scholarship) are just two of the fine students who benefit from Harold’s unwavering support.

Professor Mac Radosz was named the College of Engineering recipient of the 2004 Outstanding Teaching and Research Award, Assistant Professor Morris Argyle was named the recipient of the 2004 Dr. David Cooney Outstanding Teaching Award, and Professor Norm Morrow, J.E. Warren Distinguished Professor, was recently appointed the John and Jane Wold Centennial Chair in Energy. We are also proud of Margaret Paul whose excellent work was recognized by the College of Engineering 2004 Outstanding Staff Award.

Another biennial highlight is the completion of a six-year ABET accreditation process, in the wake of which we streamlined and substantially enhanced our undergraduate curriculum toward a modern vision of chemical engineering education, one that includes life science and molecular components. Furthermore, we also revamped our graduate program, increased the graduate enrollment, especially at the PhD level, and remodeled the departmental library to serve double duty as library and state of the art conference/meeting room.

Our future directions are captured in a five-year “Energy & Life” academic plan, which not only builds on our current strengths in energy sciences, but also reaches out boldly to new frontiers through the interface of life and material sciences. Toward this end, we hired three excellent new faculty members, Assistant Professors Youqing Shen (biomaterials), Matthew Rosinski (biology), and Morris Argyle (energy).
In the area of energy science, the Department (Drs. Radosz, Adidharma, Shen) contributed to UW's proposal for joint geoscience and engineering research on enhanced oil recovery, which recently has been funded at $2.4M by the State of Wyoming. The proposal builds on a white paper (co-authored by Associate Professor Brian Towler) for Governor Freudenthal.

Our charge is to develop new membranes and adsorbents for carbon dioxide capture from flue and natural gas streams (Shen), new phase behavior models (Adidharma), reservoir fluid-flow models (Towler), and removal of water blocks from oil and gas wells (Morrow), all part of UW's Institute of Enhanced Oil Recovery and Energy Research.

Morrow's energy group completed projects on wettability and imbibition, jointly with New Mexico Tech, and on waterflooding through control of brine composition, jointly with Idaho National Laboratory, both funded by DOE. Professor Gordon Harris completed MS projects related to oxidation and liquefaction of coal. Radosz and Adidharma's group worked on block and graft polymers (NSF-funded). Argyle's group worked on plasma membrane reactors (DOE-funded) and is developing a heterogeneous catalysis laboratory. Associate Professor Bell's group worked on explosives and oil recovery with Morrow.

In the area of life science, Shen built a research program on biomaterials obtained from living polymerization and applied them to chemotherapy and DNA-like self-assembling copolymers. H is current research, funded by NSF and UW's Biomedical Research Infrastructure Network, correlates with his energy-related research on nanoparticles membranes and adsorbents. Rosinski is developing research tools for investigating the regulation of cell migration, proliferation, and activity within the body in space and time; such technologies can then be applied to a broad range of biological problems and to questions spanning emergent diseases, neuroscience, and developmental biology.

Adidharma and Radosz, jointly with Virginia Tech, developed an NSF proposal on thermodynamics of protein separations by and interactions with salts and polymers in aqueous systems, which are relevant to new drug technologies. All these activities contribute to UW's Molecular and Cellular Life Science program initiated by Rosinski and others.

Thanks to generous donations from alumni and friends we were able to support an excellent distinguished speaker series including scholars from UW's University of Calgary, North Carolina State University, Purdue University, Sandia National Laboratories, Carnegie Mellon University and the Colorado School of Mines.

Benjamin "Benj" FitzPatrick of Los Alamos, N.M., graduated this spring with a triple major in chemical engineering, chemistry, and mathematics, and received the Tobin Memorial Award as the University of Wyoming’s top graduating male senior. He received this honor based on his contributions to the University, his participation in community and campus activities, and his academic success and citizenship qualities. In 2002, FitzPatrick received the Goldwater Scholarship, the most prestigious national scholarship for undergraduate students in the sciences, mathematics, and engineering. FitzPatrick demonstrated his leadership qualities in Tau Beta Pi — the national engineering honor society, the Joint Engineering Council, the American Chemical Society, and the American Institute of Chemical Engineers. He also served as a President's Senior Class Ambassador.

For four summers, he has interned at the Los Alamos National Laboratory, where he has worked on a project that will allow hydrogen fuel cells to be used as a potential fossil fuel replacement source for automobiles. Fitzpatrick will attend graduate school at the University of Chicago next fall on a Freud Fellowship.

