ABET
Self-Study Report

for the

Department of Chemical Engineering

at

Auburn University

212 Ross Hall

Auburn University, AL 36849-5127

June 3, 2010

CONFIDENTIAL

0. SECTION 0 - BACKGROUND

Required Content (as per E003 Self-Study Questionnaire 2009 6-11-09.doc)

A. Contact information

List name, mailing address, telephone number, fax number, and e-mail address for the primary pre-visit contact person for the program.

B. Program History

Include year implemented and summarize major program changes with an emphasis on changes occurring since the last visit.

C. Options

List and describe any options, tracks, concentrations, etc. included in the program.

D. Organizational Structure

Use text and/or organization charts to describe the administrative structure of the program from the program to the department, college, and upper administration of your institution, as appropriate.

E. Program Delivery Modes

Describe the delivery modes used by this program, e.g., days, evenings, weekends, cooperative education, traditional lecture/laboratory, off-campus, distance education, web-based, etc.

F. Deficiencies, Weaknesses or Concerns from Previous Evaluation(s) and the Actions taken to Address them

Summarize the Deficiencies, Weaknesses, or Concerns documented in the Final Report from the previous general evaluation and succeeding interim reviews, if any. Describe the actions taken to address them, including effective dates of actions, if applicable. If this is an initial accreditation, it should be so indicated.

0.1 Contact Information

Table 0.1 - Contact Information	
Department Chair	**Undergraduate Program Chair**
Dr. Christopher B. Roberts Department Chair Department of Chemical Engineering Auburn University, AL 36849-5127 Office: 210 Ross Hall Telephone: (334)844-2036 Fax: (334)844-2063 E-mail: robercr@auburn.edu	**Dr. Timothy D. Placek** Undergraduate Program Chair Department of Chemical Engineering Auburn University, AL 36849-5127 Office: 228 Ross Hall Telephone: (334)844-2022 Fax: (334)844-2063 E-mail: placetd@auburn.edu

0.2 Program History

0.2.1 HISTORICAL BACKGROUND

Auburn University was established in 1856 as the East Alabama Male College, 20 years after the city of Auburn's founding. In 1872, under the Morrill Act, the school became the first land-grant college in the South and was renamed the Agricultural and Mechanical College of Alabama. In 1899 the name again was changed, to the Alabama Polytechnic Institute. Finally, in 1960 the name of the school was changed to Auburn University, a title more in keeping with its location, and expressing the varied academic programs and larger curriculum of a major university.

Ross Hall Construction (1940)

Auburn University is a large, comprehensive land, space and sea grant research institution. Auburn is the state's major university for students in engineering, as well as agriculture, physical and biological sciences, veterinary medicine, fisheries, psychology, and many other areas of study.

Auburn first offered courses in Chemical Engineering in 1913. Our graduate program in chemical engineering began early in the department's history. The first class of M.S. Chemical Engineering graduates received their degrees in 1919. Our doctoral program began in 1974. Auburn began admitting women early in its history. The first female students came to Auburn in 1892. Women have been earning chemical engineering degrees at Auburn since the early days of our program. Mrs. Esther Thompson Spencer was one of our first female graduates; she earned a B.S. and an M.S. in chemical engineering in 1918 and 1919, respectively.

Since our program began, we have consistently attracted large classes of undergraduates and our graduate program has experienced substantial growth since the 1950's. Enrollment of graduate students began to rise as the popularity of chemical engineering graduate degrees increased and as extramural funding became more available.

Energy research was a major research focus for the department in the 1970's and 1980's. The 1980's also brought in new research expertise in areas of catalysis, materials engineering, and biotechnology, surface science, and space-related research programs through the Space Research Institute. In 1985, at the request of pulp and paper industry leaders, the Department of Chemical Engineering established the Pulp and Paper Research and Education Center (PPREC). This center has subsequently been renamed the Alabama Center for Paper and Bioresource Engineering (AC-PABE). The mission of the center is to conduct research on improving productivity and profitability in the pulp and paper industry, and to provide highly skilled engineers for the industry.

Expertise in process systems engineering, supercritical fluid technology, molecular thermodynamics, environmental transport and separations were added to the department in the 1990's. In 1996, the Center for Microfibrous Materials Manufacturing (CM^3) was established focused on a unique Auburn technology to produce microfibrous materials that have wide ranging applications in catalysis, filtration, fuel cells and others. The 2000's represented a period of significant growth and expansion for the department including the addition of expertise in process and product design, biomedical engineering and drug delivery systems, micro- and nano-technology, advanced process dynamics and controls, and systems biology.

