2006-2463: EAC-ABET ACCREDITATION: WHAT DOES IT TAKE TO SUCCEED?

Andrew Jackson, Texas A&M University-Commerce

ANDREW E. JACKSON, Ph.D., P.E., CSIT, Professor of Industrial Engineering Dr. Jackson teaches a variety of IE courses, including: Engineering Economics, Human Factors Engineering, Production Systems Engineering, Systems Simulation, and Risk Assessment. His career spans 37 years in the fields of aviation, aerospace, defense contract support engineering, systems acquisition, academics, and systems engineering. His research interests include Human Factors Engineering and Ergonomics in Large-Scale Systems.

Mary Johnson, Texas A&M University-Commerce

MARY E. JOHNSON, Ph.D., Assistant Professor of Industrial Engineering Dr. Johnson teaches the Introduction to Industrial Engineering course, System Simulation, Enterprise Analysis & Trends, and Manufacturing Systems. She has over 17 years experience in the manufacturing, aerospace industries, and in academia. Her experience includes various engineering, management, and consulting positions at Vaught Aircraft, the University of Texas at Arlington, and numerous manufacturing firms in the Dallas, Texas metroplex.

Delbert Horton, Texas A&M University-Commerce

E. DELBERT HORTON, Ph.D., P.E., Assistant Professor of Industrial Engineering Dr. Horton teaches a variety of IE courses, including: Industrial Operations Research courses, Industry Systems Design course and Engineering Management course. He has over 38 years experience in the product development and manufacturing, and intelligence systems development and integration for U.S. Government agencies and in academia. His experience includes various engineering development and management, and consulting roles at Electrospace Systems, E-Systems, Raytheon Systems and Stephen Meyers & Associates.

EAC-ABET Accreditation: What Does it Take to Succeed?

Abstract

This paper focuses on the lessons learned during the initial Industrial Engineering accreditation process undertaken at Texas A&M University – Commerce. While the department's Industrial Technology program has long been NAIT accredited, the engineering accreditation from the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (EAC-ABET) is being sought by the newly established Industrial Engineering program. The paper introduces three elements that are critical to the EAC-ABET Accreditation process, including: 1) department background, 2) the demands of the engineering discipline, and 3) ABET assessment team requirements. An alignment model is used to show the relationships between internal and external stakeholders as well as the expectations of the assessment team for continuous process improvement in the academic program. Engineering programs must constantly improve in order to remain competitive and responsive to the needs of the discipline. This paper discusses some of the characteristics of successful engineering programs.

Background on the Industrial Engineering Program at Texas A&M University-Commerce

The creation of an Industrial Engineering (IE) program at Texas A&M University-Commerce (TAMUC) was approved by the Texas Legislature in 2002. TAMUC is over 115 years old and has gone through many name changes before being incorporated into the Texas A&M System. As a state-supported university, adoption of new programs must follow rules set by the legislature. Initial program planning projected that 30 IE students would begin their studies at TAMUC during the first year it was offered. To our surprise and amazement, seventy (70) students joined the program during the Fall 2002 Semester. To date, the program has graduated eight undergraduate IE students. All eight are now employed in the IE discipline with very competitive salaries, representing such reputable companies as Raytheon, MCI, and United Parcel Service.

In preparation for the EAC-ABET accreditation visit, the initial request for an accreditation assessment is made to ABET by January 31st, in the calendar year when the assessment site-visit is planned. It should be noted that the entire schedule of events is provided on the ABET Web Site at: http://www.abet.org/deadline.shtml.[1] Once this request had been submitted to ABET, the Industrial Engineering faculty at TAMUC developed the required ABET Self Study Report during the Spring 2005 semester. The Self Study Report is an extensive document that covers all aspects of the academic program under review. For example, our 2005 Self Study Report was 308 pages long. It includes university policies, budgetary reports, facilities available to the program, information on students and alumni, faculty qualifications, course syllabi, and a host of other elements that paint a picture of the academic program for use by the reviewing team and throughout the ABET Due Process activities. The due process begins as soon as the visiting team leaves the campus and continues until the ABET meets for their annual Board Meeting in July of the year following the site visit. When completed, the Self Study Report is submitted to ABET Headquarters by July 1st, leading to the site-visit which will be scheduled for the upcoming Fall semester. The Self Study Report is used by the Team Chair and by each Program Evaluator to prepare for their three to four day campus visit.

