

B.2. Program Educational Objectives

In this section we discuss our program objectives and the processes and documentation demonstrating continuous improvement of the program. The major items discussed include:

- B.2.1. Departmental Organization
- B.2.2. Departmental, College Of Engineering And Institutional Missions
- B.2.3. Program Objectives And Consistency With Institutional Mission
- B.2.4. Program Constituencies
- B.2.5. Processes For Establishing And Reviewing Program Objectives
- B.2.6. Processes For Achieving Program Objectives
- B.2.7. Documentation To Demonstrate The Level Of Achievement Of Program Objectives And Changes Implemented In The Program

B.2.1. Departmental Organization

Overview

Since the last ABET visit six years ago, the Department of Chemical Engineering has undergone a major reorganization in governance and organization. Previously, the department had been organized in the traditional department head format where the majority of responsibility was focused in the department head who largely coordinated activities and distributed resources as necessary. In 2002 the department faculty voted to change to a more distributed form of governance characterized by shared decision making. In this new format the department chair and a three-person executive committee (EC) make decisions involving personnel, budget and other administrative matters. The major educational missions of the department (undergraduate and graduate education) were distributed to the Undergraduate Program Committee and a Graduate Program Committee (GPC) each chaired by a faculty member. In particular, accreditation and assessment matters fall under the office of the UPC Chair.

This distribution of departmental management and responsibilities has been very successful and effective in meeting the needs of the department. The details of this distribution of responsibility are found in the departmental bylaws which are available online at the following web link:

<http://www.eng.auburn.edu/department/che/chdeptbylaws.htm>

The next section discusses the function of the Undergraduate Program Committee with particular emphasis on assessment and accreditation activities.

Undergraduate Program Committee

The membership of the Undergraduate Program Committee consists of those faculty of the department who are active in undergraduate instruction, curriculum development, accreditation or other related areas.

The UPC's mission is to develop, implement and review educational policy for the undergraduate program of the department. When making significant changes in policy, recommendations are presented to the Department Chair who may bring the matter to the attention of the faculty for approval.

The UPC determines the content of undergraduate courses and the organization of those courses

to form an undergraduate curriculum including program specializations (so-called options).

The UPC is responsible for devising methods to measure the quality of the instructional program (course outcomes, program educational outcomes, etc.) and to insure the process of continuous improvement of the undergraduate courses and curricula. This area includes the coordination of accreditation activities and processes as well as interacting with and responding to our constituencies.

The UPC is also responsible for coordinating and managing curriculum related activities such as undergraduate advising, textbook selection and ordering, promotion of the program through web presence, university bulletins, catalogs and other publications. It also serves to coordinate the announcement and awarding of undergraduate scholarships, awards and grants.

The current chair of the Undergraduate Program Committee is Dr. Timothy D. Placek. There is broad faculty participation in the UPC with faculty serving as coordinators for activities such as E-Day, scholarship selection, etc.

Major areas of responsibility of the UPC include:

Oversight Activities

- Monitor the quality of academic programs and courses as needed to assure compliance with requirements of the Department of Chemical Engineering, the College of Engineering (COE), Auburn University (AU), and outside agencies.

Policy Activities

- Develop, implement and review educational policy for the undergraduate program of the department.

Accreditation Activities

- Coordinate discussions with constituencies to develop and periodically evaluate program missions, objectives, and educational outcomes.
- Construct assessment surveys and other instruments and administer the collection of assessment data. Analyze and interpret the data collected and disseminate as appropriate. Prepare reports necessary to achieve and maintain all accreditations.
- Collect and evaluate progression, retention, and graduation statistics.
- Maintain an archive of past and current course syllabi and other program guidelines as needed to insure consistency of course content and objectives.
- Recommend departmental standards in student grading and evaluation of student proficiency.
- Hold twice-annual faculty retreat meetings to discuss curricular and accreditation related matters.

Program Operation

- Coordinate “contact programs” such as high school recruiting and E-Day.

- Coordinate faculty teaching assignments in conjunction with the department chair including the collection of teaching preference data. In conjunction with the GPC, the Committee shall also coordinate GTA teaching and grading assignments.
- Establish undergraduate advisement and registration rules and regulations.
- Promote the undergraduate program through web presence, university bulletins, catalogs and other publications.
- Decide requests for exemption or substitution of degree requirements and course prerequisites.

Student Affairs

- Assist in the placement of students in careers or further educational endeavors following graduation.
- Nominate and present to the faculty the names of students to be awarded scholarships and other honors bestowed by the department.
- Facilitate the process of advising undergraduate students by providing supplementary written material as needed for students and advisors.
- Coordinate activities for undergraduate research, research scholarships, and the presentation of research at professional societies.

The majority of these activities are coordinated by the curriculum and accreditation planning and action committee (CAPAC).

Curriculum and Accreditation Planning and Action Committee (CAPAC)

This committee is made up of the UPC Chair, the Department Chair and those faculty selected by the Department Chair to actively pursue all major issues related to curriculum and accreditation planning and implementation. Members of this committee are expected to devote significant time and effort to their assignment. This committee meets (at least) weekly to consider issues related to the program operation, curriculum and accreditation.

Communications: Individual members of CAPAC interface with other members of the faculty to learn of their concerns on issues and matters currently being considered. Members of the faculty are invited to attend CAPAC meetings to directly speak to these issues. Via this mechanism, faculty introduce new items of business or discuss issues currently being considered by the committee.

Responsibilities and Duties: This committee is responsible for initially considering problems or issues related to the undergraduate program and, if necessary, coordinating and charging appropriate UPC members, standing or *ad hoc* committees to further study the matter. After receiving feedback or suggested action plans, the CAPAC committee will either develop appropriate policies or in the case of major issues, report the matter to the Department Chair for presentation to the faculty for consideration and approval.

This committee coordinates the major assessment related activities such as semiannual faculty retreats, interactions with constituencies, collection and interpretation of assessment data, and preparation of assessment documentation including departmental self-study reports.

This committee acts on recommendations for textbook selection from course committees and individual faculty.

