ABET Accreditation Criteria Revision Process

EAC of ABET Proposed Revisions to General Criteria 3 and 5

NAE Forum
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Topics

- Who is ABET?
- ABET's Global Activities
- Basics of ABET Accreditation including:
  - Process
  - Criteria
  - Continuous Quality Improvement
- Criteria Change Proposal

Goal for NAE Forum Opening Session

ABET

Who Is ABET?

ABET Statement of Purpose

With ABET accreditation, students, employers, and the society we serve can be confident that a program meets the quality standards that produce graduates prepared to enter a global workforce

What Does ABET Accredit?

- An academic program leading to a specific degree in a specific discipline
- Misconceptions clarified:
  - Not institutions
  - Not schools, colleges, or departments
  - Not facilities, courses, or faculty
  - Not graduates
  - Not degrees

Accreditation in the U.S.

- Non-governmental
- Voluntary
- Peer review

Who Recognizes ABET?
In the U.S.

- 35 Member and Associate Member Societies of ABET
- Council for Higher Education Accreditation (CHEA)
- State Boards for Engineering & Surveying Licensure & Registration (over 55 jurisdictions)
- U.S. Patent Office
- U.S. Reserve Officers Training Corps
- Council of Engineering Specialty Boards (CESB)
- Board of Certified Safety Professionals (BCSP)
- Accreditors in other disciplines
- U.S. Trade Office
- U.S. State Department
- Employers (position announcements)

Brief ABET History

1932	Engineers' Council for Professional Development (ECPD) established
1936	ECPD first evaluated engineering degree programs
1980	Name changed to "Accreditation Board for Engineering and Technology" (ABET)
1980	Mutual Recognition Agreement (MRA) signed with Canada (1st international agreement)
1989	Washington Accord Agreement signed with Canada, UK, Ireland, Australia, and New Zealand
1994	Policies and Procedures for Substantial Equivalency evaluations (evaluations outside the U.S.) approved
1995-2000	Major criteria reform (Engineering Criteria 2000)
2005	Name changed to "ABET" solely, no longer spelling out the former name
2006	Substantial Equivalency discontinued
2007	Accreditation of programs outside the U.S. began
2008	Seoul Accord Agreement signed
2009	Sydney Accord Agreement signed
2011	IFEES, GEDC Membership
2013	Dublin Accord Agreement signed

ABET Organizational Design

- ABET is a federation of 35 professional and technical societies.
- Neither institutions nor individuals are members of ABET.
- ABET relies on the services of almost 2,200 volunteers supported by 33 full-time and 10 part-time staff.

ABET's 35 Member Societies

NCEES advancing licensure for engineers and surveyors

sme

BMES

AIChE

CSAB LEADING COMPUTING EDUCATION

SFPE

ASCE AMERICAN SOCIETY OF CIVIL ENGINEERS

AMERICAN ACADEMY OF ENVIRONMENTAL ENGINEERS & SCIENTISTS

SPIE.

IIE

SPE International

ASABE

AIAA

IEEE

National Institute of Ceramic Engineers (NICE)

AMERICAN NUCLEAR SOCIETY

ASSE

swe

NSPS

ASME SETTING THE STANDARD

INCOSE International Council on Systems Engineering

WEPAN

AIHA Protecting Worker Health

THE SOCIETY OF NAVAL ARCHITECTS & MARINE ENGINEERS

SAE INTERNATIONAL

ASHRAE

ISA

TMS

AAMI Advancing Safety in Medical Technology

National Society of Professional Engineers

SME Society for Mining, Metallurgy & Exploration

NACME NATIONAL ACTION COUNCIL FOR MINORITIES IN ENGINEERING

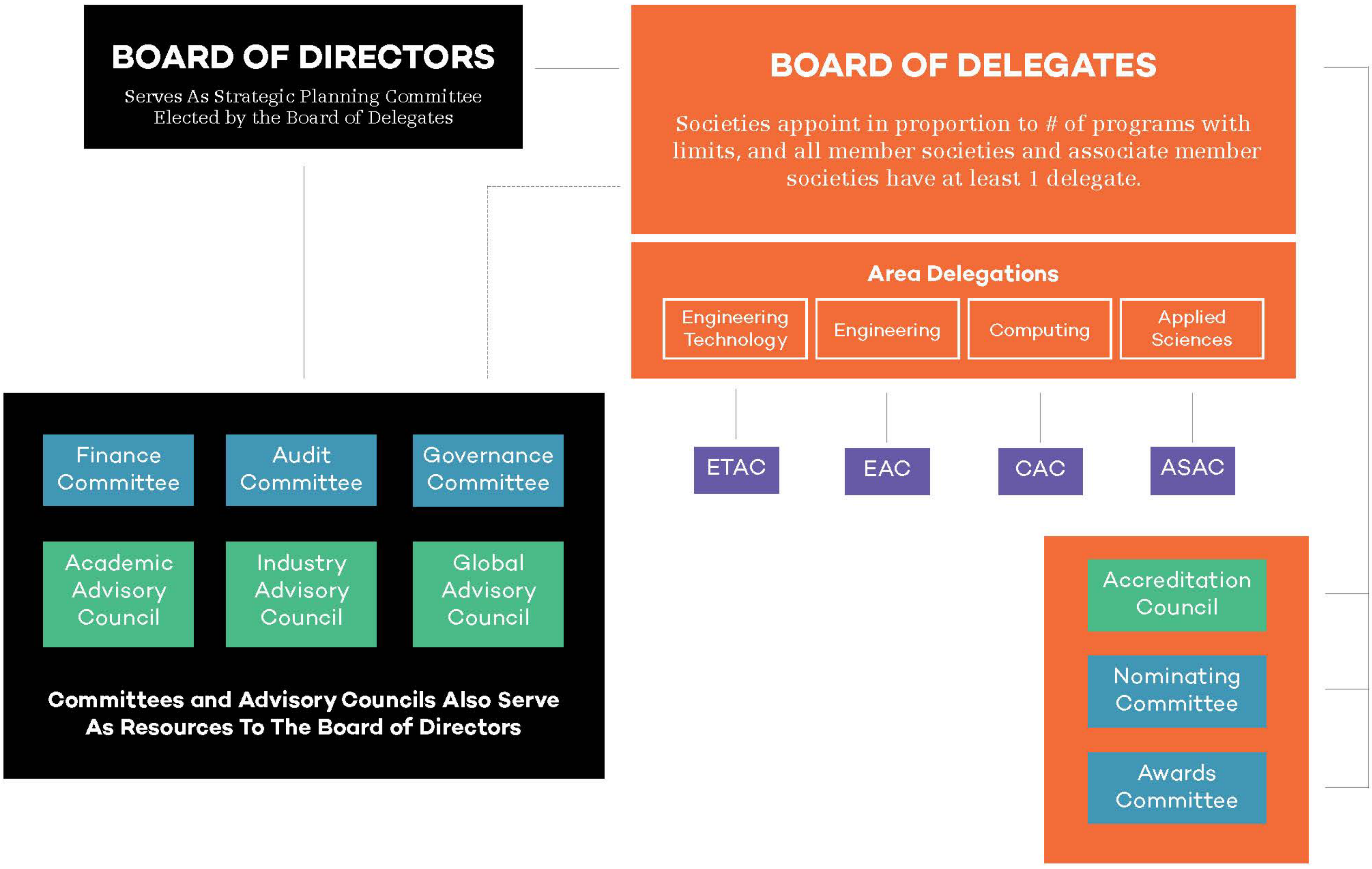
MRS Materials Research Society The Materials Gateway

