SELF-STUDY REPORT
FOR INDUSTRIAL ENGINEERING (IE)

A. BACKGROUND INFORMATION

1. Degree Titles:

The Bachelor of Science in Industrial Engineering

2. Program Modes

The majority of the courses are offered as on-campus day courses. However, select courses, mostly Professional Electives, are offered at night. There are several options for the program: (1) Basic, (2) Information Technology (IT), (3) Pre-medicine, (4) Accelerated Degrees (IE and Master of Business Administration (MBA)); Bachelor of Science and Master of Science in Industrial Engineering for basic and IT options). All of the options have the same IE core.

3. Actions to Correct Previous Shortcomings

The last ABET report cited three strengths and five concerns for the IE School. The strengths were the quality of IE faculty, both in teaching and research, the industry-based capstone course, and the Fundamentals of Engineering (FE) exam requirement for all seniors. We have kept our strengths and improved upon or removed our concerns.

One of the concerns was that the senior design (capstone) course and two IE core courses were offered in the same semester. The curriculum changes, effective fall 2001, removed this concern. However, since then one of the IE electives taken in the eighth semester was converted to a required course (IE 4363, Facility Planning, Warehousing, and Material Handling). The faculty decided to leave the course in semester eight due to the fact that moving it to the seventh semester would have created a heavy course load for students in that semester and added more pressure to the prerequisite chain.

Another ABET concern was the need for an IT faculty member. The School has hired Dr. Karabuk whose expertise areas include IT. He has developed two courses in IT (one undergraduate and one graduate) for IE students.

The ABET visitors noted that most IE faculty had administrative assignments, which put pressure on the delivery of courses for all three degree programs. The IE faculty size has been since increased from 10 to 13. The School has streamlined the graduate program allowing more focus on research and reducing the minimum course requirements at the PhD level.

The state of manufacturing and human performance laboratories was also cited as a concern. Both labs have been upgraded since the last ABET visit. A three-axis CNC milling machine was purchased for classroom and research use. Existing machines in the manufacturing lab have been calibrated and software upgrades have been completed. Three new computers were purchased to be used in the manufacturing labs by the students. Other manufacturing laboratory renovations include amplifier and force gauge upgrades and purchase of a lapping machine. Since the last ABET visit, effort has also been made to modernize the human factors laboratory. Primarily this effort involved acquiring new PCs and software for better data acquisition. The main teaching lab, Carson Engineering Center Rm. 26, has two new PCs for data acquisition and analysis and a new printer for report preparation. We have also purchased an electrogoniometer to allow study and research of human wrist posture during computer-based tasks. Efforts are currently underway to purchase additional measurement equipment to allow study of human psychomotor performance. This equipment will enhance the laboratories used in IE 4824, Ergonomics, and will allow new laboratory exercises to be developed. We have significantly improved our laboratory conditions since the last ABET visit.

The last concern in the ABET report was faculty salaries. IE faculty salaries are 20% below the Big-12 averages. The faculty received an average of 5% salary increase in 2004. While the Assistant Professor salary-average is 7% below Big 12/Big 10 averages, average salaries overall rank 16% below Big 12/Big 10 averages in 2004-2005 [1]. While the IE graduate program is ranked 27th in the nation in 2006 *US News and World Report* (3rd after Texas A&M and University of Iowa IE programs in Big 10/Big 12), the average salaries at all ranks are below Big 10/Big 12 averages. However, IE continues to be successful in recruiting and retaining outstanding faculty. However, the concern still remains.

B. ACCREDITATION SUMMARY

1. Students

<u>Admission</u>

All freshmen entering the University of Oklahoma (OU), including those with a declared major in Engineering, are first admitted to University College (UC), a non-degree granting college that specializes in advising first-year students and assisting with a successful transition from high school to college. OU Scholars advisers provide specialized advising to freshmen who are National Scholars, OU Scholars, and Honors College participants. The Director of the College of Engineering's (CoE) Williams Student Services Center (WSSC) meets with OU Scholars and UC staff monthly to be sure advisers are kept informed of issues related to advising CoE majors. UC and OU Scholars both host summer enrollment programs for incoming freshmen, and WSSC advisers participate in the designated Engineering enrollment sessions. Although freshman engineering majors are advised by UC and OU Scholars advisers, students are invited and encouraged to meet with WSSC advisers if they have questions or concerns; both UC and OU Scholars advisers frequently refer student questions directly to WSSC advisers. When a student has completed a minimum of 24 credit hours (excluding credit by advanced standing) with a 2.0 GPA or higher, and has officially declared an Engineering major, the student's records are transferred to CoE and the student is advised in the CoE. Orientation sessions are held each semester for students who will be advised in the CoE for the first time for the purpose of answering questions and explaining procedures and requirements.

All new freshmen with a declared major in Engineering are required to take ENGR 1410 and ENGR 1420 during their first year. These courses are also open to students with an interest in studying engineering but who may not yet have declared an engineering major. Students are provided with an extensive introduction to the engineering profession and to each of the engineering disciplines. This is for the purpose of helping students make a well-informed decision about a specific area of study and also to help them then learn more about each of the engineering disciplines, and how each area of study can contribute to multidisciplinary problem-solving. ENGR 1410 and 1420 also have mentoring components in which every new freshman is assigned to a mentoring team led by an upperclass CoE student. These mentoring teams meet every week in the fall semester, as part of ENGR 1410, and a minimum of once a month during the spring semester. ENGR 1410 and 1420 also provide the opportunity for WSSC advisers to frequently interact with new engineering majors early in their student career.

Transfer Students

Students admitted to OU as transfer students (7 or more hours attempted at another college or university after graduating from high school) who have fewer than 24 credit hours, are admitted to UC and advised as freshmen until they are eligible for admission to the CoE. Transfer students admitted to OU with 24 or more credit hours and a declared major in Engineering are admitted directly to the CoE. Oklahoma residents are eligible for admission to the CoE upon admission to OU (see table below). Nonresidents of Oklahoma must have a 3.0 GPA or higher to be admitted directly to the CoE. Each incoming transfer student will meet first with a WSSC adviser to discuss general CoE academic policies and procedures; how their transfer credit has been evaluated; OU's General Education requirements, and to answer any questions related to their transition to OU and the College. Students are then referred to the School in which they have declared a major for more specific advising related to selecting engineering courses and pursuing a degree in a specific program.

New CoE transfer students are required to take ENGR 3410 during their first semester, which is intended to provide much of the same information as ENGR 1410 and ENGR 1420, but is designed for the more experienced college or university student. Topics include programs and opportunities specific to OU, undergraduate research opportunities, resumes and career services, and engagement in the CoE as an upperclass student. ENGR 3410 also has a mentoring component, with mentoring teams led by upperclass students who were themselves transfer students and who have a personal interest in helping transfer students successfully transition to OU.

Students who transfer to CoE from other OU degree-granting colleges also meet with WSSC advisers the first time they are advised in Engineering for the purpose of covering academic policies and practices specific to the CoE.

OU Transfer Student Admission Requirements

7-59 semester hours attempted	2.50 GPA required
60 or more semester hours attempted	2.00 GPA required
Non-resident engineering majors must have a minimum 3.0 GPA.	

Transfer Credit Evaluation

Most of the transfer work presented for credit in the CoE is work taken at one of the Oklahoma State System of Higher Education member institutions. Most of the courses that can be taken at the freshman and sophomore levels in the State of Oklahoma have been evaluated and are regularly reviewed by the appropriate academic department. Courses determined to be equivalent to a specific OU course are posted on-line and are incorporated into the automated Advising and Degree Audit (ADA) system for use in advising. Course equivalency lists are regularly reviewed and updated and are the responsibility of the OU Office of Admissions, through the coordination and guidance of the Oklahoma State Regents for Higher Education. Coursework from other institutions is evaluated by the appropriate academic unit (Department of Physics evaluates physics classes, Chemistry evaluates chemistry courses, etc.) on a case-by-case basis. Qualified substitutions are indicated on the individual student's ADA and if the Department so indicates, the course can be added to the course equivalency tables and applied to all students taking that specific class. The Provost's Advisory Committee on General Education Oversight (PACGEO) determines if coursework meets the State Regents' General Education requirements. An example student permanent record showing general education transfer credit is included in Attachment I.15. Engineering coursework that is submitted for credit evaluation is reviewed by the respective School within the CoE. The Director of the WSSC organizes the CoE's Transfer Advising Conference each summer to meet with faculty and advisers from Oklahoma two- and four-year colleges and universities on issues related to transfer students and credit evaluation. OU CoE faculty and department representatives also participate in the meeting and play an important role in helping transfer institutions understand content, objectives, and intended outcomes.

Advising

All undergraduate students in the CoE are advised by faculty members in their area of study. Advising is required in the CoE; blocks are set each semester preventing students from registering for classes until they can demonstrate they have met with a faculty adviser. The faculty advising process is supported by WSSC in that WSSC maintains academic records, provides advising and information related to general University policies and procedures, including General Education requirements, and maintains the ADA system that helps each student and faculty adviser track the student's progress toward meeting graduation requirements. Each semester, in preparation for advising and registration, an advising packet is prepared for each student by WSSC and includes the following:

1. College of Engineering "blue sheet" on which advisers, both faculty and WSSC, chronologically document the results of each advising session, as well

as any change in the student's status in the College, e.g., academic contract or probation, and any approved course substitution. The blue sheet is kept in the student's permanent advising folder. When it is returned to WSSC, the student's advising block is removed and the student is allowed to register for classes.

2. Transfer credit evaluation records.
3. An OU Advisory, which lists coursework taken and completed in a semester-by-semester format.
4. A current ADA printout. The ADA is specific to each student and shows the curriculum requirements for that student's degree program and how each course requirement is satisfied. The ADA functions as an on-going "graduation check," as it clearly marks the courses the student still needs to take and is organized in a semester-by-semester format that takes pre-requisites and sequential courses into account, and indicates courses satisfied by advanced placement as well as transfer credit.
5. General instructions for advising and registration and the official Academic Calendar.

Students pick up their advising packets in WSSC, use them to prepare to meet with their faculty adviser, and return their blue sheet to WSSC.

All students admitted to the College of Engineering (CoE) and who have declared their major as Industrial Engineering (IE) are seen by an IE faculty advisor. This generally includes sophomores, juniors, and seniors. Freshmen are required to be seen by an advisor in University College. However, if we can identify and reach those who have declared IE, we encourage them to see an IE faculty advisor as well. Faculty advisors are assigned to a particular cohort of students and continue with that group of students until each student graduates. Nominally, there are 4 faculty advisors, each one responsible for a particular cohort. The faculty – advisee pairing initiates in the freshman year and continues through to graduation. Currently, we have 2 faculty advisors; one advises freshmen and juniors, the other advises sophomores and seniors.

The advising process begins with a student contacting the IE student liaison for an appointment with their assigned faculty advisor. They are asked to arrive on time for their appointment with their WSSC advising packets in hand. The advising session usually takes 15-20 minutes and involves a one-on-one consultation between the faculty advisor and the student. Most of the IE curricula have companion flow charts to aid in the advising process. When flow charts are used, they are often attached to the CoE "blue sheet", for the student's permanent record. The permanent record is also used to document specifically the course and curriculum advice given to the student. A sample of an IE student permanent record is in Attachment I.15. At the end of the session, the student returns their "blue sheet" to WSSC and is cleared for enrollment.

This spring (2005) IE tried a new approach to handle the increasing advising load. We held an informal IE Freshmen/Sophomore advising night. The department hosted the event with pizza and the freshmen and sophomore advisors handled advising in small groups. Since most students are "on track" at this point in the curriculum, this was an efficient (and enjoyable) way to advise these cohorts. Each student at this session was also clearly told that they could still make an individual appointment with their advisor as needed.

