

SME and Accreditation

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Purpose: This paper is written to advocate that the Society of Manufacturing Engineers take and maintain a position of strong support for and participation in the accreditation by ABETⁱ of engineering, engineering technology and applied science programs at colleges and universities. The paper begins with a discussion of accreditation, its objectives and breadth. Then, the linkage of professionalism of engineers and engineering societies to the academic foundations of the various disciplines is described. Some observations are offered on the history of accredited programs in manufacturing, as related to the level of SME activity in their support. Finally, some alternatives are explored, suggesting policy directions that could be elected by SME, along with probable outcomes from those policy options.

The author gratefully acknowledges the contributions and assistance of colleagues amongst SME members and staff, as well as from other professions and societal affiliations. The genesis of this document lies within the meetings of the SME Accreditation Committee, where the issue has been carefully and thoroughly examined on several occasions over the past decade and a half. Notable among the individuals who have been effective in supporting this document are Mark J. Stratton, Carl Williams, Wilbur Meier, Robert L. Mott, John Lorenz, Gary Conkol, Lewis Bellinger and Venkitaswami Raju of SME, George Peterson and Daniel Hodge of ABET, and Michael Bisesi and Dennis George of AIHAⁱⁱ. Their role, however, has been one of providing data or historical references or of sharing ideas, observations, experiences and encouragement on the subject. The views expressed in this paper are the sole responsibility of the author.

The Concept of Accreditation: The notion of maintaining a measure of oversight of the quality of preparation for new practitioners is common to virtually all professions. The process through which quality of professional postsecondary education is assured is 'accreditation'. In the United States, accreditation is a private, non-governmental process, managed and maintained by peers. In every case, the primary professional organization assumes responsibility -- American Medical Association for the preparation of new physicians, American Bar Association for the preparation of new attorneys, and so forth. For the past seventy-five years, oversight of the preparation of new engineers and allied professionals has been vested in ABET and its predecessors -- and it has long been so-chartered by the Council for Higher Education Accreditation and its predecessors.

ABET subdivides the essential oversight. There are both general accreditation criteria to which all engineering disciplines are held, and program criteria, where the disciplinary societies, who are the ABET members, interpret the general language into the specifics relevant to their disciplines.

In the United States, unlike many other countries, accreditation is voluntary. While there are certain marketplace incentives, only those colleges and universities who request evaluation can be accredited. There are two types of accreditation: institutional and specialized. In the former, regional organizations evaluate the overall quality of the college or university. The maximum term for institutional accreditation is ten years. For specialized accreditation, it is the program, at a specific level, that is accredited, not the university or school or department. In its realm, ABET

ⁱ Formerly the Accreditation Board for Engineering and Technology; prior to that, the Engineering Council for Professional Development.

ⁱⁱ American Industrial Hygiene Association

evaluates and accredits programs in various disciplines at associate, bachelor and master's levels, all of which are housed within regionally accredited institutions. The disciplines are classified generally as ... engineering, engineering technology, applied science, and computer. The maximum ABET accreditation term is six years. In both cases, the evaluators for accreditation are volunteers from the ranks of peers.[1]

Over its seventy-five year history, the ABET processes have developed and refined to the stage where universities in several other countries have been petitioning to have the ABET-mark-of-quality applied to their programs. After years of debate and trial, ABET, in the past year, has launched accreditation evaluation of international programs, and it is becoming clear that the world-wide quality standard for university-level engineering education will be that defined by the professional societies who are the ABET members.

