

ABET and IEEE: A History Intertwined

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In 1932, IEEE's predecessor, the American Institute of Electrical Engineers, and six other engineering organizations founded the Engineers' Council for Professional Development (ECPD). The ECPD had a mission to establish training plans for personal and professional development, devise methods whereby engineers could achieve recognition from their profession and the public, recognize engineering curricula that met specific standards and maintain a list of accredited curricula, and provide guidance for engineering students. That organization was the predecessor to the present-day ABET, which continues some of that mission today.

Since that founding more than 77 years ago, the American Institute of Electrical Engineers and now IEEE have been intimately intertwined in the ECPD's and ABET's history. This paper addresses how AIEE/IEEE, as a Founding Society, has had impact on ABET and how this partnership has sustained the quality of engineering, technology, and computing programs since the ECPD's inception almost 80 years ago.

In the Beginning

Between 1923 and 1929, the Society for the Promotion of Engineering Education (now the American Society for Engineering Education) conducted a major study about engineering education in the United States. The resulting two-volume report, *A Comparative Study of Engineering Education in the United States and in Europe* by William E. Wickenden, called for the creation of "an organization to set standards for engineering education programs and to conduct reviews of programs for compliance with these standards [1]." This charge was realized in 1932 when the Engineers' Council for Professional Development was chartered as "a conference body organized to enhance the professional status of the engineer through the co-operative support of those national

organizations directly representing the professional, technical, educational, and legislative phases of an engineer's life [2]."

The seven Founder Societies included the following:

- The American Institute of Chemical Engineers
- The American Institute of Electrical Engineers (now IEEE)
- The American Institute of Mining and Metallurgical Engineers (now divided into four societies – the Society for Mining, Metallurgy, and Exploration; the Society of Petroleum Engineers; the Minerals, Metals, and Materials Society; and the Association for Iron and Steel Technology)
- The American Society of Civil Engineers
- The American Society of Mechanical Engineers
- The National Council of Engineering Examiners (now the National Council of Examiners for Engineering and Surveying)
- The Society for the Promotion of Engineering Education (now the American Society for Engineering Education)

Each of these "participating bodies," as they were called at the time, provided three volunteer representatives to participate in the ECPD's ongoing programs. The first three AIEE representatives were American Telephone & Telegraph Company Assistant Vice-President **C.O. Bickelhaupt**, future ECPD Chairman **Charles F. Scott** of Yale University, and *Electrical World* Editor **L.W.W. Morrow** [3].

The original home of the ECPD was the Engineering Societies' Building, located at 29 West 39th Street in New York City. Charles F. Scott, a former president of AIEE, had been advocating for greater cooperation among engineering societies since the beginning of the 20th century. It was he who persuaded the

philanthropist Andrew Carnegie to donate the funds to construct this 13-story building, which was completed in 1906. AIEE had long been a tenant when the ECPD joined several of its Founder Societies at this address [4]. Both the ECPD and AIEE, as well as four of the other ECPD Founder Societies, moved to the United Engineering Center at 345 East 47th Street in New York City in 1960 and shared this location until they moved to their current locations during the mid-1990s [5], [6].

Scott was instrumental in helping to introduce the first ECPD accreditation criteria in 1932 and saw the first evaluation visits conducted in 1935, during his term as the ECPD's second Chairman (the equivalent of ABET's president today) [7]. In 1936, the ECPD published its first list of accredited programs with 35 institutions in 14 engineering fields, including electrical engineering. By October of the next year, that list had expanded to 107 engineering schools [8].

In 1940, 21 technical institutes came to the ECPD and petitioned for accreditation such as the kind that existed for engineering programs. As a result, the Subcommittee on Technical Institutes was formed, and the first "List of Accredited Programs of Technical Institute Type" was published in the ECPD's 1946 Annual Report. Among the seven programs that were accredited during this preliminary period were four related to the areas of electrical or radio technology – the Fundamentals of Industrial Electrical Engineering at Bliss Electrical School in Washington, DC, a Residence Course and a Correspondence Course in Practical Radio Engineering at Capitol Radio Engineering Institute in Washington, DC, and an Electrical Construction program at Wentworth Institute in Boston [9].

AIEE/IEEE Leadership Within ABET

Since the ECPD/ABET's founding, AIEE and IEEE have provided some of the organization's most dynamic leaders, including presidents, executive directors, and other leaders who have a profound effect on ECPD/ABET over the years.