CMAA

ASEE

Member Societies

- Represent “the profession”
  - Over 1.5 million individual members
- Develop program criteria
- Appoint Board of Delegates representatives
- Nominate commissioners
- Recruit and assign program evaluators


BOARD OF DIRECTORS
Serves As Strategic Planning Committee
Elected by the Board of Delegates
BOARD OF DELEGATES
Societies appoint in proportion to # of programs with limits, and all member societies and associate member societies have at least 1 delegate.
Area Delegations
Engineering Technology
Engineering
Computing
Applied Sciences
ETAC
EAC
CAC
ASAC
Finance Committee
Audit Committee
Governance Committee
Academic Advisory Council
Industry Advisory Council
Global Advisory Council
Committees and Advisory Councils Also Serve As Resources To The Board of Directors
Accreditation Council
Nominating Committee
Awards Committee

Organizational Structure
2,200+ Volunteer Experts

Board of Directors
- Elected by Board of Delegates
- Provide strategic direction and plans
- Appeals process

Board of Delegates
- Nominated by & represent the member societies
- Decide policy and procedures
- Approve criteria

4 Commissions
- ASAC, CAC, EAC, ETAC
- Make decisions on accreditation status
- Implement accreditation policies
- Propose changes to criteria

Program Evaluators
- Visit campuses
- Evaluate individual programs
- Make initial accreditation recommendations
- “Face of ABET”

100% of accreditation decisions are made by volunteer experts

ABET Accreditation Statistics
As of 1 October 2015 … 3,569 Programs

- Accredited programs by commission:

  ASAC: 81 CAC: 429

  EAC: 2437 ETAC: 640

Commission	Domestic		Non-Domestic	
	Programs	Institutions	Programs	Institutions
ASAC	80	62	1	1
CAC	377	296	52	35
EAC	2071	424	366	76
ETAC	581	204	59	12

Sources of ABET Funding

- ABET Member Societies
  - Costs associated with governance
- Institutions
  - Costs associated with accreditation
- Users (individuals, institutions, and societies) of professional services
  - Costs associated with workshops, symposia

ABET

ABET’s Global Engagement

ABET's Global Activities
Consistent with ABET's Constituents

- **Students/Young Professionals:** Increasingly multicultural and mobile
- **ABET Member Societies:** Nearly all have international membership/chapters
- **Higher Education:** Trend toward establishing international campuses, distance learning
- **Employers:** U.S. industry increasing its global presence

ABET Is Engaged Globally
Consistent with ABET's Positioning Statement

- Accredits programs outside the U.S.
- Assistance: MOUs with 17 agencies
- Mutual Recognition Agreements
  - Engineers Canada
  - International Engineering Alliance (IEA)
  - Seoul Accord
- Membership in Global Organizations
  - Global Engineering Deans Council (GEDC)
  - Intl Federation of Engineering Education Societies (IFEES)

Global Accreditation Activities
As of 1 October 2015

- Accredited **3,569** programs at **714** colleges and universities in **29** countries
- Non-U.S. Programs
  - Accredited **475** programs at **95** institutions in **28** countries
  - Uniform accreditation criteria, policies, and procedures used for all visits, <u>regardless of location</u>

ABET Accredited Programs

- Bahrain
- Chile
- China
- Colombia
- Ecuador
- Egypt
- Germany
- India
- Indonesia
- Jordan
- Kazakhstan
- Kuwait
- Lebanon
- Mexico
- Morocco
- Oman
- Palestine
- Peru
- Philippines
- Portugal
- Qatar
- Russian Federation
- Saudi Arabia
- Singapore
- South Africa
- Spain
- Turkey
- United Arab Emirates
- Vietnam
- USA

Basics of ABET Accreditation

Generally Accepted Accreditation Principles

- Non-governmental organization conducts accreditation (ABET)
- Accreditation is **voluntary**
- Fair and impartial process
- Requires self-assessment by the program and institution
- Continuous process (periodic, comprehensive reviews required)

Generally Accepted Accreditation Principles

- Fair and impartial peer-review process
  - Professional practitioners, educators on review teams
  - Uniform accreditation criteria, policies and procedures used for all visits, <u>regardless of location</u>
- Failure to meet a single standard results in loss of accreditation
  - Deficiencies in one area CANNOT be compensated by strengths in other areas
- Accredited programs meet the standards, but are not ranked

What Programs Does ABET Accredit?

