

MEMORANDUM

To: Board of Regents
From: Board Office
Subject: Re-accreditation of the College of Engineering, Iowa State University
Date: September 9, 2002

Recommended Action: Receive the report.

Executive Summary:

On August 16, 2001, the Accreditation Board for Engineering and Technology (ABET) notified Iowa State University that the undergraduate programs offered by the College of Engineering were re-accredited.

Specifically, the undergraduate programs in Aerospace Engineering, Agricultural Engineering, Chemical Engineering, Civil Engineering, Computer Engineering, Construction Engineering, Electrical Engineering, Industrial Engineering, Materials Engineering, and Mechanical Engineering were granted accreditation through September 2007.

The Engineering Science program was granted accreditation through September 2003.

The Final Statement of ABET is available in the Regent Exhibit Book.

Self-Study Summary

The College of Engineering prepared self-study materials based on 1999-2000 academic year data for 11 accredited undergraduate degree programs. The materials were submitted in 2000. Following the Visiting Team report in September 2000, the College prepared a response that addressed institutional concerns and specific program weaknesses and concerns.

The actions of ABET in granting accreditation depend upon the program's range of compliance or non-compliance with criteria. The range includes: deficiencies, weaknesses, concerns, and observations. (See page 3 for definitions of these terms.) In summary:

- There were no deficiencies.
- One weakness remains in the Engineering Science program; a need to better document that students had completed a major design experience.
- Nine concerns were listed; one was an institutional concern and the other eight concerns were found in six of the programs.
- Seventeen observations and recommendations were offered.

Final Statement
Report

(strengths)

The ABET report noted that the College of Engineering is Iowa State University's second largest college and therefore, a strength of the college could easily be translated into a strength of the institution. Some of the strengths listed below may be identified as institutional and others primarily as from the College of Engineering:

1. A strong commitment to the philosophy and processes of quality improvement in both administrative and academic programs.
2. The career services operation in the College of Engineering is well organized and engages students from their first semester on campus.
3. Incoming students are of high quality.
4. The College of Engineering has excellent computing facilities. Budget allocations for updating of hardware and software have kept pace with faculty, staff, and student needs.
5. The establishment of Learning Communities has aided the retention of first-year engineering students. Fifty percent of the engineering students participating during their first year. As a result, the retention rate of first-year students increased from 80% to 90%.
6. The adoption of the Ernest Boyer model of scholarship and its use in promotion and tenure criteria is expected to lead to higher standards and improved quality for the faculty.
7. The establishment of performance objectives for engineering programs has helped institutionalize outcomes-based educational practices. Block budgeting has provided latitude and flexibility for engineering programs.
8. The University is adopting Project LEA/RN, which was created in the College of Engineering. [Begun in 1994, Project LEA/RN (Learning Enhancement Action/Resource Network) helps engineering professors incorporate active learning techniques and inductive learning strategies into their courses. It is based on a partnership with faculty from the College of Education.]

Link to Strategic Plan:

This report addresses the following Key Result Areas (KRA) in the Board's Strategic Plan:

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|---------------------|--|
| KRA 1.0.0.0 | Become the best public education enterprise in the United States. |
| Action Step 1.1.3.2 | Report data in the relevant governance reports and presentations to the Board. |
| KRA 4.0.0.0 | Meet the objectives of the Board and institutional strategic plans and provide effective stewardship of the institutions' state, federal, and private resources. |
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Background:

Value of Accreditation

The accreditation of colleges is of major importance. It signifies that an appropriate professional organization recognized by the U.S. Department of Education has judged that programs of the college have met its standards.

Accredited Programs

- The undergraduate programs in the College of Engineering were last accredited in 1995.
- Currently, there are 11 accredited undergraduate degree programs offered through the College of Engineering.
- In Fall Semester 1999, the Department of Materials Science and Engineering began offering a degree in Materials Engineering with four options: ceramic materials, electronic materials, metallic materials, and polymeric materials. Two previous curricula – ceramic engineering and metallurgical engineering – are being phased out.

ABET Definitions

- Deficiency: A deficiency indicates that a criterion is not satisfied. Therefore, the program is not in compliance with the criteria and immediate action is required.
- Weakness: A weakness indicates that a criterion is satisfied but lacks the strength of compliance that assures that the quality of the program will not be compromised prior to the next general review. Therefore, remedial action is required to strengthen compliance with the criteria.
- Concern: A concern indicates that a criterion is currently satisfied; however, the potential exists for this situation to change in the near future such that the criterion may not be satisfied. Therefore, positive action is required to ensure continued full compliance with the criteria.
- Observation: An observation is a comment or suggestion which does not relate directly to the criteria being used for evaluation but is offered to assist the institution in its continuing efforts to improve its programs.