Chairmen and Presidents

The ECPD and ABET have always been driven by the vision and efforts of the volunteers from the organizations' member societies. One volunteer who has immense influence on the Board of Directors and, therefore, the organization's direction as a whole is the Chairman, as this individual was called the mid-1950s, or the President, as he or she has been known since then. ECPD/ABET has had 47 of these leaders, each serving a one- to three-year term. Ten of the individuals, more than a fifth of the ECPD/ABET's Past Presidents, who have ascended the ranks to this position were members of AIEE or IEEE:

- **Charles F. Scott** (1935-38) – The AIEE president from 1902 to 1903 [10] and a great advocate for the construction of the Engineering Societies' Building [4], this second ECPD Chairman saw the first accreditation visits during his term. He spent 23 years with the Westinghouse Electric and Manufacturing Company in Pittsburgh before becoming a professor and Head of the Electrical Engineering Program of the Sheffield Scientific School at Yale University [7].
- **Everett S. Lee** (1943-46) – An engineer with the General Electric Company in Schenectady, NY [11], Lee followed up his service with the ECPD as the president of AIEE from 1948 to 1949 [12]. During his term as the ECPD's fifth Chairman, the "Faith of the Engineer" appeared in ECPD literature for the first time [11]. In addition, an inclusive study about the status of education at technical institutes was conducted, and accreditation of programs at such schools began in 1946 [9].
- **Morris D. Hooven** (1956-58) – Hooven served as AIEE president from 1955 to 1956 [12], immediately prior to becoming the tenth Chairman of the ECPD. His professional career included work in the laboratories of the Carnegie Steel Company, as a member of the newly formed radio engineering staff at Westinghouse, and in a series of technical and management positions for the Public Service Electric Company in Newark, NJ [13]. Under his two-year term, the definition of "engineering" first appeared in the ECPD's literature [14].

- **W. Scott Hill** (1963-65) – Hill, who was a professional with General Electric in New York City during his presidential term, saw the first proposals regarding the constituent societies submitting the discipline-specific guidelines then known as “Additional Criteria [15].” Furthermore, he was in office when the ECPD Council’s name was changed to the Board of Directors [16].
- **Ernst Weber** (1968-70) – An electrical engineering professor at and eventual president of Polytechnic University in Brooklyn, NY, Weber served as the first president of IEEE following the merger of AIEE and the Institute of Radio Engineers [17]. Under Weber’s ECPD presidential term, criteria for four-year technology programs were developed in response to the increasing number of technology baccalaureate programs, and accreditation of graduate programs was approved. Weber also chaired the Joint Advisory Committee on Continuing Engineering Studies and issued a report about the importance of lifelong learning [18].
- **Edward W. Ernst** (1989-90) – During Ernst’s term as ABET’s 28th President, the organization’s Industry Advisory Council was established to help obtain an overview from the top ranks of all industry. In addition, the Washington Accord, a mutual recognition agreement among six bodies responsible for accrediting engineering degree programs, was signed [19]. Ernst was a faculty member in the Department of Electrical and Computer Engineering at the University of Illinois at Urbana-Champaign and later served as the Allied Signal Professor of Engineering at the University of South Carolina [20].
- **Jerrier A. Haddad** (1994-95) – An independent consultant by the time he became ABET’s 33rd President, Haddad’s term included the relocation of ABET headquarters from the United Engineering Center in New York City to the Candler Building in Baltimore. Furthermore, ABET conducted a study about the feasibility of establishing a credentialing evaluation service that evolved into Engineering Credentials Evaluation International [21].
- **Eleanor Baum** (1997-98) – Baum is the first woman to ever serve as dean of an engineering school in the United States, at the Cooper Union in New York City, and only the second woman to serve as ABET President. Baum signed the agreement that integrated the services of CSAB and ABET in 1998 and served as ABET President during pilot studies for outcomes-based engineering criteria. She went on to chair the Washington Accord from 1999 to 2001 [22].
- **Jerry R. Yeargan** (2001-02) – Under Yeargan’s presidential term, the ABET Accreditation Council was formed to unite the leadership of the four ABET Commissions so that they can share successful practices, seek common solutions to pressing accreditation issues, and develop consistent approaches to accreditation across all commissions. In addition, the longitudinal study to evaluate the impact of outcomes-based assessment – eventually titled *EngineeringChange* – commenced, and ABET signed the Western Hemisphere Initiative to help nations in Latin America and the Caribbean develop quality assurance systems [23]. Yeargan is the Head of the Department of Computer Science and Computer Engineering at the University of Arkansas.
- **William S. Clark** (2006-07) – During the 1990s, Clark was instrumental in writing *TC2K*, the first outcomes-based technology criteria. Having served as the 1994-95 Chair of the Technology Accreditation Commission, Clark was the first ABET President to ascend the volunteer ranks outside of the Engineering Accreditation Commission. Clark spent nearly his entire career with BellSouth and its subsidiaries, largely in the network organization in various engineering and technical management positions and later as a Director of Finance.

