

2004-2009 Planning Document Department of Mechanical Engineering

Our Purpose

- Attract highly motivated students and prepare them for the life-long learning and practice of Mechanical Engineering in industry, government, and academia.
- Develop new knowledge through an aggressive research effort that focuses on ME related science and technology as well as interdisciplinary opportunities, taking into account the local resources, talent and needs.
- Serve as a valuable resource for the people and the industry of the State and the Nation.

Core Principles

- Education is the primary function of the University.
- Research and scholarship are an integral part of a high quality education.
- Our students should be perceived as our future graduates and lifetime supporters with whom we would like to establish a mutually rewarding relationship.
- Close interaction with the alumni and the ME related industries is essential for the Department's success.
- Developments in engineering science and technology will be critical to the community's economic success. The Department of Mechanical Engineering must play a leading role in this environment.
- The Department will maintain a workload practice for equitable assignment of teaching responsibilities, based on current departmental requirements and individual faculty contributions in research and service activities.
- Accountability and a realistic reward system is the heart of any University's success story.
- We must foster an environment that promotes excellence in teaching, research and service.

Areas of Distinction

- A flexible, 128-hr curriculum that includes a business requirement, allows for several elective courses, and provides our students with a comprehensive design experience.
- A low student-faculty ratio and a philosophy that encourages access to faculty and enables a hands-on educational experience.
- Graduates with a success rate of 98% (last 7 years) in the Fundamentals of Engineering examination.
- A strong research presence in the areas of thermo-fluids and solid mechanics that will be continuously enhanced.
- Dedicated alumni who actively support the goals of the Department.

A. Undergraduate Programs

1. Progress made on 1999 action items

- “Increase flexibility in individual undergraduate student programs of study – specifically addressing individual student professional interests. Students will be able to better tailor their academic program to their longer-term goals.”

A revised curriculum has been developed and is now in place. In addition, a 128-hrs curriculum has been recently agreed upon and is now in place (Fall of 2003). As a result, we have more technical electives in the curriculum and fewer required courses. The faculty will monitor and evaluate the effectiveness of the program and continue to refine it.

- “Update the departmental laboratory report/plan and develop a mechanism for continuous improvement of ME’s facilities.”

Work is underway to update the laboratory plan of the Department. It is coordinated by ME’s Facilities Committee.

- “Enhance the design experience of our students.”

This is an on-going effort. Progress has been made in the Studio concept and the development of the rapid prototyping, spatial visualization and manufacturing capabilities of the College. The Department’s faculty and students have done an exceptional job with a number of design projects (snowmobile, zero gravity, etc). The department strives to continuously improve the Senior Design Symposium. Multidisciplinary experiences are very important for our students, but College approach/involvement will be necessary.

- #105. College Action Item: “Following recommendations by its National Advisory Board, the College should pursue discussions with the College of Business to establish an “Engineering Business” course for its undergraduate majors.” (An action item from the previous Academic Plan)

Done. ME students are required to take a Business course from an approved list.

2. Areas of Distinction for undergraduate education

The Department continues to offer a large number of electives and maintains an excellent reputation in providing an outstanding design experience to its students. This becomes evident every year from the high caliber of design projects that are presented during the Senior Design Symposium. Considerable expertise and state-of-the-art facilities in the thermo/fluid sciences and in the area of advanced materials allow for the successful involvement of undergraduate students in research. The number of students continues to increase; this fall, ME total enrollment increased by 13%. It is worth noting that ME students have the highest (within the College) passing rates in the Fundamentals of Engineering examination.

3. Assessment

Undergraduate programs in the College of Engineering are accredited by the national Accreditation Board for Engineering and Technology (ABET). New procedures were adopted by ABET in 2000 and the College has been involved in an extensive assessment process for the last several years. Details of the Department’s “Continuing Education Improvement” efforts are described at:

<http://www.weng.uwyo.edu/mechanical/Assessment-Continuing/A-Frame-01-01.html>

4. **Goals for 2004-2009**

- Contribute to the Hewlett effort to redefine and restructure the freshman and sophomore-level science, math, engineering and computational curricula of the College of Engineering.
- Examine better, more effective means to provide laboratory and computer experiences for undergraduates.
- Monitor closely the effectiveness of the new 128 hrs. curriculum.
- Optimize “continuous improvement” procedures after the first ABET 2000 visit.
- Establish an International option for our students.