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After 37 years at UW, Professor Larry Pochop retired, capping a long and productive academic career. Pochop joined UW in 1967 and specialized in teaching and researching Wyoming and Western U.S. water issues. He is extensive consumptive use research culminated in a widely-used publication updating consumptive use and irrigation requirements in Wyoming. Recently, he served as Director of the USGS Water Resources Institute Program and the UW Office of Water Programs. These programs address water issues with a broad range of interdisciplinary research and student training and focus upon state and regional concerns. He has also served as UW’s co-advisor to the Wyoming Water Development Commission and during his career served twice as Wyoming’s State Climatologist.

However productive Dr. Pochop has been on the technical front, his presence will be most missed by our students. He has been awarded the ASCE Outstanding Teaching Award three times, U.S. West Excellence in Education Award, U.W. Excellence in Advising Award, Carnegie Foundation Professor of the Year Award, U.W. Ellbogen Meritorious Teaching Award, Tau Beta Pi Teaching Award, and Mortar Board’s Top Prof Award.

When asked about Pochop’s retirement, CAE Head Dr. Jay Puckett noted, “Larry has made such a difference in so many students’ lives. He will be sorely missed not only in the classroom, but with the individual teaching so often lent in his office. His commitment to UW and the State water community is simply unparalleled.”

Thomas McPeek joined CAE in fall 2004 to teach architectural engineering courses. McPeek gained significant industrial experience as an architect after which he returned to Texas AM to pursue a PhD in architecture.

Sue Niezgoda will join our faculty as an assistant professor in January 2005. She plans to graduate from The Pennsylvania State University with a PhD in civil engineering with expertise in water resources. Her dissertation addresses field monitoring and mathematical modeling of stream channel erosion and sediment transport.

UW’s ASCE chapter continues to excel, as the Timber Bridge team placed well in several categories nationally. Our environmental engineering team placed second in their competitive project at the national WRDS competition.
Barker is a fine addition to our structural and architectural engineering faculty. A registered Professional Engineer in Wyoming, Missouri and Minnesota, his BS and MS degrees in civil engineering were awarded at Purdue University and his PhD was earned at the University of Minnesota.

Dr. Michael Barker joined CAE in Fall 2003 from the University of Missouri at Columbia (UMC) where he had been on the faculty for thirteen years. He is well known for his research work in steel bridges and evaluation of existing bridges. Barker has conducted experimental and analytical research in the elastic and inelastic behavior of structural systems and was in charge of UMC’s Remote Test Facility, a large component testing lab.

He has received numerous teaching awards while at UMC, and served as faculty advisor to Tau Beta Pi. As President of the Central Chapter for the Missouri Society of Professional Engineers, he initiated a link for the Order of the Engineer.

The Department of Civil and Architectural Engineering remains research-active with contracts of $1.45M last year. Professor John Turner continues to conduct research in deep foundations and embankments. He is conducting research on wall anchorages for Wyoming DOT. Supported by NSF, Assistant Professor David Mukai is working on membrane technologies in environmental engineering in addition to water resource projects to address the effectiveness of drip irrigation. Johnson and Assistant Professor Mike Urynowicz in collaboration with the Colorado School of Mines, recently received $430K in DOE support to study water management in coal bed methane fields. Wyoming DEQ sponsored Assistant Professor Marjorie Bedessem and Associate Professor Thom Edgar to address better methods to biologically remove nitrates from septic system flows in order to protect groundwater. Professor Charles Dolan was appointed to the H.T. Person Chair to address issues in undergraduate education. He continues to teach and conduct research in CAE and to serve on the prestigious Committee 318 of the American Concrete Institute. A new edition of his book Design of Reinforced Concrete was published in 2003.

Professor Richard Schmidt and Professor Emeritus Art Boresi recently published the sixth edition of their widely used graduate-level book Advanced Mechanics of Materials.

Professor Khaled Ksaibati became the Director of the Wyoming Technology Transfer Center, the State- and federally-supported program that provides short courses, library resources, and expertise to the transportation community. Ksaibati also leads a group of students working on a GIS-based prototype asset management for WY counties.