The department has experienced a period of growth since the last ABET on-site review, resulting in an increase in the faculty size to 20, coupled with significant increase in both the undergraduate and graduate student enrollments as described throughout this self-study.

In addition, major renovations to our facilities have been recently completed with Wilmore Laboratories being completely updated in 2002 and Ross Hall having a complete renovation and addition in 2006. These extensive renovations have resulted in a significant improvement in the quality and quantity of the facilities available to our faculty and students and have positively affected our function, including enrollment and retention of both students and faculty.

Ross Hall Today (Following 2006 Renovation)

A number of improvements have been made to the program since the last ABET on-site review, including certain curriculum modifications as described in Sections 4 and 5 of this self-study, however, no major changes to the organizational structure and operation of the department have occurred during this period.

0.2.2 PRE-EC 2000 ASSESSMENT ACTIVITIES

Assessment of student performance and improvement of our curriculum has been a longstanding central focus of the department. Since our last ABET visitation in 2004, significant revisions to our curriculum have taken place largely the result of improvements to provide a more effective learning experience. These changes will be discussed in detail in Section 5 (Curriculum).

As early as 1980, the department faculty established a list of "Curriculum Priorities" that is in remarkable agreement with ABET's EC2000 3A-3K. Table 0.2 shows the "Curriculum Goals" (similar to program outcomes) whereas Table 0.3 shows the "Expected Levels of Performance" (similar to measurable assessment data) abstracted from a July 11, 1980 memo entitled *General Guidelines to Follow in Developing the Chemical Engineering Undergraduate Curriculum*. During the 1980's and 1990's the faculty followed these guidelines and attempted to provide individual course improvements. As a result of this earlier involvement, the EC2000 approach to assessment-based curriculum and program development were well received by the faculty as a whole.

Table 0.2 – Historical Curriculum Goals (July 1980)

Level of Importance	Curriculum Goals
Highest	1. Ability to think 2. Mastery of fundamental chemical engineering concepts 3. Ability to analyze "real world" problems arriving at feasible solutions. 4. Development of invention, innovation and creativity 5. Foster good communication skills including oral presentations before groups (co-workers, superiors, subordinates) and written communications 6. Develop a positive self-image (reliability, personal esteem, responsibility, professionalism)
Second	1. Ability to learn materials on own 2. Student has ability to work on open-ended research problems including project work, design problems, and individual research 3. Familiarity with analytical techniques and instrumentation 4. Ability to use library resources effectively 5. Ability to apply available computer software to solve routine problems and projects 6. Obtain hands-on experience with large and small equipment (including process control and data acquisition equipment) 7. Develop "common sense" and an understanding of physical reality
Third	1. Acquisition of advanced chemical engineering knowledge 2. Develop a broad educational background including non-chemical engineering technical material, social and philosophical subjects 3. Develop personal behavior management and human relationship skills (learning to recognize the rights and needs of others)

Table 0.3 – Expected Levels of Performance (July 1980)	
Level	Expected Levels of Performance
Sophomore	1. Proficiency in problem solving skills 2. Develop personal reputation and integrity (academic honesty) 3. Develop a familiarity with standard references (require Chemical Engineers' Handbook) 4. Require membership in Student Chapter of AIChE 5. Homework is to be submitted on time in the standard format 6. Development of good study habits (reading assigned text material, bringing text to class, etc.) 7. Student prepares meaningful notes from class lectures and reviews them as required 8. Student is able to work exams in fashion clear to instructor
Junior	1. As applicable from Sophomore Level 2. Student should be able to analyze physical situations, understand basic phenomena involved, and set up equations that describe the situation 3. Student should be able to eliminate extraneous material added to homework problems and exams 4. Acquire library skills in finding information in chemical engineering and other technical resources 5. Develop report writing skills 6. Perform laboratory experiments primarily involved with conformation of theory 7. Be able to use the computer to solve problems not having analytical solutions 8. Student should possess an understanding of chemical engineering as a profession and his/her role in the profession.
Senior	1. As appropriate from Sophomore and Junior Level 2. Student should be able to solve open-ended problems involving substantial understanding, analysis, and innovation. This will require determining what the problem is and how to come up with an appropriate solution 3. Student should be required to demonstrate independent thinking 4. Lecture courses should introduce the student to design-type problems 5. Student should possess excellent oral and written communication skills 6. Student should possess an understanding of the importance of economics to the chemical engineering profession 7. Student should be an analytical, independent chemical engineering professional

0.3 Options

In addition to the basic-level curriculum, the department currently offers six program specializations that are constructed by careful selection of technical elective courses to provide specialized knowledge, classroom experiences and professional advising. These program specializations are informal and non-binding so that students may change from a program specialization back to the standard curriculum model without loss of credit.