5. **Action items for 2004-2009**

- ME will contribute to the realization of the goals of the Hewlett effort.
- Study student surveys, time to graduation, and enrollment with respect to the new curriculum.
- Involve at least 10% of undergraduates in research by 2009.
- Evaluate the results of the Don Smith/Scott Morton program on computer aided laboratory instruction system for inclusion in our curriculum.
- Expect all teaching faculty to participate in workshops related to teaching.
- Continue developing contacts abroad and establish an appropriate program of study for an International option in Mechanical Engineering.

B. Research and Graduate Programs

1. **Progress made on 1999 action items**

- “Provide more funding for undergraduate support of research.”

A lot of progress; about 12 undergraduate students are currently supporting our research effort.

- “Increase the number of Ph.D. students in our program. Funding is clearly a major issue, however, recruiting is an equally important concern.”

The Department has established a three-member Graduate Affairs Committee. Its charge is to enhance our graduate program. During the period 1999-2001, ME PhD enrollment averaged 1.33 students. This fall, we have 9 PhD students in our program. Unfortunately, recent INS policy changes are becoming a serious impediment to our efforts to recruit students from abroad.

- “Leverage support of PhD’s: including committing State funds, TA funds, release time, overhead returns and development support. Such a concept will include supplementary pay schedules and other augmentations. For example, supplementary pay could allow for an increase in the stipend by up to 50% over the standard rates and could also include use of these funds for summer support. Such support will be an item to be included in the departmental budget planning process.”

Done. We have utilized available resources from the Graduate School, the College, and the Department in an effort to increase PhD offers.

2. Areas of Distinction for graduate education

The faculty have identified two technical areas of distinction within the discipline of mechanical engineering: engineering mechanics for advanced materials and fluid dynamics.

Historically, the technical area of distinction within the Department of Mechanical Engineering has been composites engineering. The basis for this distinction has been a sustained level of high quality research, graduate level training and funding in the discipline. Today, the department is at a crossroads where the opportunity for sustained growth in materials engineering is promising. The department places a very high priority in maintaining the momentum in this area. As a result of this commitment, all three faculty members that were hired in 2001 have expertise in mechanics of materials.

At the same time, the departmental technical area of fluid mechanics has experienced solid growth in recent years. The current strength of the faculty, improved facilities, quality of the graduate students and funding growth combine to clearly identify this challenging field as an area of departmental excellence. Recently, we were able to recruit an outstanding senior faculty in Computational Fluid Dynamics (CFD), through the University's EPSCoR program. Considerable opportunities exist for collaboration with a number of other departments at UW. We have started to work together with the department of Mathematics in the CFD area. We proposed and are in the process of developing an interdisciplinary graduate program in the Science and Engineering of Materials (SEM) in collaboration with the departments of Chemistry, Physics, Chemical & Petroleum Engineering, Molecular Biology, and Geology & Geophysics.

3. Goals for Graduate Programs during 2004-2009

- Develop ties with quality institutions where there is a potential for providing graduate students for our program ("feeder schools").

We plan to invest in this effort, possibly collaborating with other departments and with the assistance of the international office at UW.

The target schools could be domestic/Canadian or international. Travel (both faculty and current/former students) to these institutions will become part of our effort.

- Increase the size and quality of the graduate program.
- Study the feasibility of a Plan B (professional) Masters Degree.

Contact local employers and the Warren Air Force Base and our own undergraduates to investigate if a professional degree will be helpful to them.

- Support the proposed SEM interdisciplinary graduate program.

4. Action items for ME's graduate program

- Form a departmental committee to study the feasibility of a Masters of Engineering (Plan B) degree program.
- Work with the Colleges of A&S and Agriculture to make the SEM program a reality by the spring of 2005.
- Continue to increase the number of graduate students, particularly at the doctoral level. Plan for 15 PhD students and a total active graduate enrollment of 35 by 2009.
- Visit institutions with the purpose of recruiting graduate students.

5. **Goals for research**

- Publications in scholarly journals and mentoring of graduate students will be expected of all faculty members in the Department.
- External research funding will continue to be a high priority for the faculty. It is recognized that funded research is necessary for a quality graduate/undergraduate program. Nevertheless, high quality, archival journal publications constitute the department's first priority.
- Work with the UW departments that have interests in Materials and the UW administration to make the SEM program a reality.
- Explore new opportunities for the development of core competencies as it was done with the UW ActiveAero program. Strengthen the collaboration with Mathematics; it is already producing results in the CFD area.