Mr. Jeré Hamilton works with three architectural engineering students on their senior project in HVAC design.
Much activity has occurred in the Department of Computer Science (COSC) in the last two years. In 2003, the Department hired Assistant Professor John Hitchcock (PhD/COSC, Iowa State University) whose research primarily is in computational complexity theory, the study of efficient computation. At UW, Hitchcock has taught computational complexity, languages and automata, and a seminar on theoretical computer science. In Fall 2004, he will teach a course on design and analysis of algorithms.

In 2004, the Department hired Academic Professional Lecturer John Mayer (PhD/COSC, University of Michigan with a specialization in Artificial Intelligence). Prior to joining UW, he wrote software to support biomedical research based on DNA analysis. His teaching focus is introductory programming and programming language concepts.

The Department emphasizes foundations in its undergraduate programs and in the last two years, major improvements have been made to the courses for Software Development Projects, Software Engineering, and Functional Languages. Future plans include the introduction of a junior-level design course and three tracks in the upper-division computer science curriculum. The three tracks will be AI/game programming, networking, and software engineering.

The eBusiness masters curriculum which began in 2001 has now matured into the College of Business’ eMBA program and Computer Science continues to deliver the technical courses designed for that program.

In April 2004, a team consisting of COSC students Michael Hansen and James Thein and UW Student Educational Opportunities employee Bobby Chapa participated in the Microsoft Imagine Cup regional competition held in Los Angeles, CA. Fourteen schools in the mid-western and western U.S. competed, including Stanford, BYU, and Berkley. UW’s ShopNET, an online shopping interface that allows users to navigate an interactive three-dimensional store as well as communicate with other shoppers and purchase products through Amazon.com, won 4th place.

In June 2004, undergrad Glenn Cox and grad student Wes Kerr competed in the Hidden Agenda contest sponsored by the Liemandt Foundation to encourage the development of new educational games featuring “hidden” learning. Our team placed in the top five regionally with their game, Texas Holdem. This entitled them to compete for $25,000 in Austin, TX on June 28-29, 2004. Although the team did not win at the next level in Austin, TX, they felt that it was a valuable experience and plan to compete again in 2005.
research

The department’s research continues to focus mainly on formal methods and swarm robotics. Formal methods are mathematically-based techniques for developing and verifying software, hardware, and other artifacts.

Associate Professor Jim Caldwell’s research area is the application of mathematical logic to reasoning about computer systems. His current research is twofold. He and his students are investigating methods to build correct software by extracting programs from proofs. Caldwell is also collaboratively working on ways to share formalized mathematics across the web with work funded by the Office of Naval Research.

Research continues on mathematical models of computer hardware and software systems. Professor John Cowles developed a formal model of the Java Virtual Machine, which he used this spring in teaching COSC 5010. Assistant Professor Gamboa, Professor Jeffrey Van Baalen, and Cowles developed formal models of synthesized Kalman filters for NASA.

Cowles and Gamboa continue a project to formalize analytic number theory and finite field theory in ACL2. This work should lead to mechanical proofs of the Prime Number Theorem, describing the distribution of the prime numbers, and of the correctness of a newly discovered polynomial-time primality-testing algorithm.

Van Baalen is applying formal methods to the development of practical tools for Internet Security. For example, a project currently under way uses abstract interpretation and model checking to identify cross-site scripting vulnerabilities in Web applications.

Associate Professors Diana and Bill Spears focus their robot swarms research on two major problems: chemical plume tracing (CPT) and the modeling of fluid-like robotic swarms. The goal of CPT is for a team of robots to locate an emitter that is generating a hazardous chemical plume. Using a physics-based multi-robot control technique, the robots self-assemble into a lattice. This robotic lattice acts as a computational fluid dynamics grid, enabling the robots to compute the gradients of the chemical flux. Algorithmic use of these gradients leads the robotic lattice to the source emitter.

Robotic swarms that behave like a liquid or gas can easily squeeze through narrow passageways without complex arbitration schemes or excessive communication. Using a combination of Newtonian physics and kinetic theory, the Spears have modeled such fluid-like motions for successful task achievement.