CAPAC, in conjunction with the Department Chair, appoints, as necessary, members of the faculty to serve on *ad hoc* committees and assignments including course committees.

Course Committees – Table 2-1 lists the faculty membership of the standing course committees.

Table 2-1- Course Committee Assignments

Curriculum Area and Membership (Chair)	Courses
Progress Assessment (Placek), Gopal, Roberts	CHEN 2@@0 Progress Assessment I CHEN 3@@0 Progress Assessment II
Process Fundamentals (Duke), Guin, Neuman, Placek, Roberts	ENGR 1110 Introduction to Engineering CHEN 2100 Principles of Chemical Engineering CHEN 2610 Transport I CHEN 3620 Transport II
Thermo + ENGR2200 (Gupta), Maples, Roberts	ENGR2010 Thermodynamics ENGR2200 Introduction to Thermo, Fluids and Heat CHEN 3370 Phase and Reaction Equilibria
Lab Experience (Mills), Chambers, Duke, Roberts	CHEN 3820 Chemical Engineering Lab I CHEN 4860 Chemical Engineering Laboratory II
Advanced CHEN (Gupta), Lee, Placek	CHEN 3660 Chemical Engineering Separations CHEN 3700 Chemical Reaction Engineering CHEN 6700 Advanced Separation Processes
Programming, Modeling, Statistics (Placek), Eden, Elnashaie, Tarrer	CHEN 3600 Computer-Aided Chemical Engineering CHEN 3650 Chemical Engineering Analysis
Design and Practice (Eden), Chambers, Duke, Neuman, Placek	CHEN 4450 Process Economics CHEN 6651 Process Safety CHEN 6470 Process Design Practice CHEN 6460 Process Simulation Synthesis and Optimization CHEN 6650 Hazardous Matls Management and Engineering
Process Control (Tarrer), Eden, Elnashaie	CHEN 4160 Process Dynamics and Control CHEN 6170 Digital Process Control CHEN 6171 Adv Digital Process Control
Pulp and Paper (Gopal), Duke, Neuman	CHEN 3090 Pulp and Paper Technology CHEN 4100 Pulp and Paper Processing Laboratory CHEN 4560 Pulp and Paper Process Simulation CHEN 4570 Pulp and Paper Process Design CHEN 4880 Pulp and Paper Engineering Laboratory CHEN 6110 Pulp and Paper Engineering CHEN 6120 Surface and Colloid Science of Papermaking
Biotechnology Electives (Chambers), Byrne, Lee	CHEN 6800 Biochemical Engineering CHEN 6810 Biomedical Engineering CHEN 6820 Adv Topics in Environmental Biotechnology
General Technical Electives (Guin), Lee, Tatarchuk	CHEN 3410 Creativity and Critical Thinking in Engineering CHEN 6630 Introductory Transport Phenomena CHEN 6400 Molecular Engineering CHEN 6410 Macromolecular Engineering CHEN 6420 Polymer Chemical Engineering CHEN 6430 Business Aspect of Chemical Engineering CHEN 6440 Electrochemical Engineering
Honor's Electives (Chambers), Byrne, Roberts	CHEN 4900 Independent Study CHEN 4970 Special Topics in Chemical Engineering CHEN 4980 Undergraduate Research CHEN 4997 Honors Thesis CHEN 7900 Advanced Independent Study CHEN 6970 Adv Special Topics in Chemical Engineering

B.2.2. Departmental, College of Engineering and Institutional Missions

The faculty developed the following program mission statement through a series of interactions with industry, alumni, and students. A timeline outlining these interactions is provided in Table 2-2 (see Section B.2.4. Program Constituencies).

Department of Chemical Engineering Mission Statement

The Auburn University Department of Chemical Engineering prepares its undergraduate and graduate students, through high quality educational programs, to professionally and ethically practice engineering in a competitive global environment. We provide our chemical engineering graduates with the tools, skills and competencies necessary to understand and apply today's technologies and become leaders in developing and deploying tomorrow's technologies. The Department is expanding scientific and engineering knowledge through innovative research and creative partnerships involving academia, industry, and government. Further, we actively develop outreach activities to assist individuals and organizations to find solutions to engineering problems through education, consulting activities, and practical research.

Approved by CHEN Faculty: October 4, 2002

The chemical engineering mission emphasizes our specific contributions to the missions of the Samuel Ginn College of Engineering and Auburn University.

Samuel Ginn College of Engineering Mission Statement

Prepare our students, through high quality internationally recognized instructional programs, to practice engineering professionally and ethically in a competitive global environment. Expand scientific and engineering knowledge through innovative research and creative partnerships involving academia, industry, and government. Provide outreach programs to assist individuals and organizations to find solutions to engineering problems through education, technical assistance, and practical research.

Auburn University Mission Statement

Auburn University's mission is defined by its land-grant traditions of service and access. The University will serve the citizens of the State through its instructional, research and outreach programs and prepare Alabamians to respond successfully to the challenges of a global economy. The University will provide traditional and non-traditional students broad access to the institution's educational resources. In the delivery of educational programs on campus and beyond, the University will draw heavily upon the new instructional and outreach technologies available in the emerging information age.

The University will give highest priority for resource allocation to undergraduate education and for future development of those areas that represent the traditional strengths, quality, reputation, and uniqueness of the institution and that continue to effectively respond to the needs of students and other constituents. Consistent with this commitment, the University will emphasize high-quality undergraduate education including a comprehensive general education that imparts the broad knowledge, skills, and values so essential to educated and responsible citizens, as well as specialized career preparation for students. In establishing the primacy of undergraduate education to the institutional mission, the University will assure the continued strength of its

faculty with the realization that the quality of instruction is directly related to the quality of the University's faculty and the commitment of the faculty to excellence in undergraduate education. The University will provide graduate programs in areas of need and importance to the state and beyond. Graduate programs offer students opportunities for specialized advanced education in their chosen field and are important components of the services the University provides.