When students transfer into the IE program at OU, the advising process is slightly different. All transfer students are seen by an IE transfer advisor (the chair of the undergraduate committee) for evaluation of coursework and standing. Students transferring from within the CoE at OU easily transfer their general engineering courses and can have coursework evaluated for transfer credit. Common transfer credits are applied to the IE technical elective and to ENGR/CE 2153 Strengths of Materials for alternative courses in materials. Students transferring from outside of CoE and/or OU have their general educational curriculum evaluated by the University and/or College. Industrial Engineering coursework from another institution is evaluated by the transfer advisor. Most coursework that comes from an accredited US IE program transfers directly to one of our core courses or to an IE elective provided the student received a grade of C or better. Coursework that comes from an international IE program requires documentation of course content via the course syllabus. Based on the description provided in the syllabus (certified translation) and a passing grade, the coursework can be transferred to our curriculum.

Students are advised to complete and submit a Graduation Self-Check to WSSC during the semester prior to the one in which they intend to graduate. A designated WSSC adviser will review the student's records, as well as the courses they intend to take in future terms, for the purpose of identifying any potential challenges or problems to be resolved before graduation, and communicate the results of this review with the student.

Students must maintain a 2.0 OU GPA and a combined (OU and transfer work) GPA of 2.0 in order to remain in good standing in the CoE. The student whose overall GPA falls below a 2.0 is placed on Academic Contract by WSSC, and the contract outlines the specific conditions of their returning to good standing in the CoE. This typically includes improving their GPA within one or two semesters and working directly with the WSSC retention adviser to identify other strategies for improving their academic performance. Students who do not meet the conditions of their contract, or whose grades do not improve to meet minimum requirements, are "stopped out" of the CoE and not allowed to continue their engineering coursework. The WSSC retention adviser also monitors students who make a "D" or "F" in any required course, as a "C" or better is required for all required coursework. Students are placed on Academic Warning and are required to repeat the course at the earliest possible opportunity, and if the course in which they received a D or F is pre-requisite for a course, they are prevented from taking that course. CoE students are given three opportunities to successfully complete any required course with a C or better, or they are also subject to being stopped out of the College of Engineering.

2. Program Educational Objectives

Process

In this section we focus on the educational objectives and the process by which they are developed, revised, and evaluated to lead to continuous improvement of the program. We provide mission statements for the University, College, and the School. We also state our educational objectives and conclude the section by discussing curricular improvements made as a result of the evaluation process. Details on program outcomes and assessment are discussed in the next section.

The educational objectives along with the outcomes and assessment process were first drafted by the IE Faculty in a series of retreats during the fall term of 1998. The objectives were then evaluated by consultants, the School's Advisory Board, and Teri Reed Rhoads, Assessment Coordinator for the College of Engineering at Arizona State University (now Associate Dean for Engineering Education in our College) in spring of 1999. The School began implementing the assessment process and formulating recourse plans in response to assessment results. The 2003 CoE retreat was devoted to revising the 5 year strategic plan of 1998. The plan was further revised based on input from the Board of Visitors and CoE faculty. The CoE retreat of 2004 focused on implementation of the strategic plan. Further input on the implementation plan was received from the Industrial Engineering Advisory Board (IEAB). The Fall 2004 IE retreat was devoted to reevaluation of the School's educational objectives, strategies, outcomes, metrics, measures, and standards. During the retreat, faculty agreed that the educational objectives drafted in 1998 covered all critical career and professional success factors that we would like our program to address and our objectives remain consistent with the University, College, and School mission statements. However, wording of the objectives were slightly modified to clarify the intent of each objective. Some strategies were refined and new strategies were added under the educational objectives. Minutes of the IE faculty meetings, the agenda for the IEAB meetings and the meeting minutes will be available to the ABET evaluator during the visit.

Constituencies

The program educational objectives were developed to meet the needs of the constituencies of the School of IE. The constituencies are current students, alumni, employers of our graduates, host organizations of capstone projects, IE faculty, and the IEAB. The IEAB plays an important role in the development of educational objectives and assessment of educational outcomes of our graduates. The board consists of mostly IE alumni including several recent alumni. The president of the student chapter of the Institute of Industrial Engineers (IIE) and a graduate student representative from the Graduate Student Association (GSA) are also nonvoting members of the board. Some board members also represent host organizations for capstone projects, as well as employers of our graduates.

Mission Statements:

> *The mission of the University of Oklahoma is to provide the best possible educational experience for students through excellence in teaching, research, and creative activity, and service to the state and society.*
>
> *The mission of the College of Engineering is to produce graduates and knowledge sought first in tomorrow's technology-driven world.*

The School of IE's mission statement reads as follows:

> *The mission of the School of Industrial Engineering is to create, assimilate, integrate, and disseminate knowledge promoting the profession of Industrial Engineering, through the delivery of an internationally recognized program of quality education, practice, and research.*

The (1999-2004) strategic plan of the IE School was updated in 2003 (Attachments I) based on the new CoE strategic plan for 2003-2008 (Appendix II).

Program Objectives:

The IE faculty has adopted the following five educational program objectives consistent with the University, College, and School mission statements:

> **Program Objective #1:** *Graduates are prepared for the contemporary practice of general engineering with a broad knowledge of principles of mathematics, science, and engineering.*
>
> **Program Objective #2:** *Graduates are prepared for the contemporary professional practice of industrial engineering with a broad knowledge of the analytical, computational, and experimental principles, methods and tools.*
>
> **Program Objective #3:** *Graduates are prepared for enterprise level system improvements with the knowledge and skills needed to design, analyze, and improve integrated systems of people, technologies, material, information, equipment and energy.*
>
> **Program Objective #4:** *Graduates are prepared to contribute to organizational success with the knowledge and skills needed for team-based problem solving, communication, professionalism, and ethical practice.*
>
> **Program Objective #5:** *Graduates are prepared to be practicing engineers with the knowledge and skills needed to appreciate the global scope and contemporary issues associated with engineering practice.*

Educational objectives are long-term objectives that the IE program prepares our graduates to achieve. The first objective assures that our graduates have strong fundamental knowledge required to succeed as practicing engineers. Accomplishment of Objectives 2 and 3 prepares our students to design, analyze, and improve an enterprise by ensuring that they are equipped with the fundamental methodologies and tool sets for the practice of Industrial Engineering. Objectives 4 and 5 prepare our students to be successful engineers and valuable contributors to the mission of any organization, locally or globally. Students are exposed to the "soft skills" and technical knowledge needed to promote organizational success.

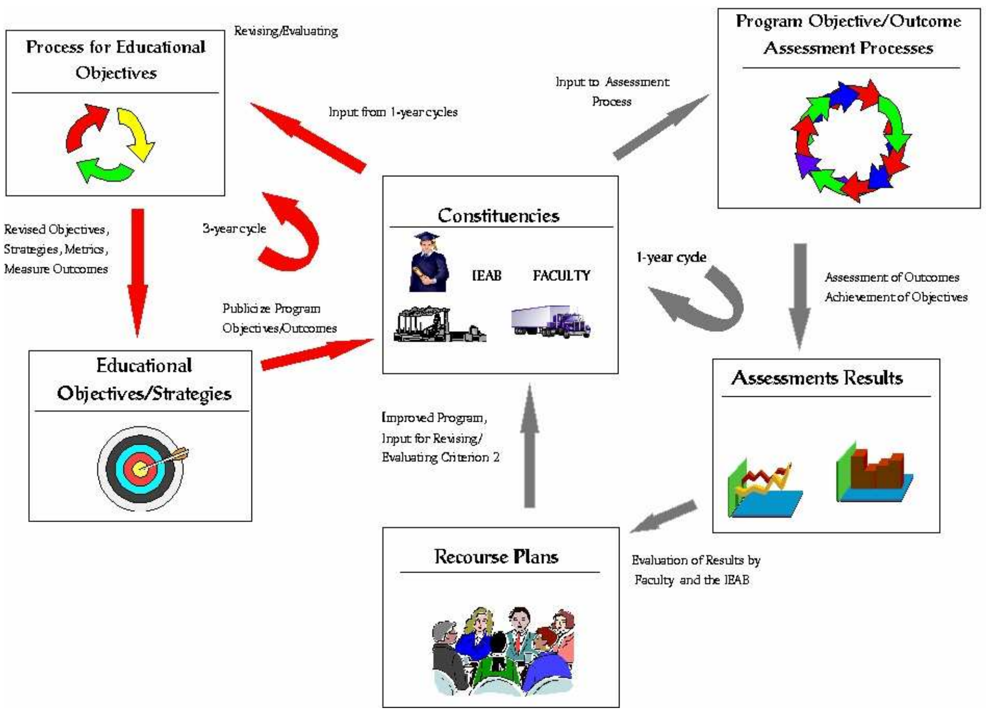

Figure 1. Integrated Process for Defining, Evaluating, Assessing Program Educational Objectives and Outcomes (Criteria 2 and 3)

Mission statements, strategic plans, input from faculty, students, alumni, host companies for the capstone course, School, College Advisory Boards, and the accreditation criteria are all utilized in defining the program educational objectives for IE. We provide a program which is geared towards the achievement of these objectives. Educational objectives and outcomes are linked by a set of strategies (Table 1). The School of IE publicizes these objectives in newsletters to alumni and other IE schools, the departmental home page (www.coe.ou.edu/ie), and in the undergraduate student handbook which is available on the School's homepage.

Figure 1 shows the integrated process for determining and evaluating program educational objectives, strategies, and outcomes for the IE School along with the process for assessing program outcomes. The figure also shows the two feedback loops that lead to continuous refinement of program objectives and curricular improvements to achieve the standards set for each outcome. The loop in "red" is executed every three years. This loop assures periodic evaluation and redefinition (if necessary) of the current educational objectives, strategies, and outcomes. The loop in "gray" is executed annually and focuses primarily on outcomes assessment and leads to curricular improvements to achieve the outcomes and educational objectives stated for the IE program. However, revisions to the existing program objectives, strategies, and outcomes can also be made at the end of each annual cycle. Students, faculty, the IEAB, and host companies of capstone projects provide input to the School in accordance with the School's assessment process. The assessment process for definition, evaluation, and revision of educational objectives, strategies, and outcomes is illustrated in detail in Figure 2. The details of the outcomes assessment process are shown in Figure 3 and discussed in Section 3 of this report. The two cycles are linked together through program outcomes assessment reports (Steps 2, 4, and 8 in Figure 2 and Step 9 in Figure 3).