- Academic program leading to a specific degree in a specific discipline
  - Assigned commission depends on program name
- Applied Science (ASAC): associate’s, bachelor’s, master’s
  - Examples: Health Physics, Industrial Hygiene, Industrial & Quality Management, Safety Sciences, Surveying & Mapping
- Computing (CAC): bachelor’s
  - Computer Science, Info Systems, Info Technology
- Engineering (EAC): bachelor’s, master’s
- Engineering Technology (ETAC): associate’s, bachelor’s

ABET Accreditation Process

ABET Accreditation Process
Objectives

- Assure that graduates of an accredited program are adequately prepared to enter and continue the practice of applied science, computing, engineering, and engineering technology
- Stimulate the improvement of technical education
- Encourage new and innovative approaches to technical education and its assessment

Program Name

- Determines:
  - Which ABET Accreditation Commission is responsible
    - ASAC, CAC, EAC, ETAC
  - Which professional society is responsible
    - Appropriate program evaluators
  - Which criteria are applicable
    - “General Criteria” for all programs
    - “Program Criteria” for certain disciplines

Basic Requirements

- Programs must have graduates
  - Institution must assess entire program
- Appropriate institutional accreditation or governmental approval
  - U.S. Department of Education, or
  - Regional accreditation agency, or
  - National accreditation agency, or
  - State authority
  - Outside the U.S.
    - Appropriate entity that authorizes/approves the offering of educational programs

ABET Accreditation Process
What Does It Involve?

- Criteria developed by member societies
- Programs prepare Self-Study Report for evaluation team
- Program review conducted by team of peer colleagues
  - Review the Self-Study Report, conduct the review visit
- ABET Program Evaluators (PEVs)
  - 2,200+ volunteer experts from academe, industry, and government (members of ABET Member Societies)
- Publication of lists of accredited programs
- Periodic re-evaluation (maximum 6 years)

Accreditation Timeline

18-21* Month Process

Year 1

November*
Readiness Review
(if required)

January
Institution requests
review of programs

February – May
Institution prepares
self-evaluation
(Program Self-Study
Report)

March – June
Team members
assigned, dates
set, Self-Study
Report submitted

September – December
Visits take place, draft
statements written and
finalized following
7-day response period

December – February
Draft statements edited
and sent to institutions

Year 2

February – April
Institutions respond
to draft statement
and return to ABET

May – June
Necessary changes
to statement,
if any, are made

July
Commission meets
to take final action

August
Institutions
notified
of final action

October
Accreditation status
publically released

Governing Documents Accreditation Process

- *ABET Criteria for Accrediting Programs in [ASAC, CAC, EAC, ETAC]*
  - Program Management
  - Assessment
  - Curriculum
  - Resources and Support
- *ABET Accreditation Policy and Procedure Manual [APPM]*
  - Eligibility for Accreditation
  - Conduct of Evaluations
  - Public Release of Information
  - Appeals

Criteria: The Guiding Principles of Accreditation Decisions

Overview of Criteria
Goals

- Ensure the quality of educational programs
- Foster the systematic pursuit of quality improvement in educational programs
- Develop educational programs that satisfy the needs of constituents in a dynamic and competitive environment

Engineering Criteria 2000 *(EC 2000)*

- Philosophy: "Outcomes-Based"
  - Institutions and programs define mission and objectives to meet their constituents' needs
  - Outcomes: preparation for professional practice
  - Demonstrate how criteria are being met
  - Wide national and international acceptance
- Commitment to Continuous Improvement
  - Process focus: outcomes and assessment linked to objectives; input from constituencies
- Student, faculty, facilities, institutional support, and financial resources linked to program objectives

ABET Accreditation Criteria

1) Students
2) Program Educational Objectives
3) Student Outcomes
4) Continuous Improvement
5) Curriculum
6) Faculty
7) Facilities
8) Support

\+ Program Criteria

Harmonization of Criteria

Criteria Common to All Commissions	Commission-Specific Criteria
Criterion 1 (Students)	
Criterion 2 (PEO)	
	Criterion 3 (Outcomes)
Criterion 4 (CQI)	
	Criterion 5 (Curriculum)
	Criterion 6 (Faculty)
Criterion 7 (Facilities)	
Criterion 8 (Support)	
	Program Criteria

Criterion 1
Students

Student performance must be evaluated.

Student progress must be monitored to foster success in attaining student outcomes.

Program must have and enforce policies for accepting both new and transfer students, awarding appropriate academic credit for courses taken at the institution and other institutions.

Program must have and enforce procedures to ensure and document that students who graduate meet all graduation requirements.

Criterion 2

Program Educational Objectives

The program must have published program educational objectives.

Consistent with the mission of the institution, the needs of the program's various constituents, and the criteria

There must be a documented, systematically utilized, and effective process, involving program constituencies, for the periodic review of these program educational objectives that ensures they remain consistent with the institutional mission, the program's constituents' needs, and these criteria.

EAC Criterion 3

Student Outcomes

The program must have documented student outcomes that prepare graduates to attain the program educational objectives.