In October 2005, the ABET team visited the Texas A&M University-Commerce campus to interview a variety of individuals, including students, faculty, alumni, Industry Advisory Board Members, the Department Chair, the Dean of the College, various leaders of campus support functions, including the Library, Student Services, Financial Aid, Housing, and recreation support services. The President and Provost are also interviewed by the Team Chair and an observer from the Texas Board of Professional Engineers. The composition of each site-visit team will vary depending on the scope of the academic programs involved in the assessment request. Some site-visit teams may have 15 to 20 members, whereas the minimum number of assessors is three, including a Team Chair and two Program Evaluators.

Faculty Background and Their Role in the Assessment Process

ABET Accreditation for the Industrial Engineering program at Texas A&M University-Commerce was led by a small faculty team, and it should be noted that this was the first time through EAC-ABET process for *all but one* of our faculty members. We were venturing into the unknown realm of the assessment process. It is safe to say we were simultaneously awed, overwhelmed, intimidated, excited, and some might even say we exhibited paranoid tendencies as we prepared for the site visit.

Poring over the ABET guidelines and requisite documentation[2] gave the faculty team the impression that there were extensive sets of conditions that had to be addressed and these assessment elements were somewhat intimidating when we first began our internal self study. In addition, state regulations and university administrators also had a stake in this process. A wide variety of stakeholder inputs was involved and had to be sorted through, analyzed, and understood before the self study report could be compiled in a coherent and logical manner. The entire process can be, and often is, overwhelming even for experienced faculty and administrators.

The tasks were made easier by assigning each member of the internal assessment team to perform a certain subset of the data collection, analysis and documentation. As each section became more well-defined, the complete committee would review and edit the individual sections and recommend to the original author how the section could be enhanced. It was determined early in the process that some key graphics needed to be created to facilitate understanding of the processes used to support our academic program. These graphics and associated acronyms were instrumental in creating a common language of discussion among the committee and served as an effective tool to indoctrinate other faculty members and administrators about the data and resources needed to successfully address EAC-ABET Accreditation requirements.

Understanding the Demands of the Discipline

A good engineer is hard to find, and sometimes hard to define. ABET has criteria for engineers, in addition to discipline-specific criteria, in an attempt to define the desired outcomes for educational programs within participating institutions. These outcomes are designed to develop good engineers. Whether the engineer is destined for graduate school, industry, or government service, there is an agreed upon set of criteria widely known as ‘a through k’, referring to ABET criterion 3(a) – 3(k). A case in point can be found on The Boeing Company web site which offers this list of the “Desired Attributes of an Engineer” (2006):[3]

Desired Attributes of an Engineer

- A good understanding of engineering science fundamentals.
  - Mathematics (including statistics)
  - Physical and life sciences
  - Information technology (far more than "computer literacy")
- A good understanding of design and manufacturing processes.
  - (i.e., understands engineering)
- A multi-disciplinary, *systems* perspective.
- A basic understanding of the *context* in which engineering is practiced.
  - Economics (including business practices)
  - History
  - The environment
  - Customer and societal needs
- Good communication skills.
  - Written, oral, graphic and listening
- High ethical standards.
- An ability to think both critically and creatively-independently & cooperatively.
- Flexibility. The ability and self-confidence to adapt to rapid or major change.
- Curiosity and a desire to learn for life.
- A profound understanding of the importance of teamwork.