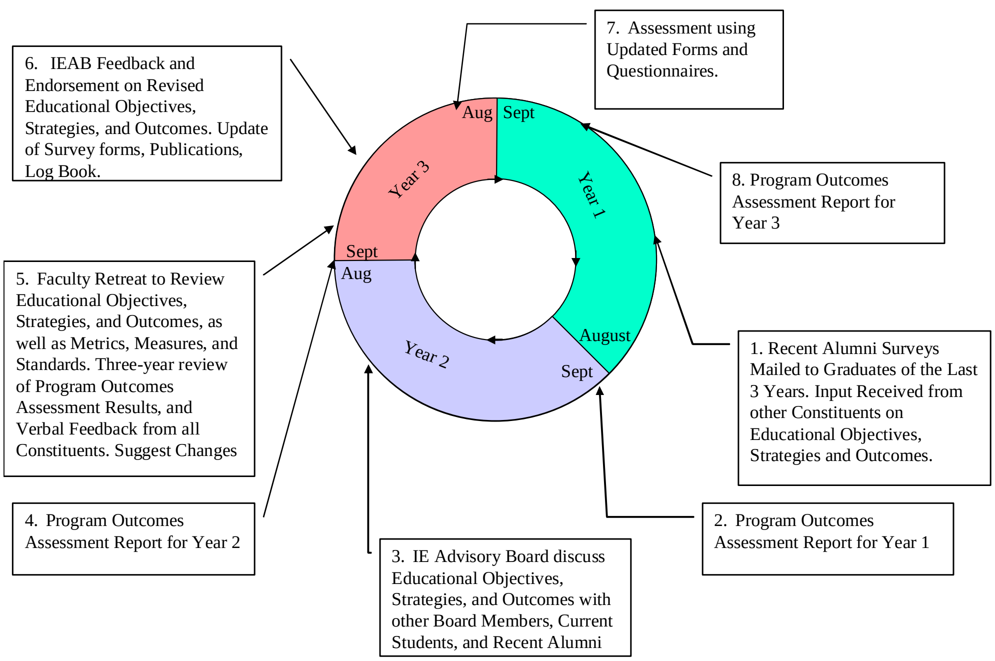

Figure 2. Process for Defining and Evaluating Criterion 2

As illustrated in Figure 2, input from constituencies regarding current program educational objectives is received as follows: A recent alumni survey, conducted every three years, asks about strengths and weaknesses of the program and suggestions for improvements (step 1). It also solicits additional comments on the strengths and weaknesses of the current program and suggestions for further improvements. In April of every year, the IEAB interviews a group of current students and recent alumni for similar input. Student and recent alumni input on the skill set that potential employers look for during interviews is very important in the evaluation of the undergraduate curriculum and the educational objectives. The IEAB reports back to the School on key elements of the feedback along with their input as the employers of IE graduates and as practitioners of our profession. Discussions with faculty members regarding the feedback and possible action plans take place during the board meeting. The IE School holds a faculty retreat every three years to evaluate/revise current program educational objectives and outcomes as well as discuss major curricular improvements based on assessment results (step 5). Retreats were held in 2001 and 2004; the next ABET retreat is in 2007. Previous three years' program outcomes assessment reports and other feed back from constituents (steps 2, 4, and 8) are reviewed at these retreats. Recourse actions identified during the retreat are presented to the IEAB in the board's subsequent fall meeting for discussion and approval. The School implements the action plan (step 8) and starts a new 3-year cycle with the revised set of objectives, strategies, measures, and metrics. It is important to note that the School does not wait three years to take action on curricular improvements. The yearly assessment cycle (Figure 3) can initiate an action plan on both curricular changes and changes to program objectives, strategies, metrics, and measures. However, the 3-year cycle assures a focused effort on the evaluation of current program objectives. One may view the three-year cycle as more of a proactive evaluation of program objectives, strategies, metrics, and measures as opposed to the one-year cycle which is more reactive in nature based on assessment results.

Evidence of Process Effectiveness

The primary instruments we have chosen to evaluate how well our program achieves educational objectives are student performance in courses, host company evaluation of capstone projects, feedback from recent alumni, and the FE exam results. Other instruments that we use are input from exit interviews regarding skills that companies look for from our graduates during job interview process, graduating student surveys, students' perceptions of how well they have achieved each educational outcome, and the IEAB interviews with students and recent alumni.

In 2002, the IE School conducted a survey of all alumni. The results were tabulated into responses from each decade. It was clear from the survey that the School has made significant changes in the curricula to improve communication skills of the graduates. The survey form was revised in 2005 using educational objectives and outcomes defined by the IE program and sent to alumni who have graduated within the last five years. Survey results indicated that the alumni are satisfied with the School in achieving all of its stated objectives except two strategies in objective 2: (i) competence in the use of manufacturing tools, mainly AutoCAD, and (ii) competence in applying facility layout techniques and tools (See Table 1 for strategies under each educational objective, discussed in Section 3). These concerns were consistent with the assessment results for the last three years and were discussed in the fall 2004 faculty retreat. Following the retreat, action plans were formulated and presented to the IEAB in the fall meeting. The board strongly endorsed the proposed curricular changes to eliminate the concerns.

Attempts to correct one of the concerns, competence in drafting and engineering drawing software such as AutoCAD, by allowing more exposure to AutoCAD in manufacturing classes did not achieve the desired results. Consequently, the School decided to add a one credit hour engineering design course (IE 2311) to the curriculum in order to improve the competence level of our graduates with engineering drawing principles and software tools. The course will be offered for the first time in spring 2006. The second concern, which was the level of coverage of facility layout and lean manufacturing concepts in the IE curriculum, led to the development of a new course in material handling, facility layout, and warehousing. The course was first taught in fall 2005 as an elective course to current students. However, it is a core course in the current curriculum. A survey sent to recent alumni to determine the set of IT skills used by our graduates identified a need to develop courses in IT. The IEAB strongly endorsed this need. The School developed two new IT courses for IEs (one undergraduate and graduate) to address these concerns. Both IT courses are electives. A sample IT survey form is provided as Attachment I.10.

Alumni survey results, IEAB student interview reports, minutes of the IEAB meetings, IT survey results, and minutes of the IE faculty meetings provide evidence that the process is functional. The IE Logbook also lists major program improvements implemented by the IE School. These will be available to the ABET evaluator during the visit.

3. Program Outcome and Assessment

<u>Program Outcomes</u>

The School of IE has identified a list strategies and actions to achieve desired outcomes under each program educational objective (Table 1). The list includes strategies and actions we kept from the list created in 1998 which were proven to be effective and the newly instituted strategies and actions. We also provide a list of the core courses in the IE curriculum addressing each strategy. Column 3 in Table 1 identifies the EC2000 (a-k) criteria and CoE strategies (see Appendix II) addressed by each strategy/action in the table. The course syllabi in Appendix IB delineate how each course addresses the program objectives and the (a-k) criteria.

<u>Assessment Process</u>

The assessment process developed in 1999 provided a solid foundation for the continuous improvement of the IE program. The IE faculty and IEAB provided significant input to help develop assessment methods, metrics, and standards to effectively measure and evaluate achievement of desired outcomes. At that time, it was unclear which assessment methods, metrics, and standards would be useful. Since the last ABET visit, the School has focused on implementation of the assessment process, validation and refinement of candidate assessment methods, metrics, and standards identified in 1999. As a result, survey forms were revised, new forms were created, the number of metrics used was reduced to a manageable size, and the process was documented in a flow chart to assure sustainability and consistency. The academic program subcommittee of the IEAB discussed revisions to the survey questions and the administration of exit interviews in their spring meeting. The IE faculty devoted the 2004 retreat to reviewing the educational objectives, streamlining the assessment process, and developing curricular changes based on feedback from the constituencies. The process is still evolving, so assessment methods, metrics, and standards may likely change in the future. However, we do not expect major changes to the process.

Figure 3 describes the outcome assessment process for the IE School. We have implemented the process in the 2004-2005 academic year (AY) and found it to be very effective.

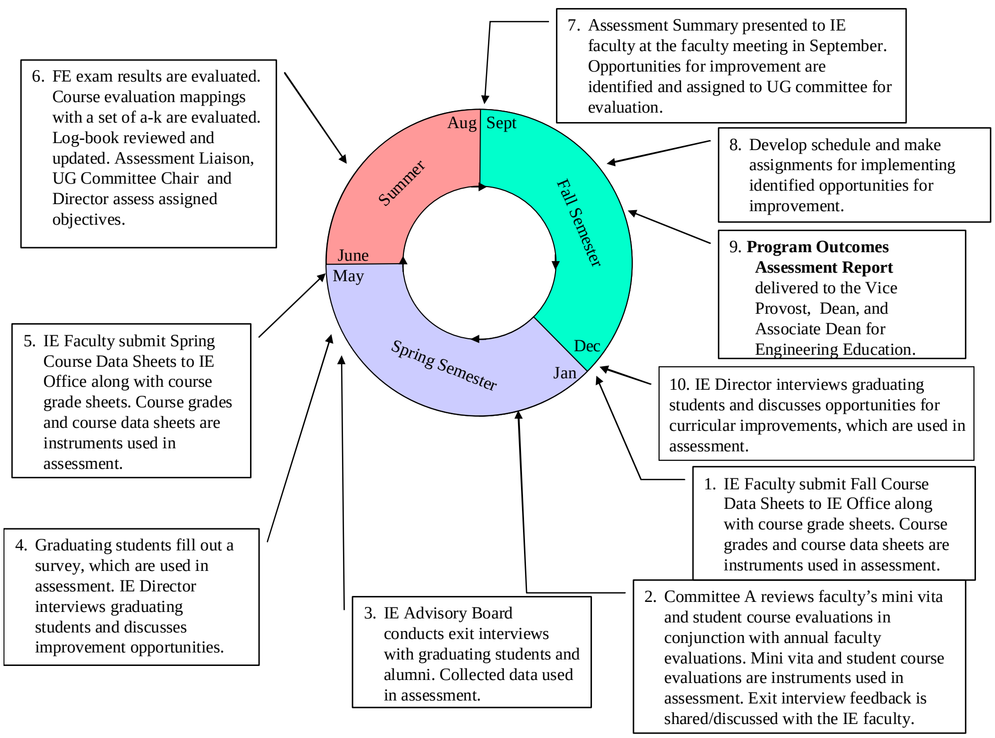

Figure 3. Process for Outcome Assessment and Achievement of Program Objectives for the IE School

Assessment Methods

Assessment methods for each strategy and action are listed in Table 1. The methods can be classified into the following three categories. Assessment instruments for each category are listed.

1. *Monitoring student and faculty performance:* Instruments used: Performance on National Exams, Student Exit Interviews, Student Performance in Courses, Course Evaluation Results, Senior Exit Interviews, Mini Vita, Annual Faculty Performance Evaluations

2. *Monitoring mix of learning experiences in the curriculum*: Instruments used: Course Data Sheets, Student Exit Interviews, mapping of Course Evaluations to (a-k) criteria, Student Participation in Professional Activities

3. *Soliciting input from various constituencies of the program*: Instrument used: Survey of Most Recent Alumni, IEAB Student Interviews, IEAB Meetings, Feedback from Host Companies of Capstone Course Projects, Feedback from Five- Year Campus Program Review

The School submits a Program Outcomes Assessment Report for the undergraduate program to Vice Provost every year. The report is required by the Oklahoma State Regents of Higher Education.

<u>Assessment Metrics</u>

Assessment metrics provide quantitative and qualitative results that one can compare against standards to demonstrate that graduates have achieved the desired set of outcomes which, in turn, demonstrates that the program meets educational objectives. The quantitative metrics we use include: (1) course and instructor effectiveness scores, (2) course grades and grades from specific deliverables such as projects, (3) FE exam pass rates, (4) distributions of responses obtained from various surveys (recent alumni, graduating seniors, exit survey), (5) number of courses involving teamwork, communication skills, and ethics, (6) host organization feedback on the capstone projects, and (7) course mapping scores to (a-k) criteria. Qualitative metrics include: (1) verbal feedback from Senior Exit Interviews, (2) comments from capstone project companies, (3) IEAB student and alumni interviews, (4) feedback from recruiters, (5) roundtable discussions with students, and (6) testimonials from graduates of the program.

<u>Standards and Recourse Plans</u>

Standards are target values for metrics. The assessment process involves continuous refinement of standards through experience and benchmarking activities. When certain standards are not met for an outcome, the IE faculty members discuss the nature of the standard and recourse plans. The plan may involve change in course content, curriculum, instructional methods, and/or assessment of student performance.

In most general terms, assessment methods and instruments assist us in answering the following two basic questions:

- Is the IE program effective and flexible in meeting the broad scope of applications in the real-world?
- Are our graduates well-prepared for industry work and for advanced degrees?