Executive Directors

David Reyes-Guerra, Ph.D., P.E., a member of the American Society of Civil Engineers, served as the ECPD's Guidance Director from 1967 to 1970 and then as the organization's Executive Secretary from 1971 to 1973. It was in that year that he became the ECPD/ABET's first Executive Director. Reyes-Guerra held this position from 1973 until 1993, when injuries sustained in a plane crash led to his early retirement.

His successor was **George D. Peterson, Ph.D., P.E.** Prior to accepting the position of Executive Director, Peterson had served as an ABET evaluator for electrical engineering programs, as a member of the Engineering Accreditation Commission, and as chair of the commission from 1991 to 1992. In addition, he had been inducted as a Fellow of IEEE, having served on the IEEE Educational Activities Board's Committee on Engineering Accreditation Activities and won the 1990 IEEE Meritorious Achievement Award in accreditation activities.

Before joining the ABET headquarters staff, Peterson served as Head of the Faculty and Teacher Development of the Division of Undergraduate Education and the Program Director in the Undergraduate Science, Engineering, and Mathematics Education Division at the National Science Foundation in Washington, DC. He had also been the Chairman of the Department of Electrical Engineering at the U.S. Naval Academy and the Assistant Vice President for Academic Affairs and Professor of Electrical Engineering at Morgan State University.

Peterson was one of the driving forces behind the advent of outcomes-based accreditation for technical programs, as well as for the longitudinal study to evaluate its impact on graduates entering the workforce, *EngineeringChange*. He helped to transition ABET from the practice of conducting substantial equivalency evaluations of non-domestic programs to its current model for international accreditation activities. Also, Peterson has guided ABET as it has furthered international agreements, such as the Washington Accord for engineering disciplines, and worked to found new

agreements, such as the Seoul Accord for computing disciplines. In doing so, he has successfully introduced ABET as a worldwide quality assurance brand. Peterson served as Executive Director from 1993 to 2008, when he assumed the newly created position of Managing Director for International Business Development.

On June 1, 2009, **Michael K.J. Milligan, Ph.D., P.E.**, became ABET's third Executive Director. A Senior Member of IEEE, Milligan had been an ABET program evaluator for electrical engineering programs. He had also been a senior member of the accreditation team preparing for an ABET visit to the United States Air Force Academy, where he had served as the Deputy Department Head and Associate Professor in the Department of Electrical Engineering.

Immediately prior to accepting the position of ABET Executive Director, Milligan led an aerospace corporation team that assisted in the development of an environmental satellite for the National Oceanic and Atmospheric Administration at NASA Goddard Space Flight Center. He had managed three major international research portfolios for the U.S. Air Force (USAF), involving radio frequency technology, space weather, and superconductivity, and served as program manager and lead engineer on the \$290 million USAF AWACS Computer Modernization Program (Airborne Warning and Control System). During this time, he led a 23-member USAF team and acted as a liaison to the British, French, NATO, and Saudi programs.

IEEE Leadership in ABET Criteria Reform

In the mid-1980s, the Engineering Accreditation Commission was taking notice of, and receiving a great deal of criticism about, how many "good" programs were just not quite meeting the minimum standard for the number of engineering design credits. IEEE was responsible for many of these programs, which were often high in science and engineering science content yet low in engineering design. **Harriett B. Rigas**, the Chair of Electrical and Computer Engineering at the Naval Postgraduate

School in Monterey, California, and an EAC commissioner during this time, had been talking to her fellow IEEE volunteer and future ABET president **Edward W. Ernst** and presented the idea that the Engineering Science and Engineering Design categories should be combined into a new category called “Engineering Topics.” It was changes like this one that, “looking more for quality than for procedure [24],” that made *Engineering Criteria 2000* a possibility a decade later.