The weaknesses and concerns as described in the Final Statement of ABET will be addressed in this report. A summary of each program's strengths will also be stated.

On-site Visit and Institutional Response

A team representing the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET) visited the Iowa State University campus from September 17 to 19, 2000.

On March 6, 2001, the College of Engineering submitted a response to the report of the Visiting Team. As a result of information and data in that report, some weaknesses and concerns were removed. Frequently, but not always, the Final Statement includes references to the institutional responses and acknowledges progress made.

Analysis: At the time the self-study materials were prepared, the College of Engineering offered 14 engineering programs, 11 of which were evaluated during the visit. As of Fall 2000, the College had:

- 4,604 undergraduate students
- 776 graduate students
- 211 full-time faculty members
- 13 part-time faculty members.
- 60% in-state students, 25% out-of-state, 15% other countries.

In addition, approximately five percent of the undergraduate students transfer to the College of Engineering from other colleges and universities.

College of Engineering – Fall 2000

Accredited Programs	Departmental Faculty	Undergrad. Students
Aerospace Engineering	15	311
Agricultural Engineering	26	131
Chemical Engineering	17	401
Civil Engineering	31	391
Computer Engineering	18	872
Construction Engineering	6	322
Electrical Engineering	26	511
Engineering Science	17	20
Industrial Engineering	17	216
Materials Engineering	20	89
Mechanical Engineering	30	907
Sub-Total	223	4171
Other:		
General ^a	1	0
Engineering - Special ^b	0	47
Engineering - Undeclared ^c	0	383
Engineering Operations ^d	0	3
Sub-Total	1	433
Grand Total	224	4604

^a: A tenured Associate Professor was a member of unit that was eliminated several years ago.

^b: Includes undergraduate students who take College of Engineering classes but do not seek a degree in Engineering.

^c: Includes undergraduate students who seek a degree in Engineering but who have not yet declared a major.

^d: Undergraduate curriculum in Engineering that leads to the degree of Bachelor of Science. Students are able to design their program of study to specialize in non-traditional engineering fields or to combine non-technical specializations with a solid foundation in core engineering subjects

Institutional
Concern

Concern: (Criterion 4. Professional Component) Students who were interviewed reported that there were serious problems with content coverage in several required mathematics and physics courses, varying dramatically from instructor to instructor.

Response: Information provided by the Physics Department satisfied ABET. The Mathematics Department acknowledges a problem with language skills of some instructors and will monitor the courses to see that improvements are made.

Aerospace
Engineering

Strengths: Computing facilities; and an excellent design sequence beginning in freshman year and culminating in a senior team project.

Concern: (Criterion 3. Program Outcomes and Assessment) The Academic Standards and Program Quality Committee has identified 30 learning outcomes. The results of several assessment tools have not been applied to further develop and improve the program.

Response: Additional evidence has been submitted demonstrating progress in the organization of assessment data and connection of data with ongoing and new program outcomes.

Agricultural
Engineering

Strengths: Student satisfaction with quality of instruction and advising; availability of reasonably modern computer hardware and software; strong program design experience; dedicated faculty; and success of learning communities in increasing retention.

Concern: (Criterion 5. Faculty) Because the program faculty also have teaching assignments in the agricultural systems technology program and graduate program of agricultural engineering, their teaching and advising loads are heavy. It appears that at least one additional teaching faculty position is needed.

*Response: The self-study notes that the department is at a crossroads regarding recruitment of undergraduates, since applications are up dramatically. **No specific action taken to date.***

Concern: (Criterion 6. Facilities) Faculty members are housed in four widely scattered locations. There is a need for a significant facility renovation or expansion.

Response: A new facility to replace Davidson Hall, current primary location for Agricultural Engineering, is on the Capital Projects Request List. In the meantime, some activities of the Department are housed in locations other than Davidson and some renovation to teaching laboratories has occurred.

Chemical
Engineering

Strengths: A faculty dedicated to undergraduate teaching and advising; quality instruction and advising; well-documented assessment process in place; and high quality facilities and laboratories.

Concern: (Criterion 4. Professional Component) The criterion mandates 1.5 years of engineering topics, consisting of engineering sciences and engineering design appropriate to a student's field of study. In this program, the requirement is met only if six chemistry elective credits are counted as engineering topics. The department needs to strengthen its assurance that minimum engineering topics will be met while simultaneously satisfying EC2000 program criteria.

Response: The program's view is that "advanced chemistry tied to the program objectives can be considered as engineering topics." Efforts will be made to insure the chemistry electives are consistent with the program objectives. One credit of core chemical engineering in the area of mass transfer and separations has been added to the curriculum for the new ISU catalog.

Civil
Engineering

Strengths: Competent faculty members in four major specialty areas who are actively involved in program assessment and the continuous improvement process; and high quality of students.