Student outcomes are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.

a. an ability to apply knowledge of mathematics, science, and engineering
b. an ability to design and conduct experiments, as well as to analyze and interpret data

EAC Criterion 3

Student Outcomes 2

c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d. an ability to function on multidisciplinary teams
e. an ability to identify, formulate, and solve engineering problems
f. an understanding of professional and ethical responsibility
g. an ability to communicate effectively

EAC Criterion 3

Student Outcomes 3

h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i. a recognition of the need for, and an ability to engage in life-long learning
j. a knowledge of contemporary issues
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Criterion 4
Continuous Improvement

The program must regularly use appropriate, documented processes for assessing and evaluating the extent to which the student outcomes are being attained.

The results of these evaluations must be systematically utilized as input for the continuous improvement of the program. Other available information may also be used to assist in the continuous improvement of the program.

EAC Criterion 5
Curriculum

The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses.

The faculty must ensure that the program curriculum devotes adequate attention and time to each component, consistent with the outcomes and objectives of the program and institution.

EAC Criterion 5

Curriculum 2

The professional component must include:

a. one year of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline. Basic sciences are defined as biological, chemical, and physical sciences.

b. one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study.

EAC Criterion 5

Curriculum 3

The engineering sciences have their roots in mathematics and basic sciences but carry knowledge further toward creative application. These studies provide a bridge between mathematics and basic sciences on the one hand and engineering practice on the other.

Engineering design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs.

EAC Criterion 5

Curriculum 4

c. a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.

Students must be prepared for engineering practice through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple realistic constraints.

One year is the lesser of 32 semester hours (or equivalent) or one-fourth of the total credits required for graduation.

EAC Criterion 6

Faculty

The program must demonstrate that the faculty members are of sufficient number and they have the competencies to cover all of the curricular areas of the program.

There must be sufficient faculty to accommodate adequate levels of student-faculty interaction, student advising and counseling, university service activities, professional development, and interactions with industrial and professional practitioners, as well as employers of students.

EAC Criterion 6
Faculty 2

The program faculty must have appropriate qualifications and must have and demonstrate sufficient authority to ensure the proper guidance of the program and to develop and implement processes for the evaluation, assessment, and continuing improvement of the program.

The overall competence of the faculty may be judged by such factors as education, diversity of backgrounds, engineering experience, teaching effectiveness and experience, ability to communicate, enthusiasm for developing more effective programs, level of scholarship, participation in professional societies, and licensure as Professional Engineers.

Criterion 7
Facilities

Classrooms, offices, laboratories, and equipment must be adequate to support attainment of student outcomes and to provide an atmosphere conducive to learning.

Modern tools, equipment, computing resources, and labs must be available, accessible, and systematically maintained and upgraded to enable the student outcomes and to support program needs.

Students must be provided appropriate guidance regarding use of the tools, equipment, computing resources, and laboratories available to the program.

Library services and the computing and information infrastructure must be adequate to support the scholarly and professional activities of the students and faculty.

Criterion 8
Institutional Support

Institutional support and leadership must be adequate to ensure the quality and continuity of the program.

Institutional services, financial support, and staff (both administrative and technical) provided to the program must be adequate to meet program needs.

Resources available to the program must be sufficient to attract, retain, and provide for the continued professional development of a qualified faculty.

Resources must be sufficient to acquire, maintain, and operate infrastructures, facilities and equipment appropriate for the program, so that student outcomes can be attained.

Program Criteria

- Each program seeking accreditation from the Engineering Accreditation Commission of ABET must demonstrate that it satisfies all Program Criteria implied by the program title.

Revising ABET Criteria

Who May Propose Revisions? (1)

- Generally speaking, proposals for criteria changes (harmonized and non-harmonized) may come from any source
- ABET member societies will typically sponsor substantive changes to general or program criteria
- An accreditation commission itself may advocate for a change

Who May Propose Revisions? (2)

- Each of the four accreditation commissions has a standing committee known as the Criteria Committee
- All changes are deliberated upon by the commission's criteria committee and recommendations are proposed for action at a meeting of the full commission

What Happens to Proposals That Pass? (3)

- The commission sends a recommendation to the Area Delegation of the Board of Delegates for “first reading”
- The Area Delegation May:
  - reject the commission proposal
  - request additional consideration by the commission
  - approve the commission proposal and release the proposed criteria change for a period of public review and comment

What Happens Then? (4)

- Comments are aggregated and reviewed by the commission criteria committee
- All proposed changes are deliberated upon by the criteria committee and recommendations are proposed for action at a meeting of a full commission
  - the commission may or may not make changes to the original proposal based upon comments received

What Happens Then? (5)

- The commission will submit the (potentially edited/revised) criteria change proposal to the Area Delegation of the Board of Delegates for "second reading"

What Happens Then? (6)

- The Area Delegation May:
  - reject the commission proposal
  - request additional consideration by the commission or request an additional period of public review and comment
  - approve the commission proposal and direct that the approved criteria:
    - become effective during the next accreditation cycle or
    - be phased in over a suitable period to allow programs seeking accreditation to develop an implementation plan

Continuous Quality Improvement

Evolution of ABET Accreditation

- Philosophical Shift
  - “Inputs-based” to “outcomes-based”
- Outcomes-based
  - Institutions and programs define mission and objectives to meet needs of their constituents
    - Provides for program differentiation
  - Outcomes: preparation for professional practice
  - Programs demonstrate how criteria and educational objectives are being met
  - Wide national & international acceptance

ABET Created a Paradigm Shift

- ABET introduced a new philosophy
- The conscious intention was to:
  - spend ***less*** effort examining what students were taught
  - spend ***more*** effort assessing what students learned.