Assessment Instruments

1. Course Data Sheets
2. Mapping of Course Evaluations to (a-k) Criteria
3. Student Exit Interviews
4. Graduating Student Surveys
5. IEAB Interview Current Students and Recent Alumni
6. Recent Alumni Survey
7. Capstone Project Performance Survey by Host Institutions
8. FE Exam Results
9. Roundtable Discussions with Undergraduate Students
10. Faculty Performance Evaluations
11. Informal Feedback and Testimonials

1. **Course Data Sheets**: This is a new assessment instrument that the School uses in collecting data on assesment metrics related to each course. Evaluation of course data sheets also helps the School to monitor coverage (both in content and quality) of subjects such as ethics, contemporary issues, and teamwork as well as project-based learning experiences and oral/written communications. A sample course data sheet is provided as Attachment I.3. Course data sheets were first used in spring 2004 with a select group of courses. Revised data sheets were used for all undergraduate courses in 2004-2005 AY (fall 2004 and spring 2005).

2. **Mapping of Course Evaluations to (a-k) Criteria**: This instrument monitors students' perceptions of the coverage of some of the (a-k) criteria (a,b,d,e,f,g,j,k) in each course. The information is provided by WSSC based on course evaluation forms completed by students in each course at the end of the semester. Results are compared to the (a-k) criteria addressed by each course. The Director shares any concerns with the faculty member teaching the course and discusses recourse plans. A sample course evaluation form is provided as Attachment I.4.

3. **Student Exit Interviews**: IE Students completing the baccalaureate program in Industrial Engineering must schedule and attend an exit interview with the Director during the semester in which they plan to graduate. Students fill out and return a questionnaire (Attachment I.5) prior to the oral interview. They also fill out an evaluation form for teaching effectiveness of each IE professor considering all of the courses taken with that professor. The Director and the student engage in open-ended dialogue on issues of the student's choosing. They also discuss survey questions for which the student has expressed some level of dissatisfaction. The student and the Director work on formulating action plans to alleviate the dissatisfaction. The feedback received from oral interviews and exit survey results are generally consistent with the feedback received from IEAB interviews and the alumni survey.

4. **Graduating Student Surveys:** At the end of each academic year, WSSC contacts graduating seniors and asks them to fill out an on-line survey. Survey results are

summarized and shared with each School. The School uses the results to detect shifts in student satisfaction with the program. The results are also used to determine percent of students with internship or research experiences before graduation.

5. **The IEAB Interviews with Current Students and Recent Alumni:** During the spring meeting of the IEAB, some members hold interviews with a cross-section of under-class and upper-class undergraduate students, graduate students, and a representative group of recent alumni. Interview results are summarized and shared with the IEAB and the IE faculty. In fall 2004, the academic programs committee of the IEAB discussed an action plan for selection of students participating in the interviews and revisions of the interview questions. The committee decided to randomly select three sophomores, three juniors, and three seniors for the interviews. Additional students will be invited to the interviews in order to have student representation for each program option. Interviews will not have a formal set of questions and will encourage dialogue on issues of the student's choice or the choice of the IEAB member. The interviewers will have the list of educational objectives, strategies, and outcomes (Table 1) along with (a-k) criteria at their disposal. The revised process was used for the IEAB student/alumni interviews during the spring 2005 meeting of the IEAB. See Attachment I.6 for sample questions IEAB uses during the interviews.

6. **Recent Alumni Survey**: The alumni survey form was revised in 2004 in order to better measure the level of achievement of each educational objective. Dr. Teri Reed Rhoads (The ABET Coordinator for the College), Dr. Randa Shehab (Undergraduate Program Committee Chair for IE), and Dr. Hillel Kumin (IE-Assessment Liaison) provided input to Dr. Simin Pulat (IE School Director) on the survey form. The survey was sent to alumni who graduated within the last five-years. The School will send the survey to recent alumni (last three years) every three years. Results will be compiled and shared with faculty and the IEAB. A sample of the survey is provided as Attachment I.7.

7. **Capstone Project Performance Survey for Host Institutions**: This is also a new survey instrument that the School administered for the first time in spring 2005. The survey addresses outcomes that students should achieve through the capstone experience. Survey results provide important feedback from future employers of our students as to their performance in solving real-life problems. Results of the survey are summarized and presented to the IE Faculty and the IEAB. Recourse plans for below standard performances are formulated by the faculty and communicated to the IEAB for feedback. A sample form is provided as Attachment I.8.

8. **FE Exam Results**: Students in IE are required to take the FE exam before or during enrollment in the capstone course (IE 4393). The registration fees are reimbursed for those students who pass the exam. The School closely monitors the performance of IE students in each test category and tracks yearly changes.

The three year average pass rate for every subject category is compared to the three year national average. Results are discussed at either the IE faculty retreat or a faculty meeting in the fall semester. They are also presented to the IEAB in the fall meeting.

9. **Roundtable Discussions with IE Undergraduates**: Every fall, the Director of the School and the Chair of the Undergraduate Committee hold a roundtable discussion session with the undergraduate students. There is no preset agenda for the meeting. Students are encouraged to voice their concerns and wishes as well as to ask any questions that they may have about the program or any other issue related to their education. This has been a useful tool for measuring the satisfaction of the students with the program.

10. **Faculty Performance Evaluation**: Every spring semester, the Director and Committee A (two faculty members voted by the IE faculty to be their voice) meet with each faculty and evaluate his/her teaching, research, and service performance in the previous calendar year. During the evaluation of teaching performance, exit interview results, course performance evaluations, course content (depth and breadth), instructional methods, and course rigor are discussed. Teaching effectiveness scores are compared to School and College norms. Appropriate recommendations are written on the faculty member's evaluation sheet. Improvements are tracked in the following year. Faculty members who are recognized as excellent teachers are nominated for national and university awards.

11. **Informal Feedback and Testimonials**: The Director of the School occasionally goes to lunch with recruiters and discusses their hiring needs and the quality of the graduates from the IE program. Their input is shared with the IE faculty and the IEAB in an effort to improve program outcomes. IE graduates send e-mails to the director and faculty either expressing their gratitude or making recommendations for curricular changes. Messages are generally forwarded to the IE Director who serves as the focal point for information gathering and dissemination.

<u>Documented Changes</u>

1. Student exit interviews, concerns from the previous ABET reviewer, and input from the IEAB and IE faculty have indicated that IE graduates with IT skills were needed for companies conducting E-business. In 2001, the IE School launched a new program option in IT. Through professional electives and addition of 6 credit hours, the new option allowed students to take 18 credit hours of Computer Science (CS) courses in addition to the core IE coursework. Students in this option also receive a minor in CS. In 2002, the School hired Dr. Suleyman Karabuk whose interest areas include IT. A survey was sent to recent IE alumni to determine which IE skills were needed in the workplace. Dr. Karabuk led the development of two new IT courses in the IE School and presented them to the IEAB. The courses received strong support from IEAB. The recommendation was

made to make at least one of the two courses a required course for the curriculum. The UG Committee is considering the recommendation.

2. The Board of Visitors for the College, IEAB, and IE alumni have all expressed the need for engineering students to have more business skills. A new engineering course, ENGR 2003, Engineering Practice I, has been added to the core. This course focuses on fundamentals that all engineers need for successful practice of engineering. In addition to the new core, the IE School, in collaboration with the College of Business, drafted an accelerated degree option where students will be able to receive a baccalaureate degree in IE and an MBA. Several IE will be entering the program in fall 2005. The option also received positive response from recruiters of both colleges.
3. Roundtable discussions with IE undergraduates identified the need for more plant tours for the students. The School worked with the IIE student chapter to organize several plant tours in 2004-2005. Students visited Hiland Dairy, UPS, WalMart Distribution Center, DitchWitch, and Goodyear for half a day.
4. Roundtable discussions with the IE undergraduates also raised concerns for the School's web page. The School also received input from the IEAB on pages concerning different degree options. Informal discussions with students and faculty also identified the need for an online undergraduate student handbook. The School's web page was redesigned and uploaded in November 2004. Responses to the new web page were all very positive.
5. Student Exit Interviews and Alumni Surveys identified the need for competency with AutoCAD software. In spite of assuring AutoCAD exposure in manufacturing courses, the concern still remained. As a result, the School added a one credit hour Engineering Design course as an IE core course to the curriculum. IE 2311, Computer Aided Design and Graphics Laboratory, will be taught for the first time in spring 2006. Similarly, concerns for a course in material handling, facility layout, and warehousing led to the development of a 3 credit hour core course (IE 4563, Facility Planning, Warehousing, and Material Handling) to address these topics. The course was taught as an elective course in spring 2005. It is, however, a core course in the current curriculum.
6. IE students' performances in the Engineering Economy category of the FE Exam led to the addition of cost analysis to the course.
7. Ethics case studies were added to IE 2823, Enterprise Engineering to strengthen ethics coverage in the program. The need for more ethics coverage was identified during the outcome assessment process.
8. Course evaluation mappings to the (a-k) criteria for IE 2303 revealed that communication skills were not addressed in the course although criterion g was included in the set of course outcomes. While investigating the concern, it was realized that program educational objectives, strategies, outcomes, and stated course deliverables were not shared with the new faculty members assigned to teach the course. A term project was added to the course to address the written communication skills.
9. Exit interview and alumni surveys, and IEAB student interviews revealed the need for more practical experiences for the students. Students also wanted more real-life applications discussed in courses. In the last two years, with the help of

the IEAB, recent alumni, and OU Career Services more internship opportunities were created for IE students. IEAB members continue to volunteer as speakers in IE courses. Recently, seven IE faculty members teamed up to provide lean training at Tinker Air Force Base. They have also incorporated lean training principles into their courses in response to student and alumni input.

10. Although course evaluations are not considered as primary assessment instruments, they have aided the School in identifying potential problems and addressing them to improve learning experiences for our students. The Director and Committee A discuss ways of improving instructor performance with faculty receiving evaluation averages below School and College norms. Some recommendations include more in-class exercises, encouragement of class participation and discussions, inclusion of case studies, and suggestion of on-campus training workshops to improve course effectiveness.

11. Feed back from the host companies regarding the students' performances in capstone projects were mostly positive. However, a few company supervisors were concerned about project management skills of their capstone students. Students either did not put enough effort into the project at the beginning of the semester or they did not keep their company supervisors informed on their progress. The capstone course coordinator will devote more class time to educate seniors of the expectations of a company and give them tips on how to successfully complete a project. Our capstone coordinator, Mr. Steve Rogers, worked in industry for over 30 years.

12. Feedback from recent alumni and the IEAB suggest the least beneficial courses in the IE curriculum are Electrical Circuits and Thermodynamics. This is consistent the alumni feedback for several years. In the current curriculum, IE students are only required to take three one-credit hour courses in Electrical Science, Thermodynamics, and Fluid Mechanics. In the old curriculum, IE students were required to take three-credit hour courses in Thermodynamics and in Electrical Science. They were not required to take any course in Fluid Mechanics. In a meeting with one of the companies in the oil industry, it was mentioned the reason why they did not hire an IE was the absence of Fluid Mechanics in the IE curriculum.

13. Feedback from recent alumni indicates that a hands-on course on applications of the toolsets, such as SAS, LINGO, MS ACCESS, MS Project, Visual Basic, that IE graduates use in the workplace would be beneficial to our graduates. Faculty and the IEAB will discuss action plans in the fall semester.

<u>Materials Available for Review</u>

Information available for review during the visit includes:

1. Course syllabi, homework, project reports, and exams
2. Self-Study Report for Campus Program Review
3. Program Outcomes Assessment Reports
4. Road map for IE
5. Student Exit Interview Results
6. Alumni Survey Results

7. Host Company Evaluations of Capstone Course Performance
8. Graduating Student Survey Results
9. IEAB Student and Alumni Interview Results
10. FE Exam Evaluations
11. Course Evaluation Mappings with (a-k) criteria
12. Course Data Sheets
13. IE Logbook

4. Professional Component

The School of Industrial Engineering offers the Bachelor of Science in Industrial Engineering degree. Freshman can enroll in one of the three options: Standard (0913A), Information Technology (0913B), and Pre-Medicine (0913E). The core courses for the standard option are also core courses in both the IT and Pre-Med options. As shown in Table I-1.1, the standard option core exceeds the minimum ABET degree requirements for Math, Basic Sciences, and Engineering; hence, all three degree options satisfy the minimum ABET degree requirements. The different degree options are delivered by incorporating electives and additional core courses. Table I-1.2 shows curricular requirements for 0913B. The first graduates of the IT option graduated in 2004. The core curriculum has been modified for the students starting the degree program after spring 2004. The Pre-Medicine option (0913E) students follow the curriculum that is currently in effect (Table I-1.5). The degree sheets that are currently in effect for each option are shown in Tables I-1.3 through I-1.5. These new degree sheets also satisfy the minimum ABET requirements in Math, Science, Engineering, and General Education.