Because research is essential to the mission of a land-grant university, Auburn University will continue development of its research programs. The primary focus of this research will be directed to the solution of problems and the development of knowledge and technology important to the state and nation and to the quality of life of Alabama citizens. The University's research programs will make important contributions to instructional programs through the involvement of graduate and undergraduate students and the renewal of the faculty. Research will also provide the knowledge base for outreach programs. In carrying out its research mission, the University will emphasize established areas of strength and will focus available resources in those areas of research and doctoral study that are, or have the potential to develop into nationally and internationally recognized centers of excellence.

Extension and outreach programs are fundamental to the land-grant mission because these programs directly affect the lives of all citizens in the state. The University will maintain the strengths of its traditional outreach programs and will increasingly involve the broader University in outreach programs that respond to the changing needs of the society in which we live. The University will continue to seek new and innovative ways to reach out to the people it serves.

B.2.3. Program Objectives and Consistency with Institutional Mission

The Department has five program objectives to accomplish the undergraduate educational components (thrusts) of the missions of the Department, College of Engineering and Auburn University.

The chemical engineering program objectives (approved by CHEN Faculty: October 4, 2002) are:

1. Develop within our graduates the technical proficiency needed for the professional practice of chemical engineering
2. Develop within our graduates the ability to communicate effectively
3. Instill within our graduates a commitment towards lifelong scientific inquiry, learning and creativity
4. Foster within our graduates a commitment to protect the public interest, health, safety, and environment in the practice of the chemical engineering profession
5. Foster within our graduates an understanding of the need to maintain the highest ethical and professional standards

B.2.4. Program Constituencies

The constituency of the chemical engineering program includes the following:

Students (and their families) -- The students expect to become a technically competent, marketable, and productive engineer on completion of the program.

Faculty -- The faculty lead the students in the learning process and assumes the responsibility for the program educational outcomes relative to the program objectives.

Alumni -- The at-large alumni expect a continued high quality educational program at Auburn University as their reputation is reflected in the quality of their own education.

Alumni/Industry Advisory Council – This select and highly involved group of alumni (more than 25 members) expect a continued high quality educational program at Auburn as their reputation is reflected in the quality of their own education. These individuals have been highly successful and bring insight from a variety of industries and academia.

During the Fall 2002 and Spring 2003 meetings of the Alumni/Industry Advisory Council, the council defined a set of focus areas that include a mission to:

- Provide assistance to help the department reach and maintain its mission and goals,
- Provide a bridge for the department to the entities who employ their graduates,
- Create a network of Auburn chemical engineering alumni.

To address these focus areas the council established three subcommittees:

- Executive Committee, chaired by Tom Hendrick, CIBA Speciality Chemicals
- Academic Committee, chaired by Frank Magazine, Lubrizol
- Industrial Liaison Committee, chaired by Metric Houser, Weyerhaeuser
- Membership Committee, chaired by Jerry McGlammery, retired from TVA.

Specifically the mission of the academic committee of the council is to:

- Assist the department in defining and continually assessing the department's mission and long-term objectives.
- Assist the department in assessment of its progress towards meeting these objectives.
- Support the department activities toward continually maintaining its accreditation.

Industry/Employers -- This group expects graduates who are technically competent, productive, effective team members, are “computer capable”, have social and environmental awareness, and have good communication skills.

State of Alabama – Auburn University is a land grant university with an institutional emphasis on engineering, science, and technology and depends on support of the citizens of the state. The Mission statements of the University, College of Engineering, and Department recognize this consistency with its promise to provide a high quality education.

B.2.5. Processes For Establishing And Reviewing Program Objectives

In 1998 the College of Engineering established an EC2000 college-wide committee. The departmental representative to this committee was Chris Roberts. At these meetings initial planning for assessment-based program improvement was undertaken at the college level and subsequently departmental representatives were charged with developing department specific plans. Early efforts included the development of draft program objectives and educational outcomes as well as initial versions of assessment tools.

Concurrent with the EC2000 activities, the department undertook a process to prepare for our university's SACS accreditation. The Southern Association of Colleges and Schools (SACS) is the recognized regional accrediting body in the eleven U.S. southern states (Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas and Virginia.) As part of this process, our departmental objectives and outcomes were established and refined with the involvement of our constituents. Assessment of seven initial "program outcomes" was begun during the Spring 2000.

These efforts were later combined with the department's ABET efforts. The effort expended in these activities increased significantly in 2002 with the establishment of the Undergraduate Program Committee. This committee comprehensively reviewed the current program and established the necessary process to fulfill ABET's EC2000 criteria. Using the materials already prepared for SACS, the faculty involved coordinated discussions with alumni, industry and students to develop working documents for program objectives and program educational outcomes. These documents were later approved by the faculty at our faculty retreat in Fall 2002.