Drs. William and Diana Spears focus their research on robotic swarms.
The Department of Electrical and Computer Engineering (ECE) has seen many changes, including the hiring of a new Department Head, Dr. Mark Balas. Balas has been a professor in the Department of Aerospace Engineering Sciences at the University of Colorado since 1987. His extensive activities in the American Institute of Aeronautics and Astronautics (AIAA) earned Balas the grade of Fellow. He received a Tau Beta Pi teaching excellence award, and has been very active promoting diversity in engineering. Balas is a world-renowned control systems expert who has made theoretical contributions in linear and nonlinear systems, especially in the control of distributed and large-scale systems. His results have been important to practical controller design and operation for many engineering system applications. Balas replaces Dr. John Steadman, who retired after 32 years of service at UW to take a position as Dean of Engineering at the University of South Alabama. The Department has also hired Assistant Professor John O’Brien as a new faculty member in the controls area (see story, next page).

Considerable effort has been focused on improving the lab experience for our undergraduates. The Digital Design Lab has new Tektronix Logic Analyzers, computers, and large flat screen monitors to assist in digital design. Associate Professor Suresh Muknahallipatna created a new teaching and research facility in the Computer Networks Lab with equipment donations from McData Corporation. The Senior Design Lab has also seen improvements, and with the support of Mike Volpi and Toni Cupal, a new endowment was established to purchase equipment and parts for projects, as well as to support design awards for top projects. Professor John Pierre worked with Agilent’s Karina Vieira-Hool (BS’96, M’98) to purchase additional equipment such as a Spectrum Analyzer, Logic Analyzer, and Network Analyzer at significantly reduced prices. The class has also been restructured to allow more interdisciplinary student projects with students from other engineering departments.

Teaching is our primary mission and four of our faculty have been recognized as Mortar Board Top Profs: Drs. Eva Ferre-Pikal, John Pierre, Bob Kubichek, and Steve Barrett. Barrett also received the ASEE Regional Outstanding Teaching Award, a UW Ellbogen Meritorious Classroom Teaching Award, and is the UW nominee for the national CASE professor of the year award. In a project aimed at improving undergraduate education, Associate Professor Jerry Hamann will be the director of the proposed UW Center for Excellence in Engineering Education funded by the William and Flora Hewlett Foundation Engineering Schools of the West Initiative.
Assistant Professor John O’Brien comes to the University of Wyoming from Washington, D.C., where, for the last two years, he was a member of the Missile Defense National Team. After obtaining his BS in Aerospace Engineering at California State Polytechnic University in 1991, O’Brien began his research career at NASA’s Jet Propulsion Laboratory (JPL) in Pasadena, CA. He worked along with some of the world’s elite researchers in the area of automatic control as a member of JPL’s Control-Structure Interaction (CSI) team. CSI’s charter was to develop high bandwidth, robust control systems to stabilize flexible, lightweight structures serving as platforms for future space-borne optical instruments. In 1995, O’Brien arrived in Laramie to pursue a master’s degree at UW, where he researched fault tolerance in precision parallel mechanisms, an open topic of interest to CSI members at JPL. He continued researching parallel robot kinematics and dynamics at Rensselaer Polytechnic Institute, where he received his PhD in 2001. At UW, he looks forward to augmenting the exceptional reputation of UW in the area of parallel robotics and automatic control. In addition to his research pursuits, he plans to offer new graduate courses in advanced control theory.

ECE is currently focusing on three general research areas: Control Systems, Electronic Systems and Devices, and Signal Processing and Computer Networks. The Control Systems team welcomes the addition of new faculty, Balas and O’Brien. In addition to his hexapod pointing system project, Professor John McInroy has been helping form the Active Aero Center with several Mechanical Engineering colleagues under a recent Air Force DEPSCoR grant. They are combining novel resonant actuators with feedback controls to push the onset of aircraft wing flutter to higher velocities allowing for lighter wings so aircraft can cruise further.

The Electronic Systems and Devices group has several ongoing projects. Associate Professor Eva Ferre-Pikal is conducting a comprehensive study of “1/f” noise in heterostructure transistor amplifiers and oscillators, funded by a prestigious Career Development Award from NSF. Her research earned international recognition through the Young Scientist Award from the European Frequency and Time Forum. A DOD grant allows Assistant Professor Jon Pikal to study the properties of quantum dots for use in semiconductor lasers. These self-assembling nanostructures have the potential to dramatically improve the performance of lasers for sensor, communication, and data storage systems.

The Signal Processing and Computer Networks area has a wide range of projects underway. Pierre received a DOE Laboratory Partnership grant with Pacific Northwest National Laboratory to develop signal processing identification techniques for assessing the stability of power systems from measured data throughout the grid. Muknahallipatna won a Microsoft Most Valuable Professional award for his work on distributed storage area networks, studying the effect of distance on application performance and security, analyzing performance of scheduling algorithms, and comparing performance between different storage protocols. Kubichek, Hamann, and Pierre are working with alum Ernie Scott (BS’93, MS’96) at Intermountain Laboratories, Sheridan, on an avalanche detection system funded through a Small Business Innovative Research award.