Two additional attributes were added to this list by Dr. John McMasters, a Technical Fellow at The Boeing Company. These additional attributes are: 1) Global awareness and 2) Knowledge of at least one language other than English.[3]

Desires of Three Diverse Constituencies

Stakeholders within a process exert pressure on the entire system to have their needs met. The needs must be documented and understood, then aligned, in order to have the differing constituencies feel that their individual needs are being met. The primary focus is on three major groups of constituents: the university, students, and employers. First, the University itself has needs. The faculty, administrators, and legislators (or other regulatory/funding bodies) have needs that stem primarily from the desire for a good image & reputation among the public & among peer institutions. The faculty may see themselves as educators and researchers, but also as keepers of the discipline. Prestige, while both personal and vicarious in nature, is also a common desire within the university. Research funding enhances faculty and program prestige and reputation as well as supplying the dollars needed to fund high quality students and research labs.

Next, the students (and possibly their parents) seem to desire a quality education commensurate with the tuition and other costs incurred. Basically, it is a value proposition where dollars and time are invested for the return of a good education. Expectations stem from the need for these stakeholders to have adequate preparation for a job, a career, or further studies. Students expect quick and painless preparation for a satisfying and rewarding career, which may conflict with faculty and employers who want the students to develop in-depth understanding of materials presented.

Finally, critical stakeholder groups also include other outside parties who depend on program outputs such as employers, graduate schools, or society-at-large. The expectation is that graduates (generally at the B.S. level) are well-prepared for the work for which they being hired at a salary close to the current market rate. In addition, employers desire "Just in Time" continuing educational services, conveniently available, in order to update the skills of employees. If the price is right, research results & technical consultation services with faculty and students are nice to have, but typically of lower importance to the employers.

McMasters and Cummings Alignment Model

As part of an informative article by McMasters & Cummings (2004) the authors created a model that describes the three-part linkage that exists in engineering education. By integrating the elements of this model into an assessment program, critical elements of program effectiveness can be addressed and improved.