<u>Curriculum for students entering before Summer 2004:</u>
IE students are required to take three engineering (ENGR) core courses fundamental to Industrial Engineering practice: ENGR 1112, Introduction to Engineering (2 credits), ENGR 3293, Engineering Statistics (3 credits), and ENGR4223, Engineering Economy (3 credits). An additional 15 hours of fundamental engineering science courses prepare students for the upper level industrial engineering courses and the FE examination. The industrial curriculum requires core coursework from three broad areas of industrial engineering: (a) *Systems Design and Analysis* (IE 2823, Enterprise Engineering (3 credit hours), IE 4623, Systems Modeling and Optimization (3 credit hours), IE 4663, Applied Engineering Optimization (3 credit hours), IE 4663, Systems Analysis using Simulation (3 credit hours), and IE 4333, Production Systems and Operations (3 credit hours), (b) *Manufacturing and Quality* (IE 2303, Design and Manufacturing Processes (3 credit hours), IE 3304, Design and Manufacturing II (4 credit hours), and IE 4563, Quality Engineering (3 credit hours), (c) *Ergonomics/Human Factors Engineering* (IE 4824, Ergonomics (4 credit hours) and IE 4553, Engineering Experimental Design (3 credit hours). All students take 6 hours of capstone experience: IE 4853, Applied Research Methods (3 credit hours) and IE 4393, Capstone Design Project. In 4853, students learn how to perform a literature search on a given applied topic, design, and conduct experiments, and prepare reports on each topic. This course provides capstone research experience. The curriculum culminates with a major capstone design experience in IE 4393. The capstone design course addresses a practitioner guided, real world design

problem defined and hosted by companies sponsoring the projects. Attachment ID contains a list of capstone design companies for spring 2005. The students also take three credit hours of IE elective, three credit hours of IE or Tech Elective, and three credit hours of Math Elective.

The General Education requirements at the University of Oklahoma, along with the College of Engineering and the School of Industrial Engineering advising systems, ensure that all students have the depth and breadth of learning experiences in their education. Two courses (HIST 1483/1493 and P SC 1113) are required in the social sciences. Humanities courses are grouped into three areas: (1) *Understanding Artistic Forms* (3 credits), (2) *Western Civilization and Culture* (6 credit hours), and (3) *Non-Western Civilization and Culture* (3 credit hours). The combined study of humanities courses promotes an appreciation of societal and global context of engineering practice, as required by EC2000 Criterion 3 (h).

The IE curriculum provides a broad knowledge of fundamental principles of math, science, and engineering with the basic math, science, and engineering courses with course abbreviations MATH, PHYS, CHEM, and ENGR as shown in the IE curriculum (Program Educational Objective #1). The IE courses, collectively, provide a broad knowledge of the analytical, computational, and experimental principles, methods, and tools fundamental to the contemporary professional practice of industrial engineering (Program Educational Objective #2). Students obtain a unique design and manufacturing experience in IE 3304 by designing and manufacturing a part at the Moore-Norman Technology Center under the guidance of a skilled technician at the center. IE 4563, Quality Engineering, IE 4853, Research Techniques in IE, and IE 4393, Capstone Design Experience provide students with experiences in designing and improving integrated systems of people, technologies, material, information, equipment, and energy (Program Education Objective #3). In addition IE 4363, Material Handling, Facility Layout, and Warehousing, taken by a majority of the undergraduate seniors as an IE elective, also offers case studies/projects involving design and improvement of integrated systems. This course is a required course in the current curriculum (Table I-1.4-1.6). IE 4393, the capstone design course, assigns student teams of two to a company to solve a real-life problem under the guidance of a company and faculty supervisor. Company survey results provide excellent feedback to the School in assessing the graduating seniors' abilities to solve real-life problems.

Courses in the Industrial Engineering curriculum have varying laboratory components, oral/written communications, computer usage, teamwork, and design projects. The content of each course is summarized on the course syllabi in Appendix IB. Additional information on the IE undergraduate curriculum is in Attachment ID.

The course and section size summary for Industrial Engineering is shown in Appendix IA, Table 2.

In addition to all the core courses described above, the IT option requires 18 hours of coursework from the School of Computer Science (CS), of which 9 hours are upper division CS electives. CS 1323, Introduction to Computer Programming (3 credits) is a core course for all options and is not counted in the 18 hours of CS courses. The required CS courses are: CS 1813, Discrete Mathematics (3 credits, replacing Math Elective in the Standard Option), CS 2334, Programming Structures and Abstractions (3credits), and CS 2413, Data Structures (3 credits). IE students also receive a Minor in Computer Science after completing all 21 credit hours of CS courses (including CS 1323). Minor requirements were slightly modified in 2004-2005. The IE IT option was also modified to reflect the changes (Table I-1.5). Although the option graduated few students, both graduates of the program and their employers have been extremely satisfied with the skill set of the graduates. This option also replaces six hours of IE and IE/Technical Electives with the CS electives. Graduates of this program are highly sought by e-business and logistics firms such as Comp One Services and JB Hunt Logistics. These companies have expressed interest in hiring other IT graduates from our program.

The Pre-Medicine option has degree requirements encompassing all IE Standard option core courses and all course requirements for the Pre-Medicine degree defined by the Pre-Medicine Office at the University. This option prepares students for health related professions.

Curriculum for Students entering after Spring 2004:

In order to increase retention and graduation rates and provide students better understanding of differing engineering majors, ENGR 1112 has been replaced by a three-course sequence of ENGR 1410, ENGR 1420, and ENGR 2003. Course descriptions for these courses can be found in Appendix IA- Table 2. ENGR 2003 has a design component along with critical skills that our graduates need to practice engineering. The new IE curriculum replaces six credit hours of Engineering Science (ENGR 2613, Electrical Science and ENGR 2213, Thermodynamics) with three one-credit hour computer assisted courses: ENGR 2431, Electrical Circuits, ENGR 2461, Thermodynamics, and ENGR 3441, Fluid Mechanics. Core material from ENGR 2313, Structure and Properties of Materials, required for the manufacturing sequence are incorporated into the manufacturing courses. IE seniors, alumni, and employers identified two areas of improvement for our curriculum: A course on engineering design and graphics and a course on material handling, facility layout, and warehousing. IE 2311, Computer Aided Design and Graphics Lab (1 credit) and IE 4363, Facility Planning, Warehousing, and Material Handling (3 credits) were added to the curriculum. Various constituents of IE have also expressed a need for more hands-on computer applications in IE. The School has added two courses (IE 4113, Decision Support for IE and a 5000 level elective) to the set of elective courses in IE. The revised curricula for all degree options satisfy minimum ABET degree requirements in Math, Science, and Engineering (Appendix IA, Tables IA 1.3-1.5). We have already received positive input from current students, alumni, advisory board, and employers on the current curriculum.

5. Faculty

Competency

The School of IE has 11 full-time or tenure-track faculty members. Two new faculty members (Yongpei Guan from Georgia Tech and Chen Ling from Purdue) will join the IE faculty in August 2005. In addition to 13 faculty members, Tom Landers, Interim Dean and Teri Reed Rhoads, Associate Dean for Engineering Education also provide teaching and research support to the School. Generally, Dr. Landers co-teaches one course and Dr. Rhoads teaches one course a year. Systems Design and Analysis courses are taught by Professors Court, Grant, Guan, Karabuk, Kumin, Landers, Pulat, and Trafalis. Professors Rhoads, Raman, and Sunanta offer courses in Manufacturing and Quality Engineering. Human Factors/Ergonomics courses are offered by Professors Ling, Schlegel, and Shehab. The School is blessed with support from several adjunct faculty members with significant industry experience. Dr. M. Pulat, Director of the Center for Engineering Logistics and Distribution teaches two courses per year. His support of the IE School spans over 20 years. Dr. Pulat teaches ENGR 4223, Engineering Economy and IE 5743, Management of Engineering function (IE elective for undergraduates). He brings to his courses 15 years of managerial experience with Lucent Technologies. Dr. Leva Swim, Director of Decision Support at Integris Health, teaches IE 5713, Engineering Project Management (IE Elective for undergraduates). She is a certified Project Manager. Dr. David Hartmann, Assistant Professor at the University of Central Oklahoma, teaches IE 5753, Organization Systems (IE Elective for undergraduates). After 21 years of military service, Dr. Hartmann worked in industry for six years and joined academia in 1996. Ms. Kim Wolfinbarger taught IE 4824 in spring 2005. She holds an MS degree from our School. Ms. Wolfinbarger has strong fundamentals in ergonomics, along with excellent communication skills. Starting with fall 2005, Mr. Steve Rogers will coordinate IE 4393, the capstone design course. Mr. Rogers, a semi-retired executive from Hatfield and Company, brings to the students a wealth of experience and advice. He is also experienced in maintaining diverse industry ties that will help him identify and grow capstone design project sponsors. He will also work with the company sponsors in assessing the performance of our seniors in capstone projects. Fall 2004, IE 4553, Engineering Design of Experiments course was taught by PhD Candidate in Psychology, Jonathan Bard. The School's new faculty member, Chen Ling will teach both IE 4824 and IE 4553, replacing Ms. Wolfinbarger and Mr. Bard. Professors Landers, Moses, and Schlegel are registered Professional Engineers. Professors Grant, Landers, and Pulat are IIE Fellows. IE Professors have received numerous teaching awards. They are known for their collegiality, scholarly and professional activities.

Service and Professional Development

Student advising is done by the IE faculty. Generally, junior faculty members are given less service load than other faculty members. Each year a group of faculty members are assigned by the Director to serve either on the undergraduate or graduate committee. They are then responsible from studying and streamlining the respective IE programs and advise students in that program. The chair of the graduate committee is the graduate liaison. Once an undergraduate student is assigned to a faculty member, every effort is made to keep his/her advisor the same until the student graduates from the program. Faculty members also serve on subject area committees. They strongly encourage student professional development through participation in student organizations, interaction with professionals, and also by serving as role models. The School of IE faculty sponsors one honor society (Alpha Pi Mu), five student organizations (Institute of Industrial Engineers, Human Factors and Ergonomics Society, Institute of Operations Research and Management Science, Society of Manufacturing Engineers, National Society of Black Engineers (CoE level)) and the Graduate Student Association. The IE faculty have also sponsored Society of Women Engineers (CoE level), Tau Beta Pi (CoE level), and the Engineers' Club (CoE Level) in the past years. A substantial number of IE faculty have significant professional experience, which allows them to bring professional issues to the students' attention. IE faculty members have also been the leaders in "Lean Training" at Tinker Air Force Base. They bring their experiences from Tinker into the classroom. Appendix IA, Table 4 lists and assesses each of the faculty based on their years of experience, professional registration, and level of research, service, and professional activities.

Size

The size of IE faculty is sufficient to the undergraduate enrollment, but not adequate to achieve national recognition as a top-quartile program. In Fall 2004, the IE School had 11 faculty and 124 undergraduate students (full-time and part-time), which brings the student/faculty ratio to 11:1. Through active recruitment and several degree options, the School has increased its undergraduate enrollment from 80 (full time and part-time) in fall 1999 to 124 in fall 2004. The School's goal is to reach 150 students by 2009. With the addition of two new faculty members in fall 2005, the size of IE faculty will be increased by 30 percent since the last accreditation visit in 1999. However, we believe that any academic unit should have a minimum of 15 faculty members to provide depth and breadth in both undergraduate and graduate curricula. Therefore, our goal is to increase the faculty size to 15 and student size to 150 by 2009.