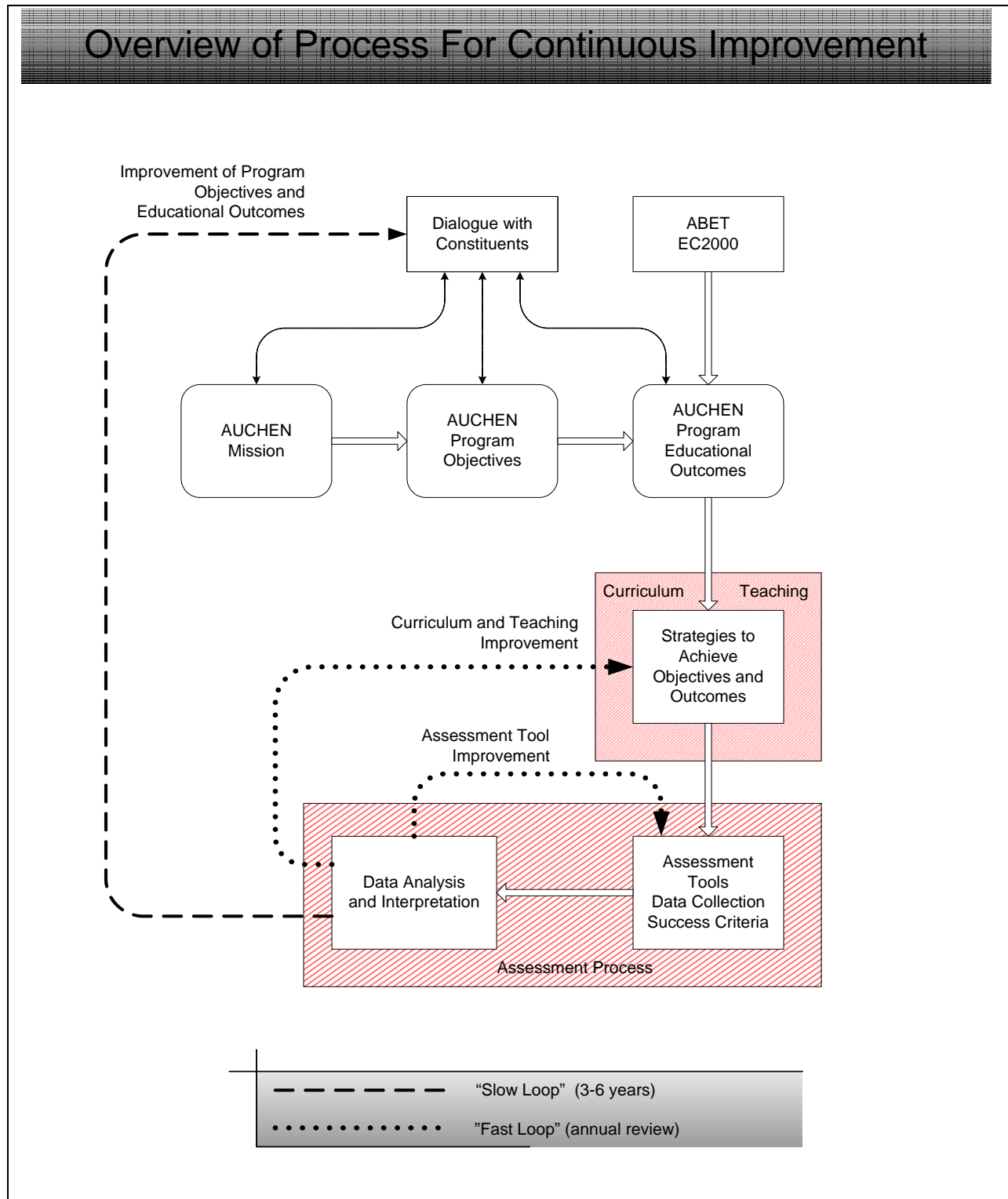
As part of this process, the department developed a process for continuous improvement which is characterized by the "two-loops" suggested by ABET. This process is illustrated in Figure 2-1.

The process employed to review our program education objectives and their appropriateness seeks to coordinate the discussions and interactions with our constituents to produce action plans that will continuously evolve and improve our program and curriculum. The major features of the process are the collection of assessment data, its analysis, and interpretation. This assessment data regarding appropriateness of our objectives are obtained through a series of alumni surveys, industry/employer surveys as well as discussions and working dialogues with our alumni/industry advisory committee and our graduating seniors during the in-person senior exit interview process.

The results from these assessment activities are brought forward to our various constituents in diverse ways such as faculty retreats, alumni/industry council meetings, consultation with individuals from industries that interview and hire our students, as well as formal and informal meetings with students, etc., for their reflections and comments. As indicated by the diagram, the communication of ideas is bi-directional. We seek the ideas and guidance of our constituents throughout the process. The appropriateness of our mission, program objectives and program educational outcomes as well as how to best incorporate these within our program and curriculum are discussed frequently with our constituents. We are particularly proud of the high-level of faculty participation in this process, both in the excellent attendance and involvement at the twice-annual faculty retreats and also in the assistance the faculty provide in Undergraduate Program Committee and the Curriculum and Accreditation Planning and Action Committee

activities.

Figure 2-1 Overview of Process For Continuous Improvement



A timeline for activities involving the consistencies is provided in Table 2-3.

Table 2-3 Timeline for Involvement of Constituency Groups in Establishment and Review of Mission, Objectives and Program Outcomes

Action Taken By	Constituency Involved	Issues Addressed	When
College of Engineering	Faculty	Establishment of College of Engineering EC2000 Committee. Initial departmental planning.	1998
Accreditation Committee	Faculty	Construction of draft objectives and mission statement	Fall 1999
Accreditation Committee	Alumni/Industry Advisory Council	Draft objectives and mission statement presented to alumni/industry advisory council for input	Fall 2000
Accreditation Committee	Faculty	Revised draft presented to faculty for input	Fall 2000
Accreditation Committee	University	Draft of program outcomes prepared for SACS accreditation	Fall 2000
Accreditation Committee	Alumni/Industry Advisory Council	Final draft of objectives and mission statement presented to alumni/industry advisory council for approval.	Spring 2001
Department Head and Accreditation Committee	Students	Objectives and mission statement presented for approval of graduating senior students.	Spring 2001
Accreditation Committee	Alumni/Industry Advisory Council	Draft of program outcomes presented to alumni/industry advisory council for input	Spring 2001
Accreditation Committee	University	SACS accreditation report using new outcomes prepared.	Fall 2001
Department Head	Faculty	Department Head makes announcement he will step down Spring 2003.	Fall 2001
Departmental Faculty	Faculty	Formation of Executive Committee, UPC, GPC. Approval of department bylaws.	Spring 2002
Executive Committee and Department Head	Students	Program outcomes presented for approval of graduating senior students. Conduct in-person interview of graduating seniors.	Spring 2002
Faculty Retreat I	Faculty	Approve of mission statement, objectives and program outcomes by faculty.	Fall 2002
Accreditation Committee	Alumni/Industry	Final draft of program outcomes presented to alumni/industry advisory	Fall 2002