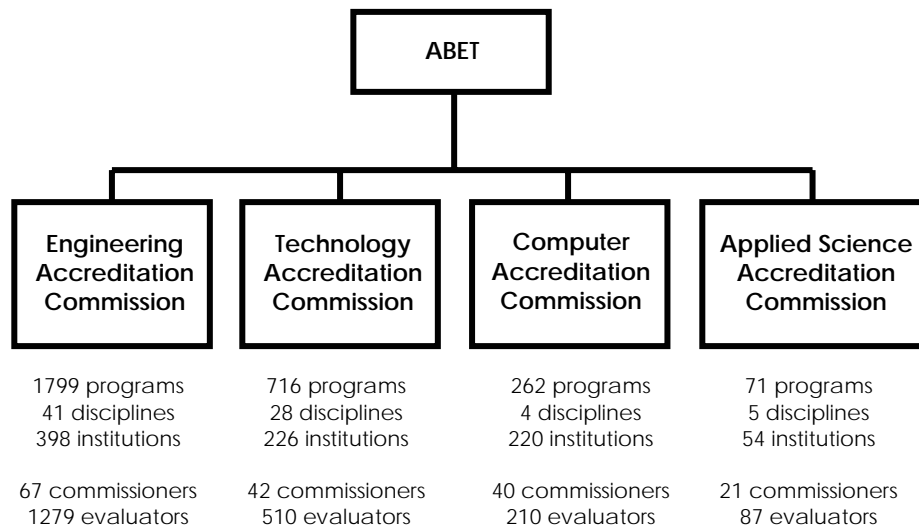


Figure 1: Structure and Composition of ABET [2]

As of the end of the 2006 accreditation cycle, ABET accredits some 2,848 educational programs at about 500 or so colleges and universities throughout the United States. The list of programs represents virtually every engineering and related discipline where a sufficiently differentiated body of knowledge exists to support a distinctive course of study. Sixty differentiated disciplines are accredited. Manufacturing engineering and manufacturing engineering technology are the tenth largest accredited disciplineⁱⁱⁱ. The list of institutions ascribing to the ABET criteria extends from the most prestigious national universities to many local community colleges. The international presence is yet to be felt. The membership of ABET is not individuals, but the societies representing the professional disciplines. There are twenty-eight member societies^{iv}. The individual people who perform the functions within the accreditation process are all representatives of and are nominated by the member societies. Exclusive of the ABET Board of Directors, 2,256 volunteers donate millions of dollars worth of professional expertise every year to the concept of engineering professional accreditation.

ⁱⁱⁱ See Appendix I for the complete listing of disciplinary programs accredited, as of the end of the 2006 accreditation cycle.

^{iv} See Appendix II for a list of the ABET member societies and the programs titles for which they are responsible.

Acquaintance with ABET begins with its mission statement. In its public proclamation, ABET serves the public through the promotion and advancement of education in applied science, computing, engineering, and technology. ABET will:

- * Accredit educational programs.
- * Promote quality and innovation in education.
- * Consult and assist in the development and advancement of education worldwide in a financially self-sustaining manner.
- * Communicate with our constituencies and the public regarding activities and accomplishments.
- * Anticipate and prepare for the changing environment and the future needs of constituencies.
- * Manage the operations and resources to be effective and fiscally responsible.[2]

Accreditation today is based upon the outcomes of the educational process. Evaluation at both institutional and program levels is founded on measuring the amount and quality of the learning that occurs, rather than on the trappings of the campus. It is no longer sufficient merely to teach courses; the institution must demonstrate that students have achieved measurable learning objectives. Outcomes assessment is entirely parallel to the lean thinking that has permeated the manufacturing landscape for the past couple of decades. The mantra on campuses is quality and continuous improvement. Educators have taken the challenging road to establishing objectives, measuring outcomes, evaluating progress and continuously improving. The levels of innovation in higher education have risen sharply over the past half-decade, as evidenced by the advent of distance learning, expansion in both quality and quantity of for-profit education, and an increase in market-focused educational specialties. It is also argued that educational quality has also increased.[2,3]

What does Accreditation Mean to an Engineering Society: To address this question, we must first review the characteristics of an “engineering” society. It is postulated that the core purpose of an organization representing an engineering discipline is the promotion and promulgation of the profession of engineering and, specifically, of the engineering discipline being represented.

Both forks in this road are important: Promotion of the discipline leads us to the dissemination of information and the sharing of knowledge about that which the members do in their careers. Disciplinary societies generally aspire to be recognized as the primary font of knowledge about their discipline. Another crucial aspect of this part of organizational purpose is the recognition and reputation of the discipline that is pursued by the membership. The worthiness of any discipline begins with peer recognition -- i.e., the respect and esteem accorded to a particular discipline by practitioners of other engineering fields. In the general profession of engineering, a society or association earns peer recognition by acting like an organization of engineering professionals -- through timely dissemination of new and relevant information; support and promotion of scholarship; participation in the community of engineering.