The fashion in which elective courses are employed in each specialization is discussed in Section 5 (Curriculum).

0.4 Organizational Structure

0.4.1 UNIVERSITY LEVEL ORGANIZATIONAL STRUCTURE

The administrative structure of Auburn University follows the conventional model, where each Department Chair reports to the Dean of their respective college. The Deans report to the Provost and Vice President for Academic Affairs who in turn reports to the President of the University. The President is responsible to the Auburn University Board of Trustees. This structure is depicted in Figure 0.1 and is provided in a more complete form in Appendix Q.

0.4.2 DEPARTMENT LEVEL ORGANIZATIONAL STRUCTURE

The Department Chair is the chief administrative officer for the Department of Chemical Engineering and, in consultation with a three-person Excecutive Committee (EC), is responsible for proper management of its resources, personnel, facilities and policies. In 2002, the department faculty voted to adopt a distributed form of governance characterized by shared decision-making. In this new format, the Department Chair and the EC make the major decisions involving personnel, budget and other administrative matters.

The major educational missions of the department (undergraduate and graduate education) are overseen by an Undergraduate Program Chair and a Graduate Program Chair who report to the Department Chair. The responsibility for maintenance, assessment, and continuous improvement of the chemical engineering undergraduate program is shared by the Undergraduate Program Chair (Dr. Timothy D. Placek), the Department Chair (Dr. Christopher B. Roberts), and the members of the department's Curriculum and Accreditation Planning and Action Committee (CAPAC) and the faculty at large. In addition, the department is advised by an Alumni/Industry Advisory Council as described later in Section 2. This structure is depicted in Figure 0.2. This distribution of departmental management and responsibilities has been very successful and effective in meeting the needs of the department.

The Department Chair's primary responsibilities include:

- Responsible for management of the Department.
- Serves as the departmental point of contact to the University, COE, and external constituents.
- Responsible for implementing policies of the Department.
- Responsible for acting on recommendations brought by the EC, UPC and GPC.
- The Chair and the EC act as the principal coordinating and policymaking body of the Department. They seek to promote the stature, image, and support of the Department, both within the university and at state, regional, and national levels and to foster vision and mission for the Department.
- Formulates and implements, in consultation with the EC, policy regarding personnel matters including annual faculty and staff evaluations and salary recommendations, faculty and staff assignments and workload policies, faculty and staff hires, and tenure and promotion procedures.
- Determines, in consultation with the EC and recommendations from the UPC and GPC as appropriate, the teaching assignments for each faculty member.
- Formulates and implements, in consultation with the EC, policy regarding budgetary matters and allocation of resources.
- Formulates and implements, in consultation with the EC, policy regarding the strategic planning of the departmental affairs (including release time, workload policies, alumni relations, developmental issues).