The UW hexapod continues to be the subject of funded research with applications in fault tolerant, six axis, precision motion control.
Graduate student Amit Singhal’s research work shows very clearly the interdisciplinary nature of mechanical engineering research.

The Department of Mechanical Engineering continues to expand its program and offers an exceptional education at both the undergraduate and graduate levels. With the addition of one new faculty member and an expanding graduate program, the Department is exploring new avenues in teaching and research.

The Department’s Advisory Board welcomed three new members this year. The Board continues to meet once a year, providing invaluable input and perspective on a variety of issues important to the Department. The Board was particularly supportive to the Department as it prepared for its ABET accreditation visit that took place in fall 2003.

The Department has recently completed an academic plan for 2004-2009. Of particular note in the plan is the expansion of the Department’s graduate program. In fall 2004, the program will have 13 enrolled PhD students.

In 2003, Professor Andrew Hansen was chosen as the first UW Presidential Faculty Fellow. Hansen’s responsibilities include involvement in institutional planning and policy-making, legislative and public relations, facilities development and private fundraising.

The Department highly values excellence in teaching and recognizes that methods for teaching continue to evolve. In 2003, Professor David Walrath received the Tau Beta Pi Outstanding Undergraduate teaching award for his creativity in the classroom and for providing students with a wealth of opportunities to learn outside of the classroom.

For many, the term “research” conjures images of the white-coated scientist in an equipment-filled laboratory. Research, however, can also include exploring new methods of teaching. Two groups within the Department have been undertaking research in engineering education.

In September 2002, a group of engineering faculty received a $1.15M grant from The William and Flora Hewlett Foundation to improve efforts in recruiting and retention of engineering students within the College, and in restructuring of the Engineering Science program. Two members of the ME faculty, Dennis Coon and Nancy Peck, are involved in this effort.

More recently, Research Scientist Scott A. Morton and Professor Donald A. Smith, in collaboration with Robin Hill of the Ellbogen Center for Teaching and Learning, received a grant from the National Science Foundation to develop a Computer Aided Laboratory Instruction System (CALISYS). This project combines hands-on experiential laboratory exercises with computer-aided instruction to enhance laboratory learning and understanding while significantly reducing time, equipment, staffing and space requirements.

In June 2004, Professor Donald A. Smith retired after 32 years of service to the Department, College and University.
The most recent addition to the Mechanical Engineering faculty is Professor Dimitri Mavriplis. Mavriplis' research involves the development, implementation and application of novel algorithms for computational fluid dynamics. These are principally based on the use of unstructured meshes, where the mesh which supports the calculations is composed of mixed-type elements such as tetrahedra, prisms, pyramids and hexahedra in three-dimensions. His investigations include adaptive meshing techniques, where the mesh is modified as the solution evolves, efficient solution techniques such as multigrid methods, and implicit time integration methods. Research into coupled problems such as aeroelastics involving fluid-structure interactions and design optimization problems is also ongoing. All these efforts are performed in a parallel computing environment using a 34 CPU Linux cluster recently acquired by the Department of Mechanical Engineering, as well as larger parallel machines at government research laboratories. The application areas for this research work include aerodynamics of commercial aircraft and business jets, fighter aircraft, store separation simulations, and unsteady aeroelastic effects.

The Department is committed to a sustained, quality research program. The recent hiring of a senior faculty member with a specialty in computational fluid dynamics brings new expertise to the Department.

In the fall of 2003, the Department welcomed Professor Dimitri Mavriplis. Mavriplis received his BS and MS from McGill University in 1980 and 1982, respectively, and a PhD from Princeton University in 1987. From 1987 until joining UW, he was a research fellow first at the Institute for Computational Applications in Science and Engineering, and then at the National Institute of Aerospace both located at NASA Langley Research Center.