6. **Action items for research**

- Strengthen the existing and develop new collaborations with other units at UW. The department will reward faculty for such activities.
- Increase the number of publications to archival journals.
- Expect that all PhD dissertations result in archival publications.
- Increase the level of research funding.
- Participate in national and international technical meetings and develop a strong presence within national professional societies.

C. Other Issues: Progress and Goals

- Growth within the framework of the University's areas of distinction.

The department is fully aware of the need to maximize the benefit of available resources and target areas of research in which we have strength and in which we can collaborate with other units within UW. The department also believes that future growth should be consistent with the agreed-upon, UW areas of distinction. In accordance with the 1999-2004 academic plan, ME hired three faculty members in the areas of computational mechanics and mechanics of materials. Recently, ME added an expert in computational fluid dynamics to its faculty. We have also targeted areas important to the State, like energy. Several of our faculty members (Lindberg, Naughton, Nydahl, and Morton) are involved in energy-related research projects. This coming spring, ME will offer a course in Renewable Energy, as a part of a soon-to-be-revived Energy track within our undergraduate degree. ME has also chosen to maximize the benefits of faculty collaborations by establishing the UWActiveAero Center. This center brings together researchers with different backgrounds in Thermofluids, Materials, and Controls from within ME as well as Electrical Engineering. It provides the framework for growth in the very important area of Engineering Systems. The UWActiveAero faculty have already obtained their first major grant through the DEPSCoR program. Within the framework of the Moving Forward document, ME plans to strengthen its interdisciplinary activities and seek its next hire in the area of materials, which has been identified as a "critical area of science and technology." This future hire will strengthen our experimental capabilities and help revitalize the research component of ME's materials testing facility (formerly know as CMRG).

- When faculty positions become available, recruit the best possible candidates, in concert with the department's research strengths and programmatic needs.

Our recruitment philosophy is based on our intention to build on our areas of excellence. At the same time, we remain fully aware of the fact that changes in direction are often necessary, in order to maintain the vigor of our program. After the recent hire in the computational fluid dynamics area, we will seek an opportunity to augment our strength in the area of materials, in concert with the SEM campus effort. We plan to strengthen our expertise in computational and experimental solid and fluid mechanics.

- Creation of an external Advisory Board. The purpose of the Advisory Board is to foster a high level of excellence in the Department of Mechanical Engineering. The Board will accomplish its mission by supporting the interaction between the Department and the engineering community at large, providing input on academic issues, supporting the promotion, development and expansion of the education programs and facilities in the Department, recognizing significant achievements of alumni and supporters, and assisting in fund-raising activities.

An External Advisory Board was formed in the Fall of 2001, consisting of 15 members from industry, government and academia. The Board met four times so far and has been extremely helpful on a number of issues, including the ABET preparation.

- Increase the involvement of the College with new and existing Wyoming industries.

The department is very supportive of this goal. Mechanical Engineering has been a UW leader in incubating new businesses. Firehole Technologies and Summer Fox are two examples. Several faculty members are involved with SBIR efforts. Dr. Kmetz of IDES and Mr. Key of Firehole Technologies/IDES are serving on ME's Advisory Board. Interactions with industries outside of the state will also be pursued.

- The issue of resources

It is important to understand that the goals stated above require not only the good will and dedication of the department's faculty and staff, but also the support of the college and the university. As research productivity is growing, several issues need to be addressed. One involves the aging facilities that are inadequate, even today. Areas of the old engineering wing require attention. The machine shop that supports our College must be outfitted with new equipment. Operations budgets continue to decrease when inflation is taken into account. Another problem is the lack of classrooms that can accommodate large classes. Widely utilized resources like the "Web of Science" must become available to UW researchers. It is very encouraging to see that several of these issues are being actively addressed.

There is no question that substantial investments need to be made if UW decides to grow its research enterprise in a significant way while maintaining excellence in undergraduate education. The recent salary increases were a very positive development in that direction. A fair and meaningful reward system is essential for the health of any organization. Experience has shown that "doing more with less" cannot be a sustainable, successful policy.