Figure 0.1 - Auburn University Upper Administration Flowchart

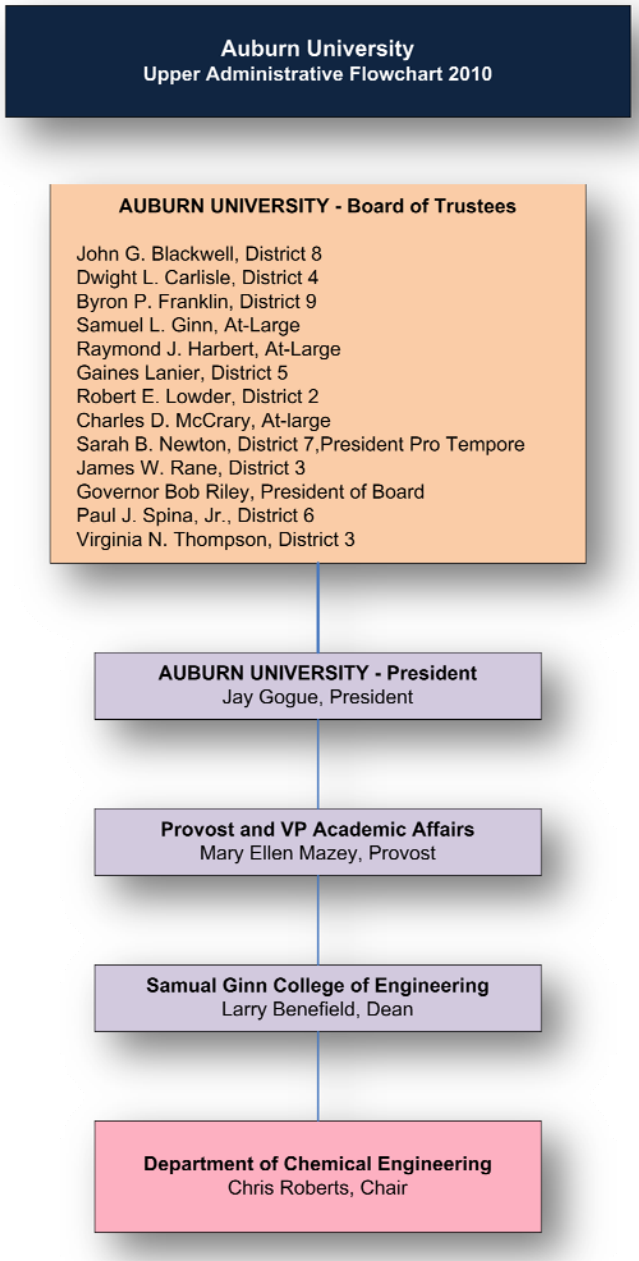
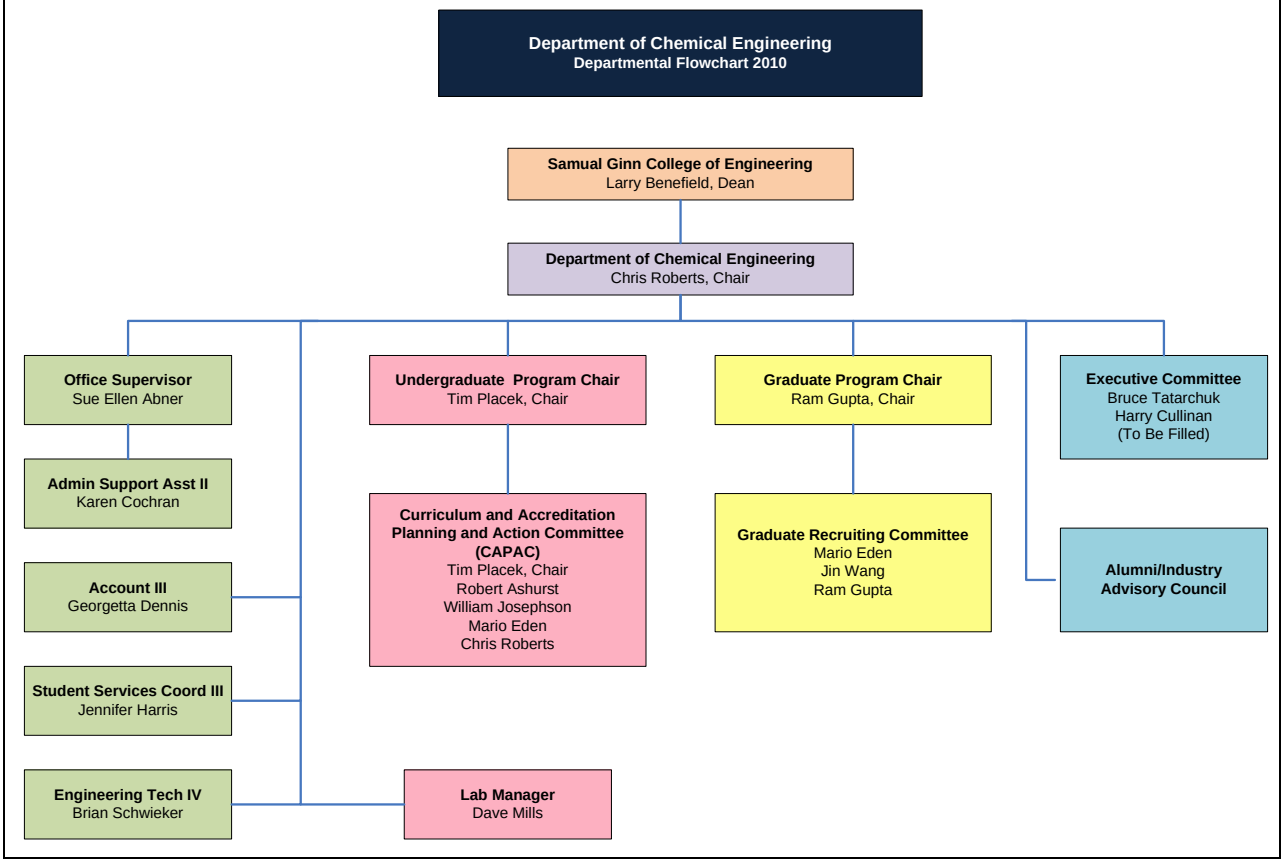