The Department continues to show a high level of externally-funded, research activity. Notably, the Department has recently received three awards totaling more than $1M in research funding from the DoD-EPSCoR program. In 2003, the ActiveAero group, comprised of Assistant Professor Bill Armstrong, Professor Bill Lindberg and Associate Professor Jon Naughton from ME and Professor John McInroy from ECE, received an award from the Air Force for a project investigating active flutter suppression. In 2004, a smaller, more competitive DoD-EPSCoR program saw only twenty awards given nationwide. Four of these awards came to UW, with two of those four to faculty in ME. One winner was new faculty member Dimitri Mavriplis who, in collaboration with Dan Stanescu from the Department of Mathematics, received an award from the Navy for work on using unstructured grids in hydrodynamics and acoustics simulations. Associate Professor Mark Garnich received the second award for a project exploring composite space structures.

This year Garnich also received a Phase II STTR award for a collaborative project he has with a local small business, Firehole Technologies, a company started four years ago by ME faculty member Professor Andrew Hansen. This Phase II STTR award will support the development of analysis tools for and a better understanding of the mechanical behavior of polymer composites under combinations of temperature and mechanical loading similar to those experienced in a pressure vessel.
The Distinction Campaign for the University of Wyoming continues to bring new and increased support. The College of Engineering has been a leader in this effort. The support our alumni and friends have shown has been truly gratifying. Annual Fund contributions as well as the percentage of our alumni who support us on an annual basis have both shown significant increases. We continue to make progress toward our goal of raising $14 million over the Campaign’s five-year timeline. If we are to move the College forward, we must continue to attract and retain students and faculty of the highest caliber.

The academic success of our students is of primary importance. Providing for scholarships and laboratory technology affords our students the opportunity for hands-on experience with state-of-the-art equipment and assures that UW graduates will continue to be among the best-educated new engineers.

Entering students indicate that the cost of education is one of the most important criteria in selection of an institution of higher education. Increasing the number and value of scholarships will increase the quality and size of the student body. Another criterion is the availability of career-appropriate extracurricular activities. Our student groups would not be able to participate in national competitions such as the Clean Air Snowmobile, the Steel Bridge and the Concrete Canoe without the private support which enhances the University’s own financial support.

Quality engineering education begins with the best faculty to guide and motivate our students. No University can hope to attain national prominence without an outstanding faculty. Recruiting and retaining quality faculty requires competitive salaries comparable with the very best institutions across the country. We hope to establish endowed professorships or chairs in at least five of our academic disciplines.

Our teaching and research are only as good as the equipment and faculty that support them. Like the practice of engineering itself, the College’s capabilities grow with acquisition and effective application of new technology. The College must make the necessary investment to support classroom learning, design, communications, research initiatives, and service.
Private giving is also an investment in the future of Wyoming’s only engineering college.

**Annual Gifts**
Whatever the amount, each gift to the Annual Fund and designated to the College of Engineering is important because it has an immediate and tangible impact on students, faculty, and academic programs across campus. These gifts are usually gifts of cash, negotiable securities, real estate, tangible personal property and corporate matching gifts.

**Honorary and Memorial Gifts**
Gifts made in honor or memory of someone are a living and lasting tribute to you as the donor and to the one you honor through your gift.

**State of Wyoming Endowment Matching Program**
The state of Wyoming Legislature, in its 2004 session, added another $18M to the $30M it previously made available to match private contributions to UW’s Distinction Campaign. Gifts qualify for a match if they are for a new or existing endowment fund and must be in the amount of $50K or more. Qualifying gifts may be paid over a five-year period thereby making this threshold easier for more donors to achieve. The opportunity to have gifts matched will continue only until the $18M is exhausted or until the 2006 deadline is reached. The State matching dollars are placed in the individual endowment accounts effectively doubling the benefit to the College or University when these accounts are created. This program shows the Wyoming Legislature’s commitment to assuring the future financial stability of the University.

F. Maxine McIntosh (BS ’47), the University of Wyoming’s first female engineering graduate, is utilizing the State of Wyoming matching program to enhance both the F. Maxine Roush McIntosh Civil Engineering Scholarship and the Floyd McKinley Roush Civil Engineering Scholarship. Maxine created the Floyd Roush Scholarship to honor her father, and the F. Maxine Roush McIntosh scholarship was established at the request of her sons George and Scott Muller.

Loy H. Harris (BS ’57), member of the College’s Hall of Fame, utilized the State of Wyoming matching program to double his gift, enabling him to create an endowment to support younger faculty members as they begin their teaching careers at the University of Wyoming. The Loy E. and Edith H. Harris Early Career Faculty Fellowship endowment is named in honor of Loy’s parents.