During the mid-1990s, the ABET community – including the organization’s leadership, its societies, the Engineering Accreditation Commission, and the engineering community as a whole – came together to develop outcomes-based assessment. This revolutionary approach to evaluations moved ABET away from the excessively long, prescriptive, and detailed criteria that had developed over the past decades to criteria that made far fewer specifications about curricular content. Instead, this new criteria, which came to be known as *Engineering Criteria 2000* or simply *EC2000*, placed a stronger emphasis on developing learning outcomes, the knowledge and skills that students should acquire by the time of graduation, and on defining program objectives, the desired achievements of graduates [25].

Once *Engineering Criteria 2000* had been developed, ABET was faced with the challenges of disseminating this information to the entire engineering education community and preparing engineering faculty and administrators for this radical paradigm shift. The primary responsibility for this fell to a group that has become known as “The Gang of Six.” This committee included three volunteers from IEEE, all of whom eventually served as Chair of the Engineering Accreditation Commission – future ABET Adjunct Accreditation Director for Engineering **M. Dayne Aldridge** (1997-98 EAC Chair), **Edward A. Parrish** (1995-96 EAC Chair), and future ABET Executive Director **George D. Peterson** (1991-92 EAC Chair). “The Gang of Six” was tasked with figuring out how to propagate these new criteria, and they applied for a National Science Foundation grant that enabled ABET to hold 12 regional faculty workshops

over a three-year period. This approach was deemed so effective that it was repeated when the Technology Accreditation Commission introduced outcomes-based assessment the following decade.

A Broadening Scope

As IEEE’s scope has continually expanded with emerging technologies, ABET has welcomed new fields under IEEE’s purview. A primary example is when CSAB, Inc., became a member society of ABET in 2001. CSAB, Inc., was founded as the Computing Sciences Accreditation Board in 1985 as a federation of the three largest technical, educational, and scientific societies in the computer and computer-related fields – the Association for Computing Machinery, Inc.; the IEEE Computer Society; and the Association for Information Systems. CSAB continues to operate as an umbrella organization for its professional societies. However, ABET assumed the accreditation responsibilities for computer science programs through the Computing Accreditation Commission (CAC), composed entirely of volunteers representing CSAB and with many coming from the IEEE Computer Society [26].

Since the CAC began, the commission has grown significantly within ABET. CAC began evaluating programs in the fall of 2001 [26], and there were 179 accredited computing programs by the end of the 2001-2002 accreditation cycle [27]. By the end of the 2004-2005 accreditation cycle, that number had grown to 240 [28]. As of 2008, 312 bachelor’s programs were CAC-accredited. These include new fields, such as information systems and information technology, that are coming under ABET’s purview. Computer science is now among the top five program areas that ABET accredits [29].

ABET and IEEE Today

Today, IEEE is ABET’s largest member society and oversees more programs than any other ABET member society. IEEE has responsibility for programs in the areas of computer engineering and technology (287 accredited programs), electrical/electronic(s) engineering and technology (523 accredited programs), electromechanical technology (10 accredited programs), information engineering technology

(curriculum but no accredited programs at this time), and telecommunications technology (7 accredited programs) [29], [30].

Currently, IEEE has three representative directors, the maximum allowed from a single society, on the ABET Board of Directors. The individuals who currently serve in this capacity have been leaders both within ABET and IEEE:

- A former Arthur J. Rowland Professor of Electrical & Computer Engineering at Drexel University, **Bruce A. Eisenstein, Ph.D., P.E.**, is now an independent consultant specializing in siting cellular telecommunications towers and antennas and a consultant and expert witness in the areas of intellectual property, business opportunities, and product liability. He served as IEEE's President for 2000 [31].
- **Moshe Kam, Ph.D., P.E.**, is the Department Head of Electrical and Computer Engineering at Drexel University. He has served IEEE as Vice

President for Educational Activities and as Director of Region 2 [32].

- **Michael R. Lightner, Ph.D.**, is a Professor of Electrical and Computer Engineering in the College of Engineering and Applied Science at the University of Colorado at Boulder. A Fellow of IEEE, he served as that organization's president in 2006 [33], [34].

Over the past 77 years, IEEE has helped to found and improve technical accreditation processes in the United States, provide some of ECPD and ABET's most dynamic leadership, and shape the curriculum for engineering and technology for decades. There is no doubt that ABET and IEEE will benefit mutually from this partnership as both organizations look to improve technical education and professions for generations to come.

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