Catalysts for Change in the ‘90s

- Proliferation of Criteria
- Need for Innovation in Programs
- Prescriptive Nature of Criteria
- Industry Call for Change

Continuous Quality Improvement (CQI)

- ABET's outcomes based criteria have been developed on the principles of continuous quality improvement.
- On-going process at institutions to improve quality of students' educational experience
  - Systematic process: documented, repeatable
  - Assess performance against criteria
  - Take actions to improve program
- Accreditation is a **part** of CQI.
  - Verification that program meets certain level of quality, and CQI is part of the quality process.

Underlying Principle

- The process of accreditation is ***evidence-based*** and should drive decision-making to ensure excellence and enhance innovation in technical education.
- Evaluation centers on the ***<u>evidence</u>*** provided that supports achievement of each of the criterion
- Majority of evidence collected through **assessment** of student learning

Assessment

- The **systematic** collection, review, and use of information about educational programs undertaken for the purpose of **improving student learning and development**
- Integral to determining how well your program is meeting objectives
- Evidence collected through assessment used in:
  - Self-Study Report
  - Continuous Improvement Process

Assessment

- Effective assessment **uses relevant direct, indirect, quantitative and qualitative measures** as appropriate to the outcome or objective being measured
- Methods for gathering data include
  - Direct vs Indirect
  - Formative vs Summative
  - Objective vs Subjective
  - Embedded vs Add-on
  - Quantitative vs Qualitative

ABET Accreditation ISO9001:2008 Certified (CQI processes that “walk the walk”)

- CQI process includes a clear understanding of:
  - Mission (your purpose)
  - Constituents (your customers)
  - Objectives (what one is trying to achieve)
  - Outcomes (learning that takes place to meet objectives)
  - Processes (internal practices to achieve the outcome)
  - Facts (data collection)
  - Evaluation (interpretation of facts)
  - Action (change, improvement)

ABET “walks the walk” on CQI

- ABET continuously assesses its own processes
  - Processes are continually audited on a regular basis
- On-going assessment and evaluation to improve quality volunteer performance
  - Each volunteer expert’s performance evaluated for each program review
  - Performance assessed against published competency model
  - Commissions take actions to improve performance
- Ongoing process to monitor and track impact and efficacy of criteria changes.
  - Monitoring of shortcoming patterns
  - Input regularly sought from constituencies.

Proposed Criteria Revisions in Process

Rationale for Proposed C3/C5 Revision (1)

- In 2009, EAC Criteria Committee was completing harmonization of criteria across ABET's four commissions.
- The committee recognized that non-harmonized Criterion 3, Program Outcomes, had not been reviewed since its original formulation in the mid-1990s.
- EAC was receiving requests from constituent groups for additional outcomes to be included in Criterion 3.
- EAC leadership was aware that each year a substantial percentage of the shortcomings cited were associated with Criterion 3.

Rationale for Proposed C3/C5 Revision (2)

- In 2009 EAC convened a Criterion 3 task force to begin a review process.
- The task force developed a process for examining Criterion 3, including:
  - the identification of stakeholders and outreach to these groups
  - examination of the number of shortcomings associated with Criterion 3
  - review of correspondence received by ABET concerning Criterion 3
  - an in-depth literature review of desired attributes for engineers
  - development of several draft proposals for review to gather feedback from a broad range of constituents

Major Publication Review (1)

In addition to the communications from constituents, the task force reviewed several major publications concerning desired attributes of engineers. These publications included, but were not limited to the following:

- ABET publication (2006) *Engineering Change: A Study of the Impact of EC2000, Executive Summary*, 2006
- ASCE's *Civil Engineering Body of Knowledge for the 21st Century,* Second Edition, 2008
- ASME (2011). *ASME's Vision 2030 Reveals Workforce Development Needs*, American Society of Mechanical Engineers.
- The Roadmap to 21st Century Engineering from James J. Duderstadt, Engineering for a Changing World, Millennium Project, University of Michigan (also published in Thrive: The Skills Imperative by the Council on Competitiveness in 2008)

Major Publication Review (2)

- Hundley, S., Brown, L., Jacobs, A., Fox, P., Didion, C., Sayre, D., Hoyer, H., (2011). *Attributes of a Global Engineer: Findings from a Work-in-Progress International Survey*, American Society for Engineering Education, 2011. AC 2011-205
- International Engineering Alliance: Graduate Attributes and Professional Competencies; Comparisons of the Washington Accord (engineers), Sydney Accord (engineering technology), and Dublin Accord (engineering technicians), June 2009
- International Engineering Alliance: Graduate Attributes and Professional Competencies; Version 3, 21-June, 2013
- National Academies. (2010) *Rising Above the Gathering Storm, Revisited.* National Academies Press.
- National Academy of Engineering. (2005) "Educating the Engineer of 2020: Adapting Engineering Education to the New Century,"
- NSPE Position Statement No. 1752 on Engineering Education Outcomes, adopted in April 2010.

Rationale for Proposed C3/C5 Revision (3)

- The task force identified the following parties as potential stakeholders:
  - Domestic and non-domestic undergraduate engineering programs
  - Domestic and non-domestic graduate engineering programs
  - Employers of the graduates of domestic and non-domestic colleges and universities, including for example:
    - Private and public companies that hire engineering graduates
    - National research laboratories
    - Government research laboratories, Corps of Engineers
  - Boards of Professional Engineering Registration
  - Professional Societies

Rationale for Proposed C3/C5 Revision (4)

- The task force had membership representing:
  - domestic undergraduate and graduate engineering programs,
  - industry,
  - professional societies;
- In addition, efforts were made at that time, and continue to the present, to gain additional input from a broad range of constituents.