	Advisory Council	council for approval.	
Departmental Faculty	Faculty	Formation of CAPAC.	Fall 2002
CAPAC	Students	Developed and administered online senior exit survey to assess objectives and program outcomes. Conduct in-person interview of graduating seniors.	Spring 2003
CAPAC	Alumni	Developed and administered online alumni survey to assess objectives.	Spring 2003
CAPAC	Faculty	Initiated faculty discussion for major curriculum modification based on assessment data and constituency feedback.	Summer 2003
College of Engineering	Industry	Administered college-wide industrial survey	Summer 2003
College of Engineering	Alumni	Administered college-wide alumni survey	Summer 2003
Faculty Retreat II	Faculty	Approval of progress assessment courses and rubrics. Approval of curriculum modification by faculty. Faculty reaffirmed the appropriateness of program outcomes.	Fall 2003
Faculty Retreat III	Faculty	Review of Spring 2003 senior exit data and student course assessment data. Faculty reaffirmed the appropriateness of program objectives.	Spring 2004
CAPAC	Students	Administered online senior exit survey to assess objectives and program outcomes. Conduct in-person interview of graduating seniors.	Spring 2003

B.2.6. Processes For Achieving Program Objectives

The discussion in the section above focuses on the process used for review of the appropriateness of the program educational objectives involving our various constituents and assessment mechanisms. However, the process for reviewing the appropriateness is fully integrated with our process for ensuring achievement of these objectives which also involves acting on feedback provided by our constituencies through data from assessment tools (e.g., alumni and industry surveys), working with the faculty, and our interactions/discussions with our students, alumni/industry advisory council, employers of our students, etc.

Together, the process for reviewing the appropriateness of our objectives (and outcomes) and the process for ensuring achievement of these objectives (and outcomes) provide an overall process for continuous improvement of our program. Figure 2-1 depicted this overall process involving constituency input in terms of the assessment data collected, dialogue, and feedback loops.

The department has established and uses a number of assessment methods to assess both the appropriateness of the program objectives as well as their achievement. These methods include feedback that is quantitative in nature as well as qualitative (non-numerical) information. Due to the importance of interacting with our constituencies, we feel that the text comments provided by our constituents is as important as the quantitative metrics. As an example, survey results (along with textual feedback from our senior exit interviews, the departmental alumni survey, and dialog with our seniors and alumni/industry advisory council) are carefully analyzed by CAPAC and our faculty during our regular retreats. These discussions have subsequently lead to improvement of our instructional program through major modification to our curriculum.

Methods primarily quantitative in nature include the COE Industry Survey, the COE Alumni Survey, and the department's Alumni Survey. These surveys measure the attitudes of alumni and employers who have hired Auburn students. Some portions of the Alumni Survey are the source of textual feedback about program objectives. In the future, the department will add questions to the Senior Exit Survey to establish graduating senior attitudes about the appropriateness and achievement of program objectives.

The role each survey plays in the process to achieve program objectives is shown in Table 2-4. Data are identified as either being primary data (identified "P") with a numerical performance criteria, secondary data (identified "S") without a specific performance criteria or textual data (identified "T") requiring careful reading and interpretation. At the present time, the departmental Alumni Survey is the only method used that employs a "numerical performance criteria."

Table 2-4 Use of Assessment Data for Monitoring Program Objectives

Objective	Legend	Alumni Survey	COE Alumni Survey	COE Industry Survey
	P - Primary data w/performance criteria S - Secondary data w/o performance criteria or post-tassel data T - Textual data requiring interpretation			
	Objective Description			
1	Develop within our graduates the technical proficiency needed for the professional practice of chemical engineering.	P/T	S	S
2	Develop within our graduates the ability to communicate effectively.	P/T	S	S
3	Instill within our graduates a commitment towards lifelong scientific inquiry, learning and creativity.	P/T	S	S
4	Foster within our graduates a commitment to protect the public interest, health, safety, and environment in the practice of the chemical engineering profession.	P/T	S	S
5	Foster within our graduates an understanding of the need to maintain the highest ethical and professional standards.	P/T	S	S

Performance Criteria

To evaluate survey and other numerical data (including the alumni survey) the department employs a three-tiered (three-level) performance criterion. By using a three-level approach, we seek to differentiate between those areas where we meet the program objective (where performance is acceptable and satisfactory) and those areas where we fail to meet the program objective (where performance deviates slightly or significantly from the desired level). These levels are:

- Level A – The assessment data for this program objective is consistent with departmental expectations. Discussions with constituents will be conducted to assure this objective is fully implemented in the program and curriculum.
- Level B – The assessment data for this program objective is slightly below the target value implied by level A. Attention should be paid to this area by the department, and discussions with constituents are appropriate.
- Level C – The assessment data for this program objective is much below the target value implied by level A. Significant attention should be paid to this area, and discussions with constituents are essential.

At the Fall 2003 faculty retreat, the faculty approved specific performance criteria to be applied to the alumni survey data. These are presented in Table 2-5.

Table 2-5 Performance Criteria For Program Objectives

Appropriateness of Program Objectives	
Level A	Greater than 80% of the alumni respondents find the objective “Very Appropriate” with no more than 5% responding that the objective is “Inappropriate” or “Very Inappropriate”.
Level B	Greater than 80% of the alumni respondents find the objective “Very Appropriate” or “Appropriate” with no more than 5% responding that the objective is “Inappropriate” or “Very Inappropriate”.
Level C	Less than 80 % of the alumni respondents find the objective “Very Appropriate” or “Appropriate” or more than 5% responded that the objective is “Inappropriate” or “Very Inappropriate”.
Achievement of Program Objectives	
Level A	Greater than 80% of the alumni responded that we were “Highly Successful” or “Successful” in achieving objective with no more than 5% responding that we were “Unsuccessful” or “Very Unsuccessful”.
Level B	Greater than 70% of the alumni responded that we were “Highly Successful” or “Successful” in achieving objective.
Level C	Less than 70% of the alumni responded that we were “Highly Successful” or “Successful” in achieving objective.