Figure 0.2 - College of Engineering to Department Level Flowchart



0.4.3 UNDERGRADUATE PROGRAM CHAIR AND CAPAC COMMITTEE

This section discusses the structure of the undergraduate program with particular emphasis on assessment and accreditation activities conducted by the Undergradute Program Chair and the Curriculum and Accreditation Planning and Action Committee (CAPAC). The current Undergraduate Program Chair is Dr. Timothy D. Placek.

The curriculum and accreditation process employed by the department is illustrated in Figure 0.3. This figure shows schematically the flow of data, archiving, interpreting of results, development of action plans and curriculum changes that exist in the departmental assessment process. In order to show in detail the fashion in which assessment activities affect the educational program, several enlargements of portions of Figure 0.3 are provided and discussed in Section 3 (Program Outcomes). Only the general features of the process are expected to be seen in Figure 0.3.

The responsibilities of the Undergraduate Program Chair and the CAPAC Committee include:

- Develop, implement and review educational policy for the undergraduate program of the Department. When making significant changes in policy, recommendations will be presented to the faculty for approval.
- Devise methods to measure the quality of the instructional program (course outcomes and program outcomes) and to ensure 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.

- Coordinate and manage curriculum related activities such as undergraduate advising, textbook selection and ordering, promotion of the program through web presence, university bulletins, catalogs and other publications.
- 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.

0.4.4 FUNCTION OF CURRICULUM AND ACCREDITATION PLANNING AND ACTION COMMITTEE (CAPAC)

The CAPAC committee is made up of the Undergraduate Program 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. The committee meets (at least) weekly to consider issues related to the program operation, curriculum and accreditation although twice weekly meetings have been the rule since 2009.

Individual members of CAPAC interface with other members of the faculty to learn of their concerns on issues and matters currently being considered. Faculty may be invited to attend CAPAC meetings to speak directly to these issues. Faculty can request to attend CAPAC meeting to introduce new items of business or to discuss issues currently being considered by the committee.