Rationale for Proposed C3/C5 Revision (5)

- The task force requested that the EAC survey program evaluators during the 2010-11 cycle regarding the elements of Criterion 3 that led to citations of shortcoming.
- Shortcomings were reported in all 11 of the (a)-(k) components of Criterion 3, mostly at the *weakness* or *concern* level.
- Data collected revealed that programs had the most difficulty determining the extent of outcome attainment with Criterion 3 elements:
  - 3(d) (ability to function on multidisciplinary teams),
  - 3(f) (understanding of professional and ethical responsibility),
  - 3(h) (a broad education to understand engineering solutions in global, economic, environmental, and societal context),
  - 3(i) (recognition of the need for and ability to engage in life-long learning)
  - 3(j) (knowledge of contemporary issues).

Rationale for Proposed C3/C5 Revision (6)

- The EAC undertook an outreach effort in 2012-13 to inform constituent groups that Criterion 3 was being reviewed and to solicit suggestions regarding changes.
- Some constituent groups independently informed the EAC that important outcomes were missing from the (a)-(k) list and they proposed additional outcomes.
- Communications with constituent groups took the form of email, letters, presentations, and position papers.
- Suggested additions to the list of outcomes brought the total to 75.

Rationale for Proposed C3/C5 Revision (7)

- Ongoing communication efforts include:
  - Presentations to ABET Industrial and Academic Advisory Councils in 2013 and 2015
  - Presentations by ABET staff at several professional society meetings in 2014 and 2015.
  - Inside Higher Ed update
  - ASEE Prism January 2016 display ad
  - Multiple issues of Catalyst (ABET e-newsletter)
  - NSPS PE Magazine (January/February 2016) issue
  - Major Dept Heads' meetings (ASCE, ASME, ECEDHA) in 2013, 2014, 2015
  - ASEE Annual Meeting in 2013, 2014, 2015
  - Prism “Last Word” letter by AAC authors in Mar 2014 issue.
  - Email blast to EAC institutional contacts in Fall 2014
  - Website description of WIP and portal for comment in Fall 2014
  - Report to ASEE Assoc Deans in 2014 and 2015
  - *Update* ticker on ABET website
  - In addition, a link on the ABET website was established so that constituents could provide comments directly.

Rationale for Proposed C3/C5 Revision (8)

- The Criterion 3 task force concluded that some of the (a)-(k) components were interdependent, broad and vague in scope.
- As a consequence, program evaluators were inconsistent in their interpretation of how well programs were complying with Criterion 3.

Rationale for Proposed C3/C5 Revision (9)

- Now, with information from a wide range of sources, the Criterion 3 task force evaluated the existing 3(a)-3(k) outcomes and those suggested by constituents, grouping them into six topic areas that would drive a possible major change to Criterion 3.
- This possible change would also serve to align ABET criteria more closely with Washington Accord graduate attributes referencing *project management* and *finance*
- The Criterion 3 task force presented their findings to the full EAC in July 2013
- At that time the work of the task force was transferred to the EAC Criteria Committee

Rationale for Proposed C3/C5 Revision (10)

- In July 2014, the EAC authorized the Criteria Committee to gain feedback on possible revisions to the Criteria prior to requesting approval upon first reading from the Board of Delegates
- Language articulating a potential revision to Criterion 3 was posted on the ABET website and circulated to constituent groups for informal comment in the fall of 2014
- More than 100 comments were received from individuals and organizations

Rationale for Proposed C3/C5 Revision (11)

Further EAC discussions in 2014-15 resulted in addition of a seventh topic area, now providing that the following topic areas would be addressed:

1) Engineering problem solving,
2) Engineering design,
3) Measurement, testing, and quality assurance,
4) Communication skills,
5) Professional responsibility,
6) Professional growth, and
7) Teamwork and project management

Rationale for Proposed C3/C5 Revision (12)

- With topic areas identified for a revised Criterion 3, the resulting language includes items that are considered more appropriately placed in Criterion 5, Curriculum
- As a result, revisions are also proposed to the language of Criterion 5.

Rationale for Proposed C3/C5 Revision (13)

- The EAC's Criteria Committee believes that all of the elements of the Criterion 3 that are applicable in 2015-16 are included in the proposed revisions to Criterion 3, Criterion 5, and Introduction section, along with some additional elements.
- Proposed changes are extensive in Criterion 3, and less so in Criterion 5.
- The proposed introductory section contains definitions that currently are embedded in Criterion 5; hence, the proposed Criterion 5 is shortened.
- ***The proposed changes are significant in configuration and grouping, but modest in content.***

The Revised Criteria (as proposed)

Proposed Revisions

INTRODUCTION

These criteria are intended to provide a framework of education that prepares graduates to enter the professional practice of engineering who are:

(i) able to participate in diverse multicultural workplaces;

(ii) knowledgeable in topics relevant to their discipline, such as usability, constructability, manufacturability and sustainability; and

(iii) cognizant of the global dimensions, risks, uncertainties, and other implications of their engineering solutions.