Methods Employed To Monitor Program Objectives

COE Surveys

The College of Engineering periodically conducts two comprehensive surveys of industry (employers) and alumni. These surveys were not specifically developed to directly provide information for ABET accreditation needs such as departmental program objectives and departmental program educational outcomes. Rather they broadly survey industry employers and alumni on various educational topics (a significant fraction of which are related to program objectives and program educational outcomes). Because of the strong correlation between our program objectives and program educational outcomes, we have chosen to interpret the results from these surveys in a combined sense (that is, to simultaneously consider program objective and program educational outcome information). Therefore, these data and their analysis are presented later in this report (Section 3.8 - Processes To Assure That Educational Outcomes Are Achieved). Generally, the data collected in both surveys strongly supported the appropriateness of the program objectives and program educational outcomes adopted by the department.

The survey forms can be viewed online at the following web link:

[http://www.eng.auburn.edu/department/che/SGCOE 2003 Surveys/COE Industry Survey Form.pdf](http://www.eng.auburn.edu/department/che/SGCOE%2003%20Surveys/COE%20Industry%20Survey%20Form.pdf)
[http://www.eng.auburn.edu/department/che/SGCOE 2003 Surveys/COE Alumni Survey Form.pdf](http://www.eng.auburn.edu/department/che/SGCOE%2003%20Surveys/COE%20Alumni%20Survey%20Form.pdf)

The data from the surveys will be available during the site visit.

Departmental Alumni Survey

The department has developed a comprehensive online survey to be used to collect information from our alumni on a variety of issues. This survey is shown in Figure 3-13 in Section B.3.6 later in this report. The data collected from the recent survey of alumni directly asks students who graduated from our program about the appropriateness and achievement of our program objectives. The interpretation of these data is discussed in the next section.

B.2.7. Documentation to Demonstrate the Level of Achievement of Program Objectives and Changes Implemented in the Program

Although the current process to evaluate program objectives employs surveys that are only periodically distributed, the department continuously dialogues with constituents about these matters. The first survey of our alumni took place during Summer 2003. At that time a departmental newsletter item invited all available alumni to take the online survey. One of the goals of this survey was to establish a baseline for future surveys as well as to establish the validity of the database of addresses we had available for our alumni. Although many of these alumni graduated within the past five years, a significant number graduated several decades before. This makes the interpretation of the data more difficult since individuals who graduated a long time ago are commenting on a program that has significantly changed. In the future, only fairly recent graduates will be polled. We anticipate using the survey instrument once each three years. This is particularly true of soliciting comments or evaluation about program objective effectiveness.

The data obtained during the first survey have been analyzed and distributed to both the faculty and the Alumni/Industry Advisory Council. At the most recent faculty retreat, faculty voted to affirm the current program objectives until feedback from all constituencies could be considered. The data is shown in Tables 2-6 and 2-7 reveals a general agreement with the appropriateness of the department's program objectives. All program objectives were felt to be very appropriate or appropriate by at least 90% of the alumni who responded. However, when we consider the data for the achievement of the program objectives, two areas received a level C rating:

Objective 2: Develop within our graduates the ability to communicate effectively

Objective 4: Foster within our graduates a commitment to protect the public interest, health, safety, and environment in the practice of the chemical engineering profession

We know from many conversations with our alumni, recruiters and employers that communications skills (Objective 2) are deemed very essential on the job and that there is generally dissatisfaction with the level of communications skills of recent graduates. The lower rating in this area most likely reflects a real need for more effort to be expended in this area.

Concerning the public health, safety and protection of the environment issue (Objective 4), many of the alumni surveyed graduated years before the curriculum paid attention to these matters. In that case, it is to be expected that some alumni might believe their experiences in this area was not sufficient preparation for current global concerns.

While the alumni response to these issues was somewhat surprising, we generally feel the matter resulted from the department selecting alumni to participate too "broadly" during the first round of surveys (that is, using our entire alumni mailing list) when evaluating the effectiveness of the

program in meeting the objectives. We feel the department overall is doing a good job and we will be focusing attention on collecting better data from a “narrower” alumni base (more recent graduates) to learn the true situation. If low evaluation levels persist in achievement of these objectives, the department will take appropriate measures to change the program. It should be noted that our initial effort to contact alumni did not provide sufficient numbers of surveys to “subset” the data and still have a “statistically significant sample size.” In the future, the department will be able to maintain better contact with recent graduates (via email and web activities) to be able to conduct surveys that will yield more “informative” results.

Table 2-6 Alumni Survey Results - Summer 2003 (Appropriateness of Objective)

Listing of Departmental Program Objectives									
1. Develop within our graduates the technical proficiency needed for the professional practice of chemical engineering. 2. Develop within our graduates the ability to communicate effectively. 3. Instill within our graduates a commitment towards lifelong scientific inquiry, learning and creativity. 4. Foster within our graduates a commitment to protect the public interest, health, safety, and environment in the practice of the chemical engineering profession. 5. Foster within our graduates an understanding of the need to maintain the highest ethical and professional standards.									
Program Objective	Raw Data (Individual Categories)					Combined Data (Merged Categories)			Level
	Very Appropriate	Appropriate	Neutral	Inappropriate	Very Inappropriate	Very Appropriate	Very Appropriate or Appropriate	Very Inappropriate or Appropriate	
	%	%	%	%	%	%	%	%	
1	82.8	16.4	0.8	0.0	0.0	82.8	99.2	0.0	A
2	76.9	20.7	2.5	0.0	0.0	76.9	97.6	0.0	B
3	33.0	57.8	9.1	0.0	0.0	33.0	90.8	0.0	B
4	52.9	38.0	9.1	0.0	0.0	52.9	90.9	0.0	B
5	73.6	22.3	2.5	0.0	1.7	73.6	95.9	1.7	B

Table 2-7 Alumni Survey Results - Summer 2003 (Achievement of Objective)