Promulgation fills the pipeline with both quantity and quality. New practitioners in any discipline come from educational institutions and programs where the discipline is taught. Healthy and well-regarded engineering societies maintain strong involvement in the university education of tomorrow's members. And, of course, the goals of promotion and promulgation are linked. It would be extremely rare indeed that the best interests of current practitioners would be served by policies which diminish either the numbers of new people entering the field or their knowledge and caliber.

In this light, it is clear that accreditation of college and university programs in engineering and its related fields is of central importance to engineering societies. All recognized and well-regarded engineering disciplines have a strong foundation in university education and in professionalism. Oversight of continuing quality in this foundation is a key to vigor and longevity in the discipline. Moreover, strong engineering disciplines thoroughly recognize that the most natural source of new

professional membership is the pool of graduates from discipline-named programs in colleges and universities.

Accreditation and SME: The discipline of manufacturing engineering and the economic field of manufacturing are inextricably bound. No one associated with manufacturing can misunderstand the seriousness of current industry trends. In particular, the disparity between needs for engineers and their supply is extremely troubling. It does not take much imagination to foresee an acceleration of off-shoring of engineering and other sophisticated jobs. When there are not enough new U.S. engineering graduates to satisfy demand, the work will go to other countries that do have a strong supply of engineers. A reminder of fundamental economics is apt: manufacturing is one of the very few human endeavors that creates wealth; the vast majority of other occupations simply transfer wealth. The troubling shortage of new manufacturing engineers that has been a recurrent theme in recent SME national conferences should be a clarion call for positive action in support of manufacturing education.

As of the end of the accreditation actions in 2006^v, there were sixty accredited manufacturing engineering/engineering technology programs. In 2002, there were 73 such programs. Figure 2 depicts the history of accredited manufacturing programs over the past quarter-century or so. Note the strong initial increase between 1980 and 2000, followed by a flat period for a few years and then a decline. Once the fastest growing discipline within ABET, manufacturing has stagnated since the turn of the century. To be sure, not all college and university educational programs are accredited. However, while equivalent documentary evidence has not been compiled, the history of accredited programs is a clear reflection of the larger picture. College and university manufacturing programs are declining.