Proposed Revisions

- *Further, these criteria are intended to assure quality to foster the systematic pursuit of improvement in the quality of engineering education that satisfies the needs of constituencies in a dynamic and competitive environment. It is the responsibility of the institution seeking accreditation of an engineering program to demonstrate clearly that the program meets the following criteria.*

Proposed Revisions

- *The Engineering Accreditation Commission of ABET recognizes that its constituents may consider certain terms to have certain meanings; however, it is necessary for the Engineering Accreditation Commission to have consistent terminology. Thus, the Engineering Accreditation Commission will use the following definitions:*

Proposed Revisions

- *Basic Science – Basic sciences consist of chemistry and physics, and other biological, chemical, and physical sciences, including astronomy, biology, climatology, ecology, geology, meteorology, and oceanography.*
- *College-level Mathematics – College-level mathematics consists of mathematics above pre-calculus level.*

Proposed Revisions

- *<u>Engineering Science</u> – Engineering sciences are based on mathematics and basic sciences but carry knowledge further toward creative application needed to solve engineering problems.*
- *<u>Engineering Design</u> – Engineering design is the process of devising a system, component, or process to meet desired needs, specifications, codes, and standards within constraints such as health and safety, cost, ethics, policy, sustainability, constructability, and manufacturability. It is an iterative, creative, decision-making process in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally into solutions.*

Proposed Revisions

- *<u>Teams</u> – A team consists of more than one person working toward a common goal and may include individuals of diverse backgrounds, skills, and perspectives.*
- *<u>One Academic Year</u> – One academic year is the lesser of 32 semester credits (or equivalent) or one-fourth of the total credits required for graduation with a baccalaureate degree.*

Proposed Revisions

Criterion 3. Student Outcomes

The program must have documented student outcomes. Attainment of these outcomes prepares graduates to enter the professional practice of engineering.

Student outcomes are outcomes (1) through (7) plus any additional outcomes that may be articulated by the program.

1. *An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.*
2. *An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.*
3. *An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.*

Proposed Revisions

Criterion 3. Student Outcomes (cont'd)

4. *An ability to communicate effectively with a range of audiences.*
5. *An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.*
6. *An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.*
7. *An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.*

Proposed Revisions

Criterion 5. Curriculum

The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The curriculum must support attainment of the student outcomes and must include:

a. *one academic year of a combination of college-level mathematics and basic sciences (some with experimental experience) appropriate to the program.*
b. *one and one-half academic years of engineering topics, consisting of engineering sciences and engineering design appropriate to the program and utilizing modern engineering tools.*
c. *a broad education component that includes humanities and social sciences, complements the technical content of the curriculum, and is consistent with the program educational objectives.*

Students must be prepared to enter the professional practice of engineering through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple constraints.

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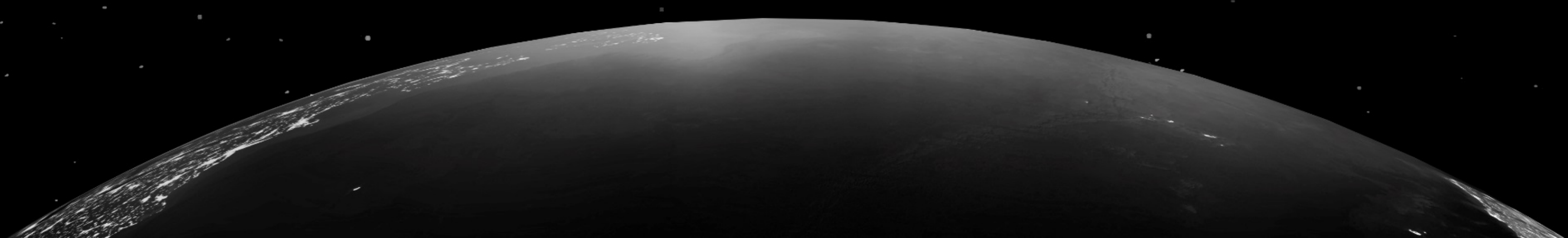
PROPOSED C3/C5 REVISIONS

Criteria for Accrediting Engineering Programs



3 a An ability to apply knowledge of mathematics, science, and engineering.

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.

2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.

3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

4. An ability to communicate effectively with a range of audiences.

5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.

7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

3 b An ability to design and conduct experiments, as well as to analyze and interpret data.

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.

2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.

3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

4. An ability to communicate effectively with a range of audiences.

5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.

7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

3 C

An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.

2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.

3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

4. An ability to communicate effectively with a range of audiences.

5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.

7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

3 d

An ability to function on multidisciplinary teams.

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.

2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.

3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

4. An ability to communicate effectively with a range of audiences.

5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.

7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

3 e An ability to identify, formulate, and solve engineering problems.

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.

2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.

3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

4. An ability to communicate effectively with a range of audiences.

5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.

7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

3 f An understanding of professional and ethical responsibility.

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.

2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.

3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

4. An ability to communicate effectively with a range of audiences.

5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.

7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

3 g

An ability to communicate effectively.

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.

2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.

3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

4. An ability to communicate effectively with a range of audiences.

5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.

7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

3 h The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.

2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.

3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

4. An ability to communicate effectively with a range of audiences.

5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.

7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

3 i

A recognition of the need for, and an ability to engage in life-long learning.

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
4. An ability to communicate effectively with a range of audiences.
5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.
7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

3 j

A knowledge of contemporary issues.

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
4. An ability to communicate effectively with a range of audiences.
5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.
7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

3k An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
4. An ability to communicate effectively with a range of audiences.
5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.
7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

(Washington Accord - Graduate attributes)

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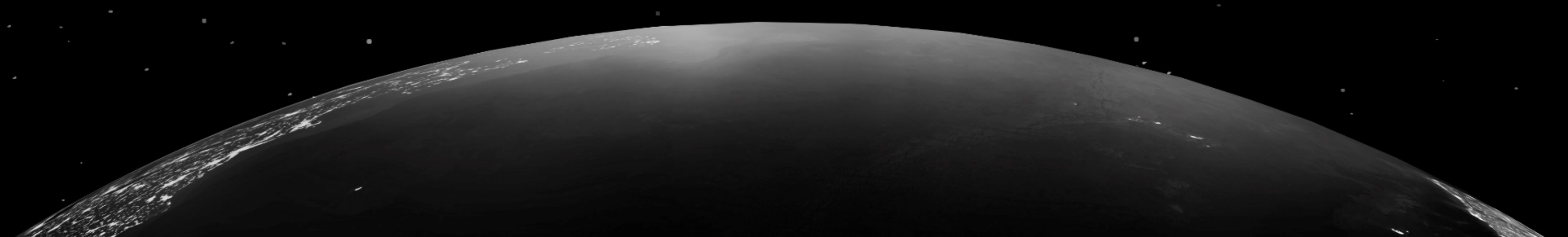
CRITERION 5

Curriculum



5

The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The faculty must ensure that the program curriculum devotes adequate attention and time to each component, consistent with the outcomes and objectives of the program and institution. The professional component must include:

The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The curriculum must support attainment of the student outcomes and must include:

(a) one academic year of a combination of college-level mathematics and basic sciences (some with experimental experience) appropriate to the program.