Listing of Departmental Program Objectives								
1. Develop within our graduates the technical proficiency needed for the professional practice of chemical engineering. 2. Develop within our graduates the ability to communicate effectively. 3. Instill within our graduates a commitment towards lifelong scientific inquiry, learning and creativity. 4. Foster within our graduates a commitment to protect the public interest, health, safety, and environment in the practice of the chemical engineering profession. 5. Foster within our graduates an understanding of the need to maintain the highest ethical and professional standards.								
Program Objective	Raw Data (Individual Categories)					Combined Data (Merged Categories)		Level
	Highly Successful	Successful	Neutral	Unsuccessful	Very Unsuccessful	Successful or Highly Successful	Unsuccessful or Very Unsuccessful	
	%	%	%	%	%	%	%	
1	40.7	57.7	0.8	0.8	0.0	98.4	0.8	A
2	23.0	45.9	27.9	3.3	0.0	68.9	3.3	C
3	24.0	52.1	22.3	1.7	0.0	76.1	1.7	B
4	17.1	49.6	31.7	1.6	0.0	66.7	1.6	C
5	29.3	43.1	24.4	3.2	0.0	72.4	3.2	B

Textual Comments From Alumni Survey

In order to illustrate the importance of text responses from alumni during the survey process, two tables of sample comments are provided. Table 2-8 provides sample comments received in response to the question *Do You Have Any Suggestions For Ways To Better Meet These Objectives?* Table 2-9 provides sample comments received in response to the question *Do You Have Any Suggestions To Modify, Add Or Delete Any Of These Objectives?* The department is highly appreciative of the carefully considered comments of our alumni and over the next few months will be developing modifications to the curriculum that take some of these suggestions into account. We will also be making the complete results of the alumni survey available online for all alumni to read to generate additional discussion and dialogue.

*Table 2-8 Sample Comments “Ways To Better Meet Objectives”***Do You Have Any Suggestions For Ways To Better Meet These Objectives?**

I believe the most work is needed in meeting objectives (3) and (5). In addressing objective (3), I think it is fair to say that we are a university committed to training students to maintain current ways of operating rather than to thinking of new and inventive ways to better operate. In some ways this training is good, as many of the graduates will be moving into positions where maintenance is their primary objective. However, I think it would also be useful to expose students to new and cutting edge ways in which chemical engineers are being utilized. For instance, in the introductory ChE course, rather than just having speakers from pulp and paper industries, petroleum plants, or other mainstream chemical engineering fields, it would be good to balance these lectures with those from people working, for instance, to use nanotechnology to build micro-machines or to build bioreactors to grow artificial arteries. Allowing students to see the broad spectrum of what they can do with the knowledge they are acquiring will inspire them to be curious and creative. In addition, objective (5) could also use some work. It isn't that I think students are taught unethical standards; I think that the issue of ethics is not really addressed at all. One way to address this issue might be to start at the classroom level. That is, hold students to a high standard of ethics in the classroom, and make sure that they understand that such standards will be even higher when they leave the classroom. As a former student, I remember how much copying of homework and lab reports, data sharing and falsification, and cheating on tests occurred. Maybe cracking down on these problems at the classroom level would help to eliminate them in the workplace.

When I was in school, there were not classes to teach the engineering students about the OSHA's, EPA's, DOT's, DNR's, etc. I was not prepared for my first introduction to them. The students need to understand how compliance with regulations is going to impact them in every area. Process Safety Management and Risk Management Planning have a direct impact on every plant or plant expansion where regulated materials are used. Having to comply with environmental regulations including obtaining permits and filing all the necessary paperwork is another area that impacts students once they leave college. These students need to have a mandatory class in regulatory affairs to prepare them for what they will face once they graduate. This class needs to be taught before they take plant design so they will understand the need for certain changes in their designs to meet government requirements. I would be pleased to discuss this further with the department. I have made presentations in the past to the student AIChE chapter. Spending the last 20 years in this area has shown me just how much impact it does have on the chemical industry.

My experience is 30 years old and may not be applicable today. However, it seemed to me that much of the approach of my courses were more theoretical than applied (i.e. - no practical courses in pump and valve selection, etc.) One of the most useful experiences was a very demanding GTA in the Ops Lab that taught me how to write reports, draw graphs, etc. I also think topics in project management, requirements development and writing, team building / interpersonal interaction-communication, system interface / interactions would be helpful. Again, these are more applied topics for graduates that are working in ChE operations, etc., as opposed to pre-med, research, etc. I also don't recall any specific course topics that addressed ethics and professional standards. I can also identify with a comment from Henry Petroski in "To Engineer is Human": "Twenty-five years ago, the undisputed symbol of engineering was the slide rule.... What our engineering instructors were interested in teaching us was not all the grand things that our various models of rules could do, but their common limitations. They told us about significant digits, for most engineering instruments then had analog dials and scales from which one had to estimate numbers from between the finest divisions...we were expected to know that we could only report answers accurate to three significant digits from our rules... We also learned how to estimate the order of magnitude of our answers, for the slide rule could not supply the decimal point to the product of 0.346 and 0.16892, and we had to develop a feel for the fact that the answer was about 0.06 rather than 0.6 or 0.006. These requirements in our judgment made us realize two important things about engineering: first, answers are approximations and should only be reported as accurately as the input is known, and, second, magnitudes come from a feel for the problem and do not come automatically from machines or calculating contrivances." Many current graduates accept calculated answers at face value without thinking through what the expected answer should be. Finally, I think topics on Decision Theory / Trade Studies, safety, project risk management, test design and execution, integrated project budget and schedule control, and documentation configuration management would also be helpful.

The largest downfall that I see of new graduates from every school is that most technical people have a very difficult time (particularly early in their career) in communicating effectively. Many can communicate on a technical level, but the day-to-day interaction seems to cause problems. Engineers are taught to think logically through every situation, but as we all know most people will not react logically. Engineers seem to have much difficulty in dealing with people that are not thinking logically because they simply cannot relate. Some suggestions would be to require speech communications as a core course for all engineering students. Additionally, oral presentations for labs or in any other type of setting would improve every engineer's ability to interact with a group.

More emphasis should be placed on health and safety topics; specifically the need to identify hazards in an industrial setting. This is something that should probably be done in the Unit Ops labs. For instance, students could be required to perform safety audits on the lab equipment and/or their peers.