Computer
Engineering

Strengths: Articulate, enthusiastic, and hard-working students; excellent faculty-student interaction; and well-structured curriculum.

Construction
Engineering

Strengths: Faculty members have strong, on-going ties with a large number of well-defined program constituents; all faculty have significant construction industry experience and are registered professional engineers; outstanding students who are actively recruited by construction industry; and noteworthy on-the-job learning experiences.

Electrical
Engineering

Strengths: Exemplary knowledge of EC2000 requirements and preparation of report; faculty who have published electrical engineering textbooks and faculty who demonstrate significant engagement in contemporary teaching methods; excellent laboratory facilities; and multi-disciplinary design projects.

Concern: (Criterion 5. Faculty) Current staffing level is adequate. However, it appears that five additional faculty will be needed to cover microelectronics (1), communications (3), and power (1).

Response: Although additional faculty lines have not yet been added, the Department has been protected from budget reductions in the last cycle. The projected undergraduate enrollment for Fall 2002 is down slightly.

Concern: (Criterion 6. Facilities) Additional laboratory and office space will be needed to house the anticipated additional faculty hires in both electrical engineering and computer engineering.

Response: The renovation, including a major addition to Coover Hall, is the current top capital project request for Iowa State University.

Engineering
Science

Strengths: An avenue for students with interests outside of traditional engineering programs; and students can design their own programs.

Weakness: (Criterion 3. Program Outcomes and Assessment and Criterion 4. Professional Component) Criterion 4 requires students have a major design experience. Almost all Engineering Science students graduating from 1996 to 2000 substituted an “independent study” course for the design course. A weakness also exists in that the program was unable to document the ability of students to design a process or system to meet stated needs. Related is the small size of the program.

Response: A defined process controlled by the Engineering Science Committee is now in place. The process requires student portfolios to give clear evidence of compliance with criteria 3c and 3d. Examples of past Engineering Science design final reports have been located and are in the process of being archived.

Status: The weaknesses with respect to Criterion 3 are now considered concerns. However, until the major design experience is documented, the weakness with respect to Criterion 4 remains.

Industrial
Engineering

Strengths: A growing emphasis on manufacturing systems; new laboratories; enthusiastic department personnel; well-designed curriculum; well-prepared students; good advising system; outcomes assessment system; and industry recognition of the program.

Concern: (Criterion 7. Institutional Support and Financial Resources) There is a need for leadership to assure program quality and continuity.

Response: A new permanent chair was appointed following the most recent accreditation visit.

Materials
Engineering

Strengths: Articulate and enthusiastic students; faculty active in research; extensive assessment plan; and a vertically integrated design experience (sophomores are teamed with juniors and seniors).

Mechanical
Engineering

Strengths: Students have almost perfect pass rates on fundamentals of engineering examination; dedicated faculty who were pioneers in developing Project LEA/RN; and emphasis on cooperative education and internship experiences.

Concern: (Criterion 6. Facilities) The newly established heat transfer and fluid mechanics laboratories are barely adequate.

Response: Donations have been received to upgrade two laboratories.

Status: The planning process for the fluids lab has not been completed. The concern remains.

Summary and
Trends

The College of Engineering has been fully re-accredited.

Generally speaking, its students are of high quality. The 1999 College of Engineering student body included 218 National Merit Scholars, 55 of whom were first-year students.

The various curricula of the College are well-structured, student outcomes assessment strong, graduation placement high, and employer satisfaction high. In surveys of graduates of various programs, respondents typically feel prepared in technical areas, but believe more could be done in such non-technical areas as ability to function on multi-disciplinary teams, communications, and understanding of professional and ethical responsibilities.

Faculty are consistently viewed by students as well prepared and dedicated. Many participate in recruiting programs to gain outstanding new students. Replacement of experienced faculty appears to be an issue for many departments, in part due to faculty retirements.

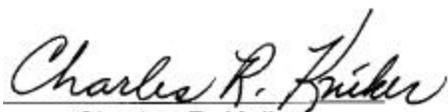
The College appears committed to emphasizing student learning, through such facilities as the "Active Learning Complex." Departments are promoting team-based learning and student-faculty, student-student, and graduate student-undergraduate student interactions.

Like other colleges and the University as a whole, the College of Engineering must respond to budget limitations. The concerns cited above will be addressed as soon as it is feasible.

Some of the College's objectives may have to be postponed. For example, one college-wide objective is that 100% of the graduating seniors (by 2005) will have experienced job-related summer employment, an internship, or been involved in a cooperative education program.

Copy of Materials

A complete copy of the materials on this accreditation action, including the self-studies, on-site visiting team report, institutional responses, and letter of formal notification of accreditation, is on file in the Board Office.


Charles R. Kniker

Approved: 
Gregory S. Nichols