Workload

The average teaching load for an IE faculty is three courses per year provided that the faculty member has significant research activity. The three-course teaching load is considered as 45 percent of the faculty member's total workload. A typical faculty member distributes the workload as 45 percent teaching, 45 percent research, and 10 percent service. The loading model permits a faculty member to reduce the teaching load by one course by generating external funding equivalent to 1/3 of their 9-month salary, upon approval of the Director of the School. The course release is not approved unless a qualified instructor is identified for the course. Junior faculty are assigned a two-course per year teaching load for the first year of employment in order to allow adequate time to develop his/her research program. Thesis and dissertation supervision are counted towards the teaching load, whereas, the publications resulting from this effort are counted towards research productivity. Faculty members without sufficient research activity can be required to teach up to four courses per semester.

Research and scholarly activity consist of externally funded research leading to archival journal publications and refereed conference proceedings articles. Faculty members are also encouraged to devote a portion of their creative activity to technology transfer, such as patentable design and licensable software development. They are also encouraged to establish research centers of excellence. IE faculty either lead or are active in several research centers: Electromagnetic Compatibility Center (EMC); Center for Engineering Logistics and Distribution (CELDi), Oklahoma Transportation Center (OTC), Center for Aging Systems Infrastructure (CASI), Center for the Study of Human Operator Performance (C-SHOP), K-20 Center for Educational and Community Renewal (K20 Center), and Human Technology Integration Center (HTIC).

Faculty members participate in numerous committees at the School, College, and the University level. They are also expected to have an active role in professional organizations. Several of IE faculty members are on editorial boards of a number of archival journals. Some also hold organizational positions at the national level. IE faculty also lead or participate in organizing professional conferences. They serve on review panels, review articles for publications, and participate in several professional activities at the national and international levels.

Appendix IA, Table 3 summarizes recent workloads of IE faculty. Curriculum vitae of each faculty member can be found in Appendix IC.

6. Facilities

Overview

The School of IE facilities are located mostly in Carson Engineering Center (CEC). Some faculty members have labs and offices at the Sarkeys Energy Center (Dr. Grant) Stephenson Center for Research and Technology (Dr. Trafalis), Research Institute for STEM Cross Education – RISE (Drs. Rhoads and Shehab), and OU Research Partners Building on Marshall Avenue (Dr. Schlegel). The School has experienced growth in faculty size, research funding, and research center development. However, additional space in CEC is scarce and hinders the growth of the School in one contiguous space. Two new engineering buildings with the scheduled groundbreaking in January 2006 will significantly resolve space problems in CEC. The space vacated by the Electrical and Computer Engineering will be allocated mainly. to two schools: Industrial Engineering and Civil Engineering and Environmental Science. At the current time, one faculty member moved his office and laboratory in order to allocate office space for one of the two new faculty members. A graduate student office will be converted to a faculty office in order to create space for the second faculty member. Both new faculty members have not been given any lab space. The School does not have a meeting room. The IE team room in CEC 116 can accommodate only six people and cannot be used for most of the IE functions. This creates constant pressure for the School. The School reserves meeting rooms of other units in the College or at the University to hold its meetings. Frequently, last minutes reassignments have to be made since IE does not have priority over the rooms occupied by those units. In order to sustain growth and educational excellence, additional space has to be allocated to the IE School.

The IE curriculum has varying course and lab requirements. Most IE classes and lab sessions are held in CEC. However, classes with large enrollments are often scheduled in larger classrooms across campus. The computing facilities in the college are adequate for instructional purposes. The School shares feedback from student exit interviews with the Engineering Computing Services (IT/ECS) in charge of computing facilities for the College. IT/ECS provides tech support, security and virus monitoring, software support, as well instructional and research support for students, faculty, and staff.

Modern Engineering Tools
Engineering students are required to have laptop computers for use in classroom and laboratory settings. IT/ECS offers leasing services to students, faculty, and staff. The IE School also has three laptop computers, three LCD projectors, two digital cameras, VCR, and a TV for student, faculty, and staff check-out. Some IE classes are scheduled in multimedia classrooms (CEC 119, CEC 121, and CEC 438). The CoE has recently renovated two classrooms (CEC 119 and CEC 121) to allow multimedia presentations in courses requiring multimedia usage. The CoE plans to renovate CEC 117 and CEC 123. Other lab facilities used by the undergraduate IE courses are the Instructional Computing lab (CEC 215F), Production Logistics lab (CEC 215C), Ergonomics labs (CEC 26, CEC 27, CEC 28, CEC 42, and CEC 217), and occasionally the Team Design lab (CEC S23) and Manufacturing labs (CEC S15, CEC 33). The undergraduate manufacturing experiences are contracted out to the Moore-Norman Technology Center, a vocational-technical institution located approximately seven miles from the Norman campus. This approach is innovative and highly effective. It provides modern, fully functional, and safely supervised learning experiences for the students in manufacturing courses. Furthermore, it is highly beneficial for industrial engineering students to interact with shop floor personnel and obtain first hand experience in technical skills acquired by trade school students.

IE students use several software tools in the undergraduate Industrial Engineering curriculum. These tools include MS Office tools (Word, PowerPoint, Excel), engineering drawing and graphical design software (AutoCAD, Visio), statistical software (SAS, Minitab, Excel), optimization software (LINDO, EXPRESS), simulation software (ARENA, SLAM), and facility layout software (VIP-PLANOPT). They also learn JAVA programming language in CS 1323. IE 4113, teaches them Visual Basic applications for Excel.

The various facilities and equipment used by IE undergraduate students are described below.

Production Logistics Lab, **CEC 215C**: The lab is used for both education and research purposes. Besides using the standard computer hardware and software housed in the lab, students have access to supply chain management software marketed by i2 Technologies. The market value of the software is more than $500K. Most of the research performed in the lab is concerned with developing scalable due-date promising models for make-to-order environments.
Courses: IE 4333, 5323

Instructional Computation Lab, CEC 215 F: This lab contains nine PCs and a printer for IE students. The lab is mostly used by seniors and graduate students.
Course: IE 4333, 4393

Physical Performance Lab, CEC 26: The lab is used for undergraduate and graduate teaching and research. It supports anthropometric and human strength measurement as related to industrial ergonomics and product design. Various equipment contained include a computer-based system for collecting various strength measurement data, as well as the necessary hardware (e.g., strain gauges, analog-to-digital converters, and posture support mechanisms) to aid such data collection; apparatus to enable manual-material handling studies; and a complete anthropometric measurement set. A Pentium-level computer equipped with the Statistical Analysis System (SAS) is also available for students to use for data analysis.
Courses: IE 4824, 4853, and 5843 (elective)

Motion Analysis Lab, CEC 27, Used for undergraduate and graduate teaching and research, this lab houses a video-based motion analysis system, consisting of video cameras (with tripods and lights) a video-mixer board, and necessary computer system and software to support data collection and analysis. This lab adjoins the Physical Performance Lab through a set of double doors to provide additional space to accommodate the requirements of videotaping human motion. This lab also has a computer system to support students in data collection, analysis, and computer interface development for evaluation of distance education and collaborative research. The system is equipped with a video camera for distance education and collaborative research. It also houses a video-based data collection system consisting of VCRs, an SMTP time code video collection board, and a television. In addition, a variety of computer-based cognitive performance and workload assessment software are available for student projects.
Courses: IE 5843 (elective)

Environmental Work Physiology Lab, CEC 42, The major equipment in this lab is the environmental chamber that provides control of the physical thermal environment (temperature and humidity). This chamber is used to simulate a variety of working conditions for various course lab exercises and research experiments. Also housed in this lab is a variety of basic equipment for the measurement of physiological variables (heart rate, blood pressure, body temperature), environmental variables (sound, vibration, light, temperature, and humidity), metabolic workloads (a programmable treadmill, and a programmable cycle ergometer), and psychomotor performance (reaction time, manual dexterity, eye-hand coordination, and tracking).
Courses: IE 4824, 5843 (elective)

Human Technology Integration Lab, **CEC 217**, This recently renovated lab houses networked computers and workstations to do research and applications in electronic learning human computer interaction. Active graduate research topics include the role of visual impairment in interface design, and stress and situation awareness. In an expanded scope, the lab is also used to promote collaborative interdisciplinary research into understanding the role that technology plays in modern society. The interdisciplinary development of web-based learning tools (electronic books, brochures, etc.) has been a significant component of the research in this lab. This lab recently served as the "headquarters" for a 6-year NSF REU program targeting multidisciplinary students interested in human technology interaction.

Machining and Precision Lab I, CEC S15, Manufacturing process equipment housed in this lab, for teaching and research purposes, include a research engine lathe for friction and wear studies, a 3-axis CNC milling machine, a CNC 3-axis miniature milling machine, 3 coordinate measurement machines (1 CNC and 2 manual), an optical projector, a micro-computer based data acquisition system (including piezoelectric tool force dynamometer with amplifiers), a high-resolution data acquisition system with card/box for isothermal compensation (cold junction), amplification, linearization, calibration, and A/D conversion, and acoustic emission measurement equipment.
Courses: IE 3304, 5303, 5313

Precision Engineering Lab II, **CEC 33**, Used both for undergraduate and graduate teaching and research in manufacturing engineering, the equipment in this lab include a complete machine vision system (with analog framegrabber, processing monitors, a Pentium-based PC workstation, and vision software), optical measurement accessories (lenses, linear and circular stages, laser light source), tool-maker's microscope, a contact surface roughness profilometer, ultrasonic pulser/receiver, oscilloscope, an industrial SCARA robot, and a precision lathe modified for specimen rotation in roughness measurement experiments. Several Pentium-based computers are also available. Software available includes MasterCAM, CAM software.
Courses: IE 3304, 5303, 5313

Team Environment for Automated/Multi-media (TEAM) Design Lab, **CEC S23,** This lab is currently used primarily by students completing the capstone Senior Design course, although the long-term plan is to allow students to utilize the lab for any of the courses involved in the coordinated design sequence. The lab currently features Gateway ES4200 workstations equipped with AutoCAD, an HP 600 plotter, an HP LaserJet printer, and a blueprint machine.
Courses: IE 2823, IE 4393 (occasionally)

CoE Instructional Computer Lab, CEC 205-206, This lab houses 60 PCs, 6 laser printers, and instructional resources (ELMO, LCD Projector, and a marker board). The lab is used by IE 2823, Enterprise Engineering and IE 4663, Systems Analysis Using Simulation. The lab is also used by undergraduates to solve course assignments.

In addition to the above labs, the School houses several research labs for optimization, data mining, advanced systems modeling, quality engineering, and simulation. Undergraduate research assistants work in these labs on externally funded research projects.
Course: IE 2823, IE 4663

7. Institutional Support and Financial Resources

Budget Process

The School of IE is allocated an annual budget from the State of Oklahoma to cover faculty, staff, and graduate assistant salaries and wages, maintenance and operations (M&O). The M&O budget of $31.5K barely covers communication, contractual obligations, supplies, and computing needs for staff. The School also receives approximately $20K from technology fees, $3.5K as course fees and $5K as teaching incentive. The technology fees are used to upgrade instructional laboratories and purchase equipment and software required for instructional purposes. The course fees partially cover Moore-Norman Technology Center contractual expenses and expandable supplies for other courses. Teaching incentives are often used to compensate expenses not covered by the course fees and as a supplement to the M&O budget. The budget lacks resources for professional development of faculty, staff, and students. The School of IE must raise funds through externally funded research grants and alumni/corporation gifts to cover these expenses. There is also very little support in terms of start-up funds for new faculty. The university will cover ¼ of the equipment expenses. Faculty positions remain open for at least a year to accumulate start-up funds for the new faculty members.