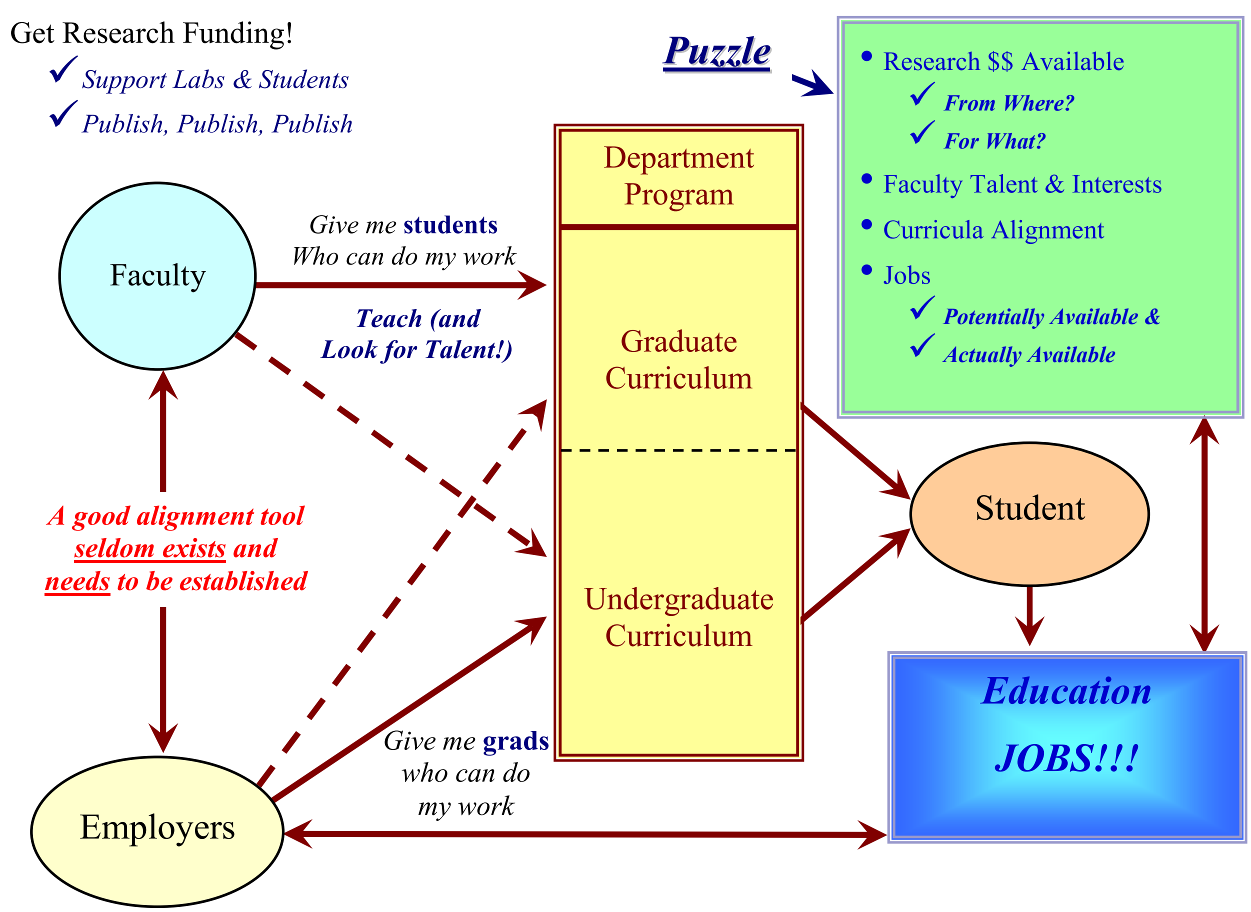

Figure 1. A Puzzle for Engineering Academe

(Source: *The BENT of Tau Beta Pi*, Summer 2004, *Used with permission of Dr. John H. McMasters*)[4]

Using the McMasters & Cummings model as a design tool, the TAMUC Industrial Engineering program has created a three-tier Assessment Model as shown in Figure 2. Program Educational Outcomes (PEOs), Industrial Engineering Educational Objectives (IEPOs), and Industrial Engineering Core Competencies (IECCs) are defined, assessed, evaluated, and modified to insure continuous process improvements within the program. These elements require a variety of assessment tools including surveys, in-class evaluations, peer-to-peer evaluations, employer surveys, and other related feedback vehicles.