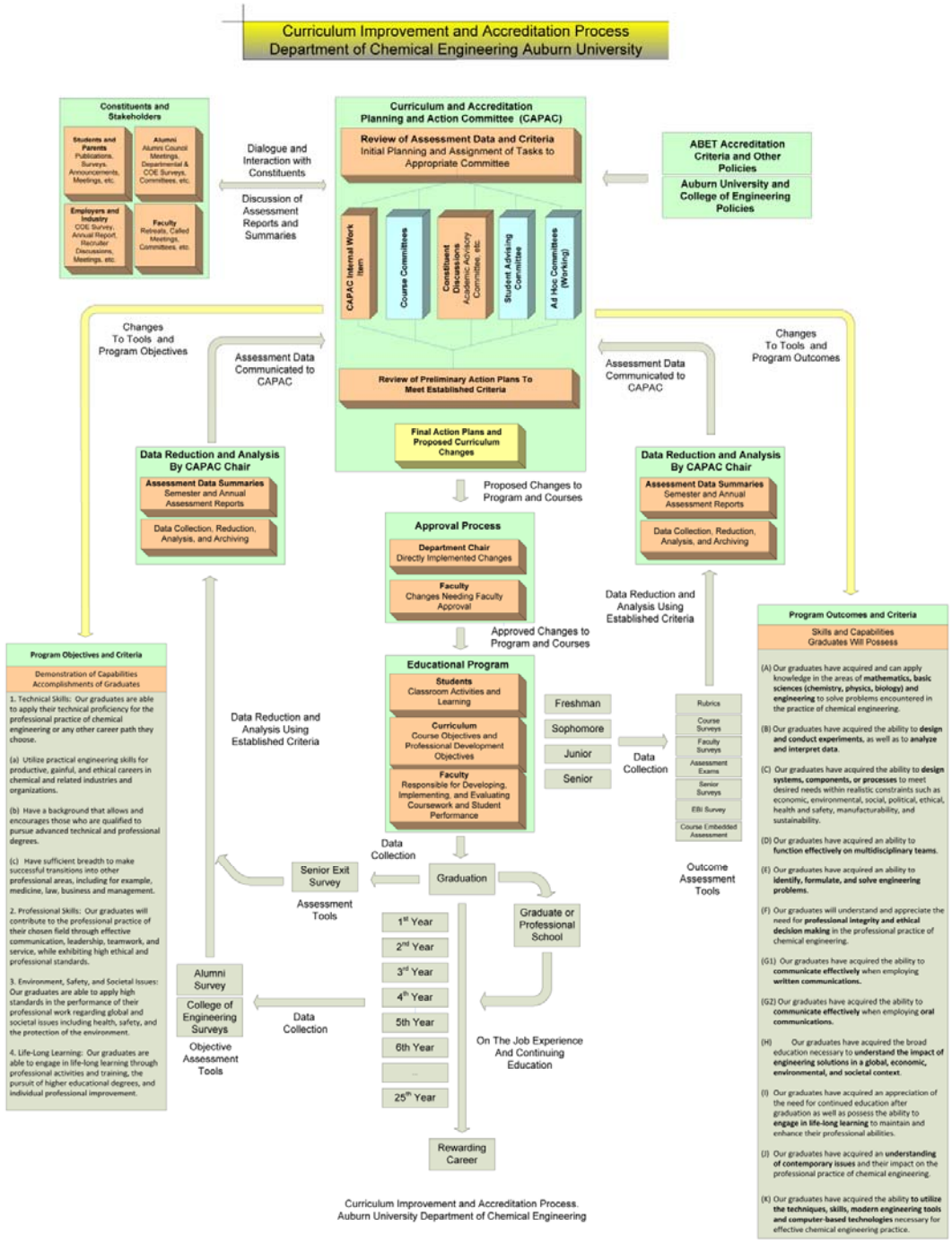
The CAPAC committee is responsible for initially considering problems or issues related to the undergraduate program and, if necessary, coordinating and charging appropriate UPC members, standing or ad hoc committees to further study the matter. After receiving feedback or suggested action plans, the 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.

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

There is broad faculty participation in the UPC with faculty serving as coordinators for activities such as E-Day, scholarship selection, etc.

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.

Figure 0.3 - CAPAC Committee Operational Flowchart



0.4.5 COURSE COMMITTEES

Table 0.4 lists the current faculty membership of the standing course committees.