The state allocation covers only 40% of the IE School's expenses. The remaining portion of the expenses is covered by funds generated by (i) externally funded research grants and (ii) alumni/corporation gifts. Alumni gifts are generally used for variety of activities including scholarships for undergraduate students, student enrichment activities such as picnics, student travel to conferences, banquets, student awards, chapter meeting expenses, expenses related to activities for alumni and the IEAB (meetings, receptions, gifts). The School charges $2500 per capstone project to profit organizations out of which capstone related expenses are reimbursed and faculty sponsors are allocated $500 of discretionary funds per project. The remaining funds (about $20K) are used for scholarships to 25 undergraduate students (mostly incoming students, freshman, and sophomores).

The level of externally funded research activity is critical to the professional development of faculty members, maintenance of laboratories, providing start-up funds for new faculty and funding student recruitment activities, compensating student support for School's operations such as student recruitment activities, web-page development and maintenance, and assessment related activities. Currently, the School has committed $80K to the two new faculty members, Professors Guan and Ling. The School also sponsors two student recruiters throughout the year whose primary job responsibilities are: (i) visits to high schools, (ii) participation in recruitment activities arranged by the College and the University, (iii) providing campus tours for prospective IE students, and (iv) promoting IE among undecided engineering students. The externally funded research grants provide the following additional resources to the School: (1) Research expenditures from grants and contracts, (2) Faculty Salary Release funds (FSR), (3) Strategic Research Incentive funds (SRI), and (4) Research Facilities Support funds (RFS). In 2003-2004 research expenditures in IE were in excess of $1.7 million. These funds are used to provide faculty salary support (academic and/or summer), graduate teaching and research assistant salaries, travel, major research equipment, and other direct costs such as supplies, publication and printing costs related to the project. Academic salary compensation through research grants and contracts allow faculty to release a portion of state salaries (FSR) for a reduced teaching load which will allow them to concentrate on requirements of the contracted research. Most FSR funds are used to support adjunct professors. In order to initiate strategic research growth in academic units, the university returns a portion of the overhead charges to the respective Schools. The University currently charges 48% of indirect cost on research grants and contracts. The CoE keeps 2 percent of the 20 percent returned to the College (SRI funds) and returns 18% to the academic units performing the research. The School of IE keeps 50% of the funds and returns the remaining to the faculty members performing the research. In 2003-2004, IE's SRI funds were approximately $66K of which $33K was kept by the School. The remaining $33K returned to faculty is used as discretionary monies by the faculty. The IE School also received $22K from the Vice President for Research as FSR funds. These funds are mainly used to partially support the research infrastructure (maintenance, outsourcing technician activities, etc) within the School.

Adequacy of Institutional Support

IE faculty salaries are below the Big 12 averages even though IE's graduate program is ranked 3rd among all Big 12 IE schools. Only Texas A&M and Iowa State IE graduate programs are ranked above ours. The School has recruited outstanding junior faculty members in the last three years but faces retention problems due to OU salary increases falling short of Big 12 and national averages.

Rank	OU Average Salary	Big 12/Big 10 Average Salary	Ratio OU/Peer
Professor	94,860	115,977	0.82
Associate Professor	68,517	81,915	0.84
Assistant Professor	68,040	73,303	0.93
All Ranks	82,755	98,146	0.84

Institutional support covers minimum operating expenses for the School. Staff support in the school is not sufficient. This is a hindrance to the School's growth since the Director must often prioritize activities and postpone tasks which are forward looking in order to provide quality service to the School's constituents. These forward looking events include preparation of annual reports, professionally constructed newsletters, brochures, and aggressive recruitment and retention activities. The School has also experienced significant growth in the last six years. The number of IE faculty has increased from 10 to 13, undergraduate student enrollment has almost doubled, new degree options are offered, and research expenditures have more than doubled. The number of staff has remained the same. The IE School critically needs an additional staff member in order to continue to provide excellent support services to its constituents and to allow growth activities for the School.

Since the IE school is one of the most recently founded disciplines in the CoE, the size, nature, and the number of gifts and endowments to the School are not significant. Hence, IE lacks major funds for endowed chairs and professorships, graduate student fellowships, major office renovations, and development of new state-of-the-art instructional labs.

The School's budget for graduate teaching assistants (GTA) allows approximately 7-8 GTAs funded 50% FTE per semester to cover all courses taught by the IE School each semester. The courses with lab sessions and courses with enrollment in excess of 30 students have the priority over others for GTA assignments.

Adequacy of Faculty Professional Development

The IE portion of the state budget does not have adequate funds to cover faculty travel to professional conferences, registration costs for any workshops or, in general, any professional development activities. To maintain professional development and to continue to deliver nationally-recognized programs, the School needs at least $20K per year travel budget. This will allow approximately $3000 travel expenses for un-tenured and $1500 for tenured faculty. As noted above, the School supports its travel expenses from funds generated by externally funded research grants and contracts.

There are a number of professional development activities offered by the Office of Vice President for Research and by the Instructional Development Program (IDP) within the University. IE faculty often make use of such services.

Purchase, Maintenance, and Operations of Facilities and Equipment

Teaching laboratories are maintained by the technology fees managed by IT/ECS. At the end of spring semester, the Schools submit a budget for instructional needs which is evaluated by the CoE and IT/ECS. In the past IT/ECS has funded the majority of the instructional development budget requests by the IE School. These monies were instrumental in meeting the computing hardware and software needs of the School and must continue in the future. Research laboratories are maintained by the RFS funds. Faculty members are asked to submit proposals to government agencies for major instrumentation needs. The School relies on ad-hoc external funding sources for purchase, maintenance, and calibration of equipment. Since the IE School does not have a technician, most of the technician work needed is contracted out to technicians in other Schools. Although the department is charged excessive amounts for the contracted work, the level of activity does not justify hiring a full-time technician. The School can, however, use a ½ time technician to purchase, maintain, and build equipment and parts necessary for student projects and faculty research.

Support Services

The CoE has its own library. There is also a main library for the university system. The library staff provides sufficient services to students and faculty. The acquisitions are somewhat adequate for undergraduate program, but marginal to support graduate program. Inadequate funds are available for new acquisitions of technical journals. The library has adequate on-line services for electronic books and journals. Computer facilities are adequate for undergraduate students. Students need study lounges equipped with PCs, printers, software and furniture that will allow group discussions. See

Appendix II, Section 6 for more information on the library and computing services, Williams Student Services Center, and the OU Career Services. Appendix IA Table 5 reports the School's expenditures in the last five years.

8. Program Criteria

As shown by the degree sheets in Appendix IA Tables I-1.1 and I-1.2 (old curriculum) and Tables I-1.3- I-1.5 (current curriculum), the IE curriculum provides a broad knowledge of fundamental principles of math, science, and engineering with the basic math, science, and engineering courses with course abbreviations MATH, PHYS, CHEM, and ENGR (Program Educational Objective #1). IE courses (IE), collectively provide a broad knowledge of the analytical, computational, and experimental principles, methods, and tools fundamental to the contemporary professional practice of industrial engineering (Program Educational Objective #2). Students experience a unique design and manufacturing course experience in IE 3304 by designing and manufacturing a part at the Moore-Norman Technology Center under guidance of a skilled technician at the center. IE 4623, 4663, IE 4563, Quality Engineering, IE 4853, Research Techniques in IE, and IE 4393, Capstone Design Experience provide students experiences with designing and improving integrated systems of people, technologies, material, information, equipment, and energy (Program Education Objective #3). In IE 4623, the students learn mathematical models that one can use to improve systems under scarce resources of material, workforce, equipment, and money. In IE 4663, they learn how to create a computer model of a system using ARENA. Students use ARENA to analyze the system and make improvement on the computer model. IE 4563 course incorporates student projects to illustrate application of statistical quality control techniques for system performance monitoring and measurement. In addition, IE 4363, Material Handling, Facility Layout, and Warehousing course taken by a majority of the undergraduate seniors as an IE elective also offers three case studies/projects focusing on design and improvement of integrated systems. This course is a required course in the current curriculum (Table I-1.3-1.5).

IE 4853, the capstone research experience, is critical to the School of IE's strategy to prepare graduating students for design of experiments, empirical analysis, and life-long learning. The capstone research experience course also contains significant design component, associated with an open-ended team project involving design of an experiment, human subject testing, construction and instrumentation of apparatus, collection, analysis, and interpretation of experimental data and results. The students also learn guidelines for human subject testing which covers ethics in a research setting. The course also teaches technical report writing and discusses the importance of life-long learning. IE 4393, the capstone design course, assigns student teams of two to a company to solve a real-life problem under the guidance of a company and faculty supervisor. A list of projects in fall 2004 and spring 2005 is provided as Attachment I.9. Company survey results provide excellent feedback to the School in assessing the graduating seniors' ability to solve real-life problems. Hence, IE curriculum provides students with experience in designing and improving integrated systems of people, technologies, material, information, equipment, and energy (Program Education Objective #3).

Several IE courses require term projects where students work individually or in teams to apply the fundamental principles and concepts to hypothetical or real-world problems (IE 3304, 4363, 4393, 4563, 4853, 4824). Courses in simulation, manufacturing, and ergonomics also have lab sessions. Through laboratory and term project requirements students gain diverse experience in team-based problem solving, communication, professionalism, and ethical practice (Program Educational Objective #4).

Professional issues and other non-traditional topics are addressed in all design projects. The capstone research and capstone design courses address issues of professional practice such as professional registration, ethics, life-long learning, global and societal implications of engineering problem-solving (Program Objectives #5). Social Science courses and humanities electives also exhibit an understanding of the impact of societal and cultural issues around the globe and their effects on everyday life. Ethics case studies are also covered in IE 2823. The content of each course is summarized on the course syllabi in Appendix IB.

Attachments I.11-I.14 provide information on different degree sheets, accompanying flowcharts, approved IE, technical, and general education electives.

REFERENCES

1. *2004-2005 Special Faculty Salary Survey*, Office of Institutional Research, Oklahoma State University

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TABLE 1. Program Education Objectives

PROGRAM OBJECTIVE #1

Graduates are prepared for the contemporary practice of general engineering with a broad knowledge of principles of mathematics, sc

Strategies and Actions	Outcomes	ABET 2000 Criterion 3 (CoE Strategy)	Candidate Assessment Methods	Candidate Assessment Metrics	Prelir Stanc *W*	
All	Teaching excellence	a,b,c,d,e,i,k (1)	Course evaluations	Mapping of (a-k) to course evaluations	90% of respo positive (ove *WSSC to Asses*	
1.1 Provide a solid **math and science**-based curriculum that provides the necessary knowledge in fundamental concepts (MATH 1823, 2423, 2433, 2443, CHEM 1315, PHYS 2514, 2524; Note: IE4824 introduces basic physiology)	Ability to apply scientific and mathematical knowledge to formulate and solve problems in higher-level contexts.	a (1)	Achievement of CoE entrance standards Performance in ENGR courses Demonstration of professional competency	Percent of entering Freshmen IE students passing (C or better) basic math and science courses in first attempt Percentage of IE students mastering (B or better) application of math/science in key engineering science courses (ENGR 2113, 2313, 3293, 4223) FE exam results on Math, Chemistry battery	80%* passing *From WSSC to Liaison* 50%* **From WSSC t Liaison** 3-year average norms overall a *Senior Design*	
1.2 Provide a curriculum based on **engineering sciences** (ENGR 2113, 2153, 2213, 2313, 2613, 3293, 4223; replaced by CE 2113, CE 2153, ENGR 2431, ENGR 2461, and ENGR 3441)	Ability to function on multidisciplinary engineering teams Demonstrated skills in engineering fundamentals	a,b,c,d,e,i,k (1)	Performance in ENGR courses Performance in IE 3304 and IE 4553 Demonstration of Professional Competency	Percentage of IE students mastering (B or better) in E1112 and E3293 Percent of IE students receiving B or better in IE 3304 and IE 3293 FE exam results in general and on Computers, Dynamics, Electrical Circuits, Engineering Economy, Engineering Statistics, Material Science, Mechanics of Materials, Statics, Thermo battery	70% of respon **WSSC to Asse Liaison** 70% of respon **WSSC to Asse Liaison** 3-year average norms on batte *Senior Design*	

TABLE 1. Program Education Objectives

PROGRAM OBJECTIVE #2

Graduates are prepared for the contemporary professional practice of industrial engineering with a broad knowledge of the analytical principles, methods and tools.