(b) one and one-half academic years of engineering topics, consisting of engineering sciences and engineering design appropriate to the program and utilizing modern engineering tools.

(c) a broad education component that includes humanities and social sciences, complements the technical content of the curriculum, and is consistent with the program educational objectives.

Students must be prepared to enter the professional practice of engineering through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple constraints.

5

(a) one year of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline. Basic sciences are defined as biological, chemical, and physical sciences.

The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The curriculum must support attainment of the student outcomes and must include:

(a) one academic year of a combination of college-level mathematics and basic sciences (some with experimental experience) appropriate to the program.

(b) one and one-half academic years of engineering topics, consisting of engineering sciences and engineering design appropriate to the program and utilizing modern engineering tools.

(c) a broad education component that includes humanities and social sciences, complements the technical content of the curriculum, and is consistent with the program educational objectives.

Students must be prepared to enter the professional practice of engineering through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple constraints.

5

(b) one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study. The engineering sciences have their roots in mathematics and basic sciences but carry knowledge further toward creative application. These studies provide a bridge between mathematics and basic sciences on the one hand and engineering practice on the other. Engineering design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs.

The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The curriculum must support attainment of the student outcomes and must include:
(a) one academic year of a combination of college-level mathematics and basic sciences (some with experimental experience) appropriate to the program.
(b) one and one-half academic years of engineering topics, consisting of engineering sciences and engineering design appropriate to the program and utilizing modern engineering tools.
(c) a broad education component that includes humanities and social sciences, complements the technical content of the curriculum, and is consistent with the program educational objectives.
Students must be prepared to enter the professional practice of engineering through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple constraints.

5

(c) a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.

The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The curriculum must support attainment of the student outcomes and must include:

(a) one academic year of a combination of college-level mathematics and basic sciences (some with experimental experience) appropriate to the program.

(b) one and one-half academic years of engineering topics, consisting of engineering sciences and engineering design appropriate to the program and utilizing modern engineering tools.

(c) a broad education component that includes humanities and social sciences, complements the technical content of the curriculum, and is consistent with the program educational objectives.

Students must be prepared to enter the professional practice of engineering through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple constraints.

5

Students must be prepared for engineering practice through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple realistic constraints. One year is the lesser of 32 semester hours (or equivalent) or one-fourth of the total credits required for graduation.

The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The curriculum must support attainment of the student outcomes and must include:
(a) one academic year of a combination of college-level mathematics and basic sciences (some with experimental experience) appropriate to the program.
(b) one and one-half academic years of engineering topics, consisting of engineering sciences and engineering design appropriate to the program and utilizing modern engineering tools.
(c) a broad education component that includes humanities and social sciences, complements the technical content of the curriculum, and is consistent with the program educational objectives.
Students must be prepared to enter the professional practice of engineering through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple constraints.

Next Steps

- The EAC recognizes that programs must reconfigure assessment tools and practices to map course content to the proposed organizational structure of Criterion 3 and to a lesser extent of Criterion 5.
- Because of the magnitude of change that has been proposed, a phase-in period for compliance following adoption of the proposed changes would be reasonable and appropriate
- Based on feedback received and the recommendation of the EAC, the Engineering Area Delegation may decide to extend the review and comment period for one additional year.
- Likewise, due to the breadth and complexity of the proposed changes and the impact to programs demonstrating compliance with Criteria, a phase-in implementation period may be recommended by the EAC to the Engineering Area Delegation.

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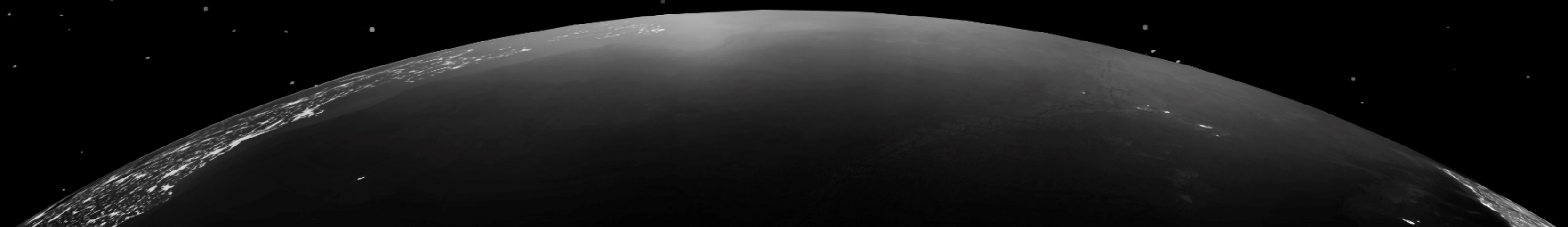
THANK YOU



Questions?

ABET Website Portal for Comment

http://www.abet.org/news/abet-releases-criteria-proposal-for-public-comment/

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