Table 0.4 - Chemical Engineering Undergraduate Course Committee Assignments	
Program Area Course committee chair is designated by (parentheses)	Courses and Principal Faculty Assocated with Course
Progress Assessment (Placek), Ashurst, Roberts	CHEN 2AA0 Progress Assessment I, Roberts CHEN 3AA0 Progress Assessment II, Ashurst
Process Fundamentals (Bryne), Duke, Lipke, Neuman, Placek	ENGR 1110 Introduction to Engineering, Duke CHEN 2100 Principles of Chemical Engineering, Byrne CHEN 2610 Transport I, Lipke CHEN 3620 Transport II, Neuman
Thermo + ENGR2200 (Gupta), Maples, Roberts, Davis, Neuman	ENGR 2010 Thermodynamics, Maples ENGR 2200 Introduction to Thermo, Fluids and Heat, Maples CHEN 3370 Phase and Reaction Equilibria, Gupta
Lab Experience (Mills), Duke, Roberts	CHEN 3820 Chemical Engineering Lab I, Josephson CHEN 4860 Chemical Engineering Laboratory II, Mills
Advanced CHEN (Gupta), Lee, Placek	CHEN 3660 Chemical Engineering Separations, Duke CHEN 3700 Chemical Reaction Engineering, Lee
Programming, Modeling, Statistics (Placek), Ashurst, Eden	CHEN 3600 Computer-Aided Chemical Engineering, Placek CHEN 3650 Chemical Engineering Analysis, Ashurst
Design and Practice (Eden), Chambers, Duke, Placek	CHEN 4450 Process Economics and Safety, Chambers CHEN 4460 Process Sim Synth and Opt, Eden CHEN 4470 Process Design Practice, Eden
Process Control Eden, Wang	CHEN 4170 Digital Process Control, Wang
Pulp and Paper (Josephson), Neuman, Duke	CHEN 3090 Pulp and Paper Technology, Josephson CHEN 4100 Pulp and Paper Processing Laboratory, Josephson CHEN 4880 Pulp and Paper Engineering Laboratory, Josephson CHEN 5110/6110 Pulp and Paper Engineering, Josephson CHEN 5120/6120 Surface and Colloid Sci, Neuman
Biotechnology Electives (Byrne), Lee, Hanley	CHEN 5800/6800 Biochemical Engineering, Hanley CHEN 5810/6810 Biomedical Engineering, Byrne
General Technical Electives Placek, Gupta, Ashurst, Roberts, Tatarchuk	CHEN 5410/6410 Macromolecular Engineering, Hanley CHEN 5430/6430 Business Aspect of Chem Eng, Tatarchuk
Honor's Electives (Chambers), Byrne, Roberts	CHEN 4930 Directed Studies CHEN 4970 Special Topics in Chemical Engineering CHEN 4980 Undergraduate Research CHEN 4997 Honors Thesis CHEN 5970 Adv Special Topics in Chemical Engineering

0.5 Program Delivery Modes

The program is offered in the day mode employing traditional lectures, recitation sessions and laboratories. The department encourages cooperative education and internships opportunities. These experiences help students integrate their academic work with real-world practice and enhances their employability.

0.6 Deficiencies, Weaknesses or Concerns from Previous Evaluation(s) and the Actions Taken to Address Them

No deficiencies, weaknesses or concerns were identified during the previous evaluation. The final ABET Statement for Chemical Engineering (2004) is provided in Table 0.5 for reference:

Table 0.5 – Final ABET Statement for Chemical Engineering (2004)

Program: Chemical Engineering
1. Students are of a high quality, enthusiastic, strongly involved in cooperative education and summer internships, aware of program objectives and outcomes, and readily engage faculty members, alumni and advisory council members in discourse for program improvement.
2. Published program objectives and outcomes are consistent with the institutional and program missions, processes are in place for regular evaluation and are periodically evaluated; and qualitative and quantitative data obtained from all constituents are fed back into the program's assessment process for making program improvements.
3. Subject areas adequately address engineering, mathematics, science, and general education components culminating in a capstone design experience engaging students in critical issues facing engineering practice. The core curriculum and various specializations amply address the distinctive areas of modern chemical engineering.
4. Faculty members provide a breadth and depth of experience and expertise capably leading students toward excellence in chemical engineering through a variety of topical specializations enabling graduated to pursue an equally varied number of career options. Student career advising is strong; service to the program, university and profession is consistent; and professional development is ongoing.

0.7 Departmental Performance Criteria for Success

In the balance of this document, references will be made to the Department's "performance criteria for success." In order to provide a uniform explanation of this concept, it is presented at this early point in the self-study report.

During the collection of assessment data, a rational means to interprete the results of assessment instruments is essential. The Department employs the following success criteria for all assessment methods that yield quantitative data (such as rubrics and numerical responses to survey questions). We seek to differentiate between those areas where we have met the program outcome target performance (success) and those areas needing minor or significant improvement. We denote these levels as "A", "B", "C" with the following characteristics:

- **Level A** – The assessment data for this program outcome is consistent with departmental performance expectations. Discussions with constituents will be conducted to continue to improve performance for this program outcome. Appropriate adjectives are "on target" and "satisfactory."
- **Level B** – The assessment data for this program outcome is slightly below the target value. Attention should be paid to this area by the department, and discussions with constituents to improve performance are appropriate. Minor changes to the curriculum should be satisfactory to improve the situation. Appropriate adjectives are "below target" and "needs improvement".

- **Level C** – The assessment data for this program outcome is much below the target value. Significant attention should be paid to this area, and discussions with constituents are essential. Major and minor changes to the curriculum may be necessary to remedy the situation. Appropriate adjectives are "well below target" and "needs significant improvement".