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Strategies and Actions	Outcomes	ABET 2000 Criterion 3 (CoE Strategies)	Candidate Assessment Methods	Candidate Assessment Metrics	Prelim Stand *Wl*	
All	Teaching excellence	a,b,c,e,f,g,h,I,j,k (1)	Course evaluations	Mapping of (a-k) to IE course evaluations	Good to accepta outcome mappi (a-k) to the IE c *WSSC to Assess*	
2.1 Provide foundations and practical experience in **Operations Research** principles, methods and tools (Required: ENGR 3293, IE 2823, 4333, 4563, 4623, 4633, 4663)	Understanding of principles, methods, and tools of modeling, optimization, engineering statistics, quality, simulation, and decision analysis Competence in the use of OR and statistical analysis tools (e.g., LINDO, Excel, SLAM, ARENA) Ability to apply principles, methods and tools to problems such as facility location, inventory allocation, and queuing	a,b,c,e,i,k (1,2)	Course performance Student surveys Project and lab reports in IE 4333 and IE 4563 Demonstration of professional competency	Percentage of students making C or better Exit interview survey results Project or lab report grades FE exam results in general and on Computer Computation and Modeling, Math/Optimization Modeling, Queuing, Simulation battery	90%* of student or better grade *Course data she* 90% of the resp positive **IE Director** 70%* of grades *Course data she* Three-year aver or better than 3- pass rate averag on battery *Senior Design C*	
2.2 Provide foundations and practical experience in **Manufac. Engineering** principles, methods and tools (Required: IE 2303, 3304; and IE 2311 effective Spring 2006)	Understanding of principles, methods, and tools of design and drafting, tolerancing and metrology, tooling, and processing (fabrication and assembly) Competence in the use of manufacturing tools including drafting instruments, PC-based CAD, measurement instruments, and machine tools. Ability to apply principles, methods, and tools to problems such as product design and process planning	a,c,e,f,g,h,i,j,k (1,2)	Course performance Student surveys Student surveys Demonstration of professional competency	Percentage of students making C or better Exit interview survey results Exit interview survey results FE exam results in general and Manufacturing Processes, Systems, and Design battery	100%* **IE Director an** 90% of respons *IE Director* 90% of respons *IE Director* Three-year aver or better than 3- pass rate averag on battery *Senior Design C*	

TABLE 1. Program Education Objectives

PROGRAM OBJECTIVE #2 (cont.)

Graduates are prepared for the contemporary professional practice of industrial engineering with a broad knowledge of the analytical principles, methods and tools.

Strategies and Actions	Outcomes	ABET 2000 Criterion 3 (CoE Strategies)	Candidate Assessment Methods	Candidate Assessment Metrics	Preli Star \	
2.3 Provide foundations and practical experience in Physical and Cognitive **Ergonomics/Human Factors** Engineering and experimental design principles, methods and tools (Required: IE 4553, 4824, 4853)	Understanding of principles, methods, and tools of anthropometry; work measurement; human performance; human-machine interface design; workplace, task, display, and tool design; industrial safety and health standards Competence in the use of experimental design principles, methods, and tools (e.g., Excel, SAS) for data analysis as applied to engineering problems Ability to apply principles, methods, and tools to problems such as experimental analysis of fieldwork projects, NIOSH and OSHA standards, and job severity index surveys	a,b,e,f,g,h,i.j.k (1,2)	Course performance Student surveys Project and lab reports in 4824 and 4853 Demonstration of professional competency	Percentage of students making C or better Exit survey results Project or lab report grades FE exam results in general and Industrial Ergonomics and Industrial Design of Experiments battery	90% of the **Course da** 90% of the positive *IE Directo* 70%* of gr better *Course dat* Three-year rate at or b year nation average ov battery *Senior Des Coordinat*	
2.4 Provide opportunities for degree options in **Information Technology and Pre-Medicine** as well as electives in **Engineering Management.** (Required courses to minor in CS and for Pre-Med program, Electives: IE 5713, 5743, and 5753)	Competence in computer science subjects for IT applications Competence in the Pre-Medicine fields required to pursue a career in medicine Ability to apply principles, methods, and tools to management case studies	f,g,h,i,j,k (2,3)	Performance in the required CS courses for the IT option Performance in the courses required by Pre-Medicine Performance in courses IE 5713, IE 5743, and IE 5753	Percentage of IE-IT students making B or better in CS courses Percentage of IE students with B or better grades in pre-medicine courses Percentage of IE undergraduate students with B or better grades in the engineering management courses	70% of the students **Grade she** 70% of the students *Grade shee* 70% of the undergradu 5713, 5743	

TABLE 1. Program Education Objectives

PROGRAM OBJECTIVE #3

Graduates are prepared for enterprise level system improvements with the knowledge and skills needed to design, analyze, and impr technologies, material, information, equipment and energy.

Strategies and Actions	Outcomes	ABET 2000 Criterion 3 (CoE Strategies)	Candidate Assessment Methods	Candidate Assessment Metrics	Prelir Stan W	
All	Teaching excellence	All a-k (1,3)	Course evaluations	Mapping of (a-k) to course evaluations	90% of resp positive for 4853 *WSSC to Ass Liaison*	
3.1 Coordinated Projects: Successively coordinated projects that span multiple courses integrating principles and methods of Industrial Engineering (Required 4563, 4853)	Ability to assimilate a broad knowledge base in order to take an integrated systems-approach to defining and solving problems Ability to demonstrate effective project management and participation, including, planning, allocation and coordination of tasks, providing quality deliverables at milestone dates	e,h,i,j,k (1,2)	Grade on project deliverables Demonstration of professional competency	Instructor grade FE Exam results in general and Facility Design and Location, Material Handling Systems Design, Production Planning and Scheduling, and Statistical Quality Control battery	70%* of pro or better *Course data* Three-year a rate at or abo national thre average on b *Senior Desig Coordinator*	
3.2 Industrial Partnership: Industrial partnership program teaming students, practicing engineers, and faculty to solve real engineering problems. (Required: Capstone design experience – IE 4393)	Experience in evaluating, designing, and improving integrated systems. Demonstrated capability to function in a work environment, with open-ended problems. Experience working with industrial engineers.	All a-k (1,2)	Evaluations of project work, reports, and presentations, company feedback	Course grades	70%* of gra better *Course data*	
3.3 Empirical Research Experience: Solution of engineering problems through empirical research involving problem formulation, experimental design, data collection, analysis, and interpretation. (Required: 4393 - Capstone research experience – and IE 4853)	Demonstrated understanding of the scientific method. Ability to recognize relevant research issues.	b,e,f,i (2)	Grade on project deliverables	Instructor grade for project in IE 4853	70%* of gra better *Course data*	

TABLE 1. Program Education Objectives

PROGRAM OBJECTIVE #4

Graduates are prepared to contribute to organizational success with the knowledge and skills needed for team-based problem solvin professionalism, and ethical practice.

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Strategies and Actions	Outcomes	ABET 2000 Criterion 3/ (CoE Strategies)	Candidate Assessment Methods	Candidate Assessment Metrics	Prelimin Standar *Who*	
All	Teaching excellence	d,e,f,g (1,3)	Annual evaluation	Course/faculty evaluations Exit interviews	Student Satisfact *IE Director*	
4.1 Group projects requiring professional interaction of team members to successfully accomplish goals (Required: 2303, 3304, 4393, 4563, 4824, and 4853, and 2311 effective spring 2006)	Demonstrated ability to function as a responsible team leader and team member. Ability to demonstrate effective project management and participation, including, planning, allocation and coordination of tasks, providing quality deliverables at milestone dates	d,e,g (1,2,3,4)	Distribution of individual and team work in courses Performance in Capstone Course	Percentage of team versus individual activity in IE courses Percent of students with B or better grade	20%* - 30%* tea *Course data shee* 80% with B or b *Capstone Instruc*	
4.2 Formal oral and written **communication** dispersed throughout the curriculum to communicate project deliverables (Required: ENGR 1112; IE 3304, 4393, 4563, 4824, 4853)	Demonstrated ability to communicate professionally and effectively in formal and informal settings	g (1,3,4)	Distribution of oral/written communications in courses Student surveys Course evaluations	Percentage IE courses with oral/written communications Exit interviews and student survey results Mapping of outcome g to course evaluations	60%* - 90%* *Course data shee* *90% of response positive IE Direc* *90% of response positive*	
4.3 Discussion and demonstration of professional **ethics** by faculty and practicing engineers; presentation of the Engineers' Professional Code of Ethics, and guidelines for the ethical use of human subjects (Required: (IE 2823, 4393, 4824, 4853; and ENGR 2003 effective fall 2005)	Internalized understanding, appreciation and practice of professional and ethical responsibility and conduct	f (1,2,3,4)	Presence of ethics concepts in IE curriculum Adherence to the human subjects research guidelines Demonstration of professional competency	Student performance in ethics assignments Course documentation FE exam results in general and Ethics battery	100% of students or better grade *Course data shee* Subject coverage one course *Course data shee* *Three-year avera rate at or above national three-ye average on batte Senior Design Co*	

TABLE 1. Program Education Objectives

PROGRAM OBJECTIVE #5

Graduates are prepared to be practicing engineers with the knowledge and skills needed to appreciate the global scope and contem engineering practice.

Strategies and Actions	Outcomes	ABET 2000 Criterion 3/ (CoE Strategies)	Candidate Assessment Methods	Candidate Assessment Metrics	Preli Stan V	
All	Teaching excellence	d,f,h,i,j,k (1,3)	Course evaluation	Mapping of (a-k) to course evaluations	90% of resp positive eval stated outco *WSSC to As Liaison*	
5.1 Prepare for professional practice through senior **capstone design** experience (Required: IE 4393) and taking of FE exam	Ability to pass FE exam Ability to address contemporary engineering issues and practices through industry-based project(s)	d,f (3)	Demonstration of professional competency Capstone course performance	FE exam results Percentage of Senior Design teams making B or better	Three year o rate at or ab national ave 100%* Senior Desi	
5.2 Expose students to **contemporary, global, and societal issues** of business related to engineering practice, including: analysis techniques, market and business issues, and business/technical writing (Required: IE 4333, 4393, 4824, 4853)	Ability to use contemporary tools of engineering in a business context Ability to integrate global and societal issues into engineering solutions	d,h,i,j,k (2,3)	Presence of literature search requirements on engineering related topics in IE courses Internship/co-op/study-abroad experiences of graduating students	Number of IE courses requiring literature search on topics related to engineering applications Percentage of IE students participating in internship, co-op, and study-abroad programs	At least thre *Course data* 60%* *Exit intervie*	
5.3 Provide a **global perspective** on societal issues by embedding the social sciences into the curriculum. The social science core at OU now requires and should continue to include both Western and Non-Western Civilization (PSC 1113, HIST 1483/1493, 2 Humanities electives)	Ability to integrate the social sciences principles into engineering solutions within a global societal context. Exhibit an understanding of the impact of social and cultural issues around the globe and their effects on engineering projects	f,h,j,k (3)	Course performance	Percentage of IE students making C or better on social sciences courses	80%* *WSSC to As Liaison*	