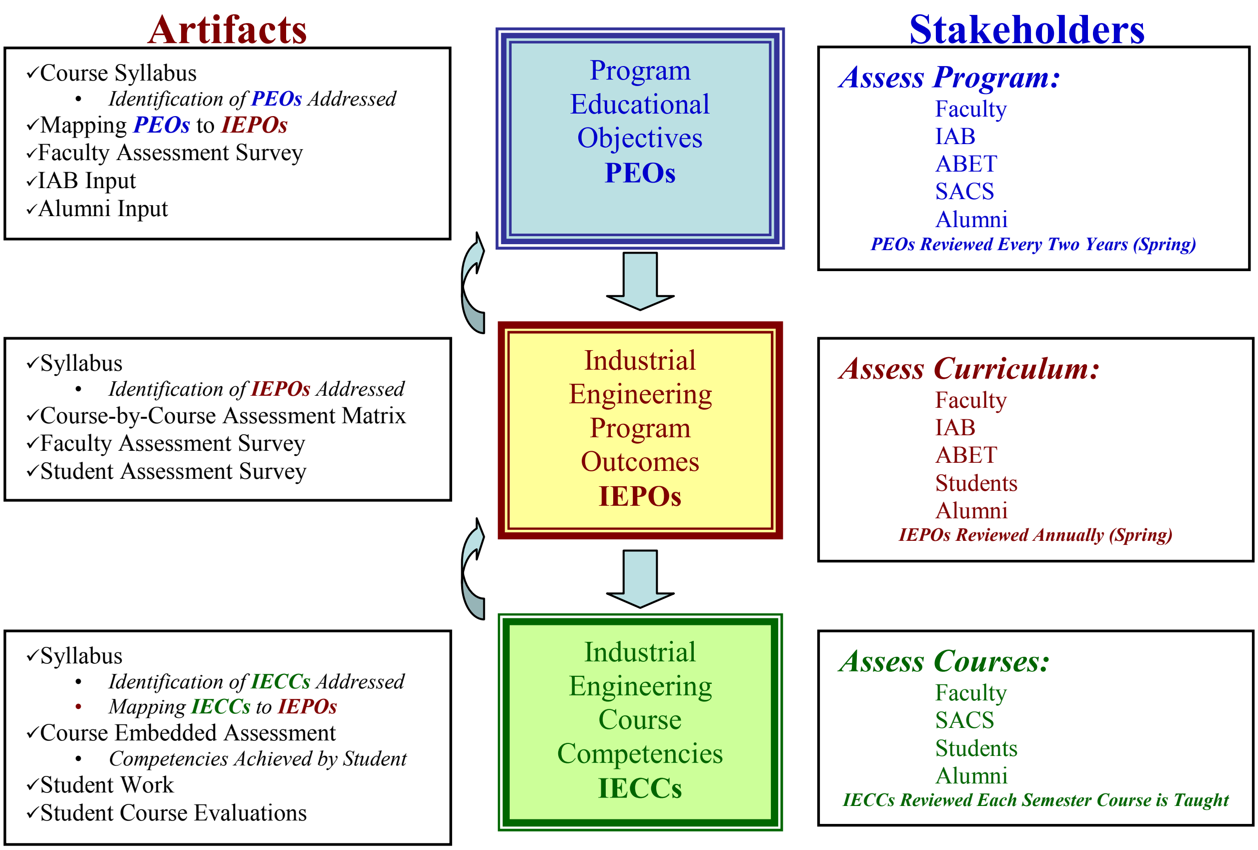

Figure 2. TAMUC Industrial Engineering Program Assessment Mapping Process

This process has proven to be an effective means of monitoring the status of engineering program outcomes, even though only eight students have graduated from the new IE program at Texas A&M University-Commerce. The most important part of this process has been the establishment of a performance baseline on which to base future assessment studies.

Summary and Conclusions

As a result of preparing the Self Study Report to support the EAC-ABET assessment process, the Industrial Engineering Program at Texas A&M University-Commerce has developed a thorough understanding of performance outcomes of our students and have restructured the IE curriculum to address the seven areas of concern, weaknesses, and deficiencies cited by the visiting team. These seven items are now being assessed as part of the Due Process methodologies embedded within the ABET accreditation process. Create and sustain an effective assessment model that satisfies the needs of accrediting agencies and other stakeholders, both internal and external. Satisfy stakeholder demands that lead to life-long learners in engineering to improve the quality of life for all of our citizens. These lofty goals are all achievable if we use the structure called for by accrediting agencies and use the continuous improvement cycle to improve each class, every time it is offered.

In short:

Employers, Industry Leaders, and Students Must be Included in the Improvement Dialogue
We Must Recognize that Life-Long Learning is an Essential Skill for our Students (*and for Us!*)
Changes in Technology will also Cause Changes in our Instructional Methodologies
We Must Continually Improve if We are to Succeed in a Globally Competitive Environment

We Must:

Listen to Our Constituents (*All of Them!*)
Establish Links with Employers and Industry Leaders
Encourage Life-Long Learning Among Students
Use Technology to Improve our Educational Methodologies by Working Smarter, Not Harder!
Learn from Others who are Doing it Better than We Are

References

1. Accreditation Board for Engineering and Technology Home Page. (2006). Deadlines and due dates. http://www.abet.org/deadline.shtml Retrieved March 8, 2006

2. Information for Programs Seeking Initial Accreditation. (2006). http://www.abet.org/new_program.shtml#Helpful%20Documents. Retrieved: January 17, 2006.

3. The Boeing Company. (2006) Desired attributes of an engineer. http://www.boeing.com/companyoffices/pwu/attributes/attributes.html Retrieved March 8, 2006.

4. McMasters, J.H. & Cummings, R. M. (Summer 2004) Challenges for education in aerospace for the 21st century. The BENT of Tau Beta Pi. Pp. 12-19.

5. Self-Study Report: Bachelor of Science Degree Program Industrial Engineering. (Spring 2005). Texas A&M University-Commerce: Department of Industrial Engineering & Technology.

6. Deadlines and Due Dates. (2006). http://www.abet.org/deadline.shtml. Retrieved: January 17, 2006.