To better meet the second objective, I suggest that you incorporate more group projects. Also, have students make more individual presentations. I would also encourage students to interact with the faculty more. Perhaps students should be forced to interact with the faculty through biweekly one-on-one meetings or by requiring students to discuss tests or projects with the professors.

The department put little emphasis on communication skills until student senior year. Those skills need to be fostered throughout students' tenure at Auburn.

I think that it would be helpful to describe and discuss how engineers end up in positions that require them to make ethical decisions. I have enjoyed the section in the NSPE on engineering ethics.

Expose students to real world of chemical engineering as often and as long as possible during their educational tenure.

To foster appreciation, invite guest lectures by engineering managers on industrial practice in the area of each objective. Encourage the managers to bring one or two engineers along. Require attendance by all undergraduates. Limit the time to one hour. Cover all 5 objectives each academic year.

*Table 2-9 Sample Comments “Suggestions To Modify, Add, Delete Objectives”***Do You Have Any Suggestions To Modify, Add Or Delete Any Of These Objectives?**

Provide more instruction in business skills. Also, should provide some emphasis on global aspects and encourage foreign language acquisition.

When engineers work in the corporate world they need some level of appreciation of business practices. They need to understand how they relate to providing value to shareholders. They also need to understand how to manage their career such that they stay happy with what they are doing. A happy and satisfied engineer will be the best ambassador to the world for his alma mater. To this end, not only is technical proficiency needed, but career management proficiency.

After a very successful 8 years with ExxonMobil, I had my first child. My priorities suddenly changed in ways I was not prepared for. After struggling to be the parent I was driven to be AND pursue my career full force for a year, my career pursuits collapsed. I tried part time work after my second child and decided that felt too much like punching the clock. I am now a full time stay at home mom with 3 kids. I am very happy with my current situation, and I am sure I will return to the work force eventually...objective #3 is too strongly instilled for me not to. My suggestion for you is to provide some sort of preparation for your students for the struggles of work/life balance. This type of preparation probably would not have changed my ultimate career/life decisions, but I believed it could have made the transition to motherhood easier and spared me, or at least prepared me for the grief of letting go of a hard earned career. The application of work/life balance preparation to women who hope to have families is obvious, but I believe this would apply to everyone. I cannot tell you how many bitter 50 yr old male engineers I encountered during my career. They are unhappy with what they have achieved in life, and yet they don't even see that the options were always there for them to do something different with their lives. Many sacrificed their marriages for their jobs and are dismayed that the company does not have the same "loyalty" to them. Our graduates will have an incredible edge on being successful in their lives if they are prepared for the tough life decisions we all face during our careers.

Students also need to have better communication skills when they graduate. They need to understand how to write a technical document to support their work. I would suggest a technical writing class to help in this area. As a corporate auditor for refineries, I spent many hours writing technical reports on my findings (165 pages plus). I had to learn how to write this type of document after I graduated. I thought I knew how to write, but sadly found out I did not. Students also need to be able to stand up and talk about their work. I would suggest that students make presentations about lab experiments as part of their "write-up." They need to be able to talk about what they did and be able to defend their work. By giving short talks on labs and answering questions on them, the student will learn to think and communicate while on their feet. It will also teach them how to defend their work and build confidence in their ability.

In addition to placing high emphasis on communication (verbal, written, and effective listening), interpersonal relations and work ethic must be stressed. I place as much or more emphasis on an employee's ability to work well with others / work ethic / integrity, as I place on one's technical ability.

Encourage professional association membership and involvement.

Objective 4 should be amended to foster those commitments while recognizing the need to achieve an appropriate balance with overall economic benefit to society.

Focus more on preparing the student and less on global objectives, which are hard to teach or measure.

"Communication" means many things to different people. Selling one's product to a customer? Explaining the results of one's scientific work? Paving the way to a better job? I suggest clarification of this objective.

Require a small independent study to foster research and interest. It would be a nice course to give a broad

overview of chemical processes, for example: refinery, gas plant, petrochemicals, paper mill, electronics, etc.

I'm not sure what the answers are, although I found co-op students, in general, were better able to contribute to the objectives sooner than non-co-ops. I've hired and worked with ChEs, EEs, and MEs from all over the U.S. and outside the U.S., and there is little doubt about their intelligence and academic knowledge, but the majority of them today can't write a decent memo, frequently making themselves look stupid when sending an e-mail and are terrible major report writers. Second, their practical skills are sorely lacking. We teach these on-the-job, but it would be a breath of fresh air to find some basic skills in the new hires. Third, the advent of calculators and computers, have made many students unable to think through problems requiring even modest amounts of arithmetic and mathematics on the fly. I remember a senior seminar I had at Clemson as an undergraduate. We met for an hour once a week with the whole class and department staff. Student names were pulled from a hat and a question was asked of the student. With nothing but the chalk board (minimal use encouraged) he or she was asked, for example, to estimate the weight of the earth or to estimate the number of pharmacies in the U.S. or to explain why you can have frost on a car roof when the outside temperature is above freezing. The point here is not the exact value of the answer (although you would be surprised at how close you can get), but the thinking process used to arrive at the answer; whether or not the answer was in the correct order of magnitude; and doing without any electronic or mechanical (slide rule in my day) assistance. Nine out of ten students today could not begin to tackle this. I know because I've tried it for years on new students.

Objective 3 might be strengthened with the ideas of maintaining and improving proficiency and practicing with the highest technical standards.

Develop within our graduates the fundamental skills of engineering judgment so that they can apply them in whatever career path they choose.

Summary Statement

The faculty first approved the program objectives in October 2002. Since that time, no changes to program objectives have been made. One reason for this is that much of the department's effort and resources have been directed into the area of developing assessment tools, collecting data and in a major curriculum revision. Another reason is that we plan to review our program objectives on a three to six year schedule with our first complete review of our program objectives is scheduled for our Fall 2005 faculty retreat.

At the current time, the department feels the current objectives have been validated and that they are both appropriate and being effectively addressed in the curriculum. We further believe that if a significant constituent concern was to be raised about any particular objective, the review process would adequately respond to meet the need.