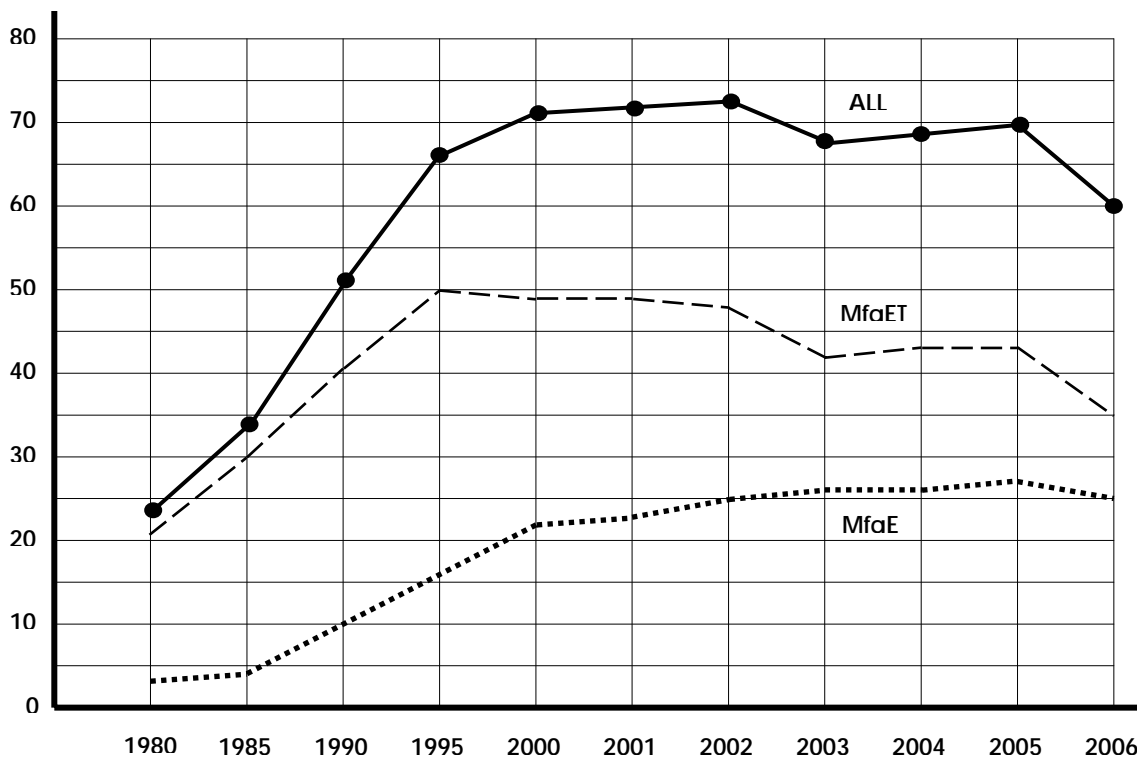


Figure 2: History of ABET-accredited Manufacturing Programs[2,4]

^v Statistics for 2007 have not been published as of the date of this paper.

It is certainly true that there are interlocking causes for the changes. One key factor is surely the decline in the public perception of manufacturing industry. A steady stream of front-page news reporting off-shoring and down-sizing convinces the public that manufacturing industry is a decaying art. This perception is tacitly reinforced by an absence of industry statesmen to explain that a vibrant manufacturing sector is vital to the well-being of the nation. The professional discipline of manufacturing engineering is painted with the same brush, and every university manufacturing program in the country is struggling with flat-to-declining enrollments. Nonetheless, no one can truly identify a precise or certain causal relationship.

It is not coincidence, however, that the period of rapid growth in accredited manufacturing programs coincided almost exactly (given a necessary lag between stimulus and response) with the vigorous promotion and presentation by SME of focused public forums and workshops that supported and encouraged individual colleges to pursue manufacturing-specific curricula and to have those programs recognized and attested by accreditation. Those workshops were regularly held in Dearborn and a few other venues throughout the 1980's and early 1990's. These were always well-attended and highly-rated by those who paid the registration fees. And the majority of the newly accredited programs in the fast-growth period has been represented at one or more of the SME workshops. The last SME accreditation workshop was presented in St. Louis in 1995 and attracted approximately 100 registrants. It may also be noteworthy that the SME Education Foundation changed its policy in the late 1990's from wide-spread support of many manufacturing programs to the issuance of a small number of focused grants.

It should be noted that, even in the current challenging times for manufacturing education, the accreditation process touches well-over two thousand SME members directly, and many thousands of others indirectly. The sixty accredited programs all have faculty, students and industrial advisory boards -- SME members who are deeply committed to manufacturing education. There are also some sixty experienced SME members who are actively involved in ABET accreditation matters (two at board-level; nine at commission-level; forty-nine program evaluators) Moreover, every graduate of an engineering or related curriculum carries the recognition of the quality of his/her education in that program's accreditation.

One of the pervasive aspects of professional engineering education rests in the specialized program criteria. Every disciplinary engineering, engineering technology or applied science program that is accredited is required to adhere to both the general criteria that apply to all disciplines and the program criteria that interpret the broad requirements into discipline-specific terms. The program criteria for manufacturing programs are written by SME members. Further, SME is a cooperating society in several related disciplines and fulfills a contributory role in creating those program criteria. Thus, SME influences the content of manufacturing and related disciplines throughout the United States, and increasingly, abroad.

Policy Options: SME and manufacturing engineering, in general, are facing a serious threat. Some of this arises from the tenor of the times; some is self-induced. It would seem that, sooner or later, the Society will be required to decide whether it is an engineering organization (the Society of Manufacturing Engineers) or a trade group (the Society of Manufacturing). The Society position on accreditation and wider-ranging issues of professional education in manufacturing will be a massive signpost in this path.

As to accreditation specifically, the alternatives are to stay in the game or to abandon it. If SME is to simply maintain ABET participation, the requirements are straight-forward. There are currently eight SME commissioners (two in EAC; three in TAC, plus one Executive Committee; one in ASAC,

plus one Executive Committee), in addition to one representative on the Board of Directors.^{vi} While the travel costs for these people are borne entirely by ABET, each of these bodies has (or should have) an SME-appointed alternative who should be Society-supported for travel to the annual commission meetings in July.

Through mere maintenance of a Society position in ABET, SME retains the ability to influence manufacturing education world-wide. Further, by continuing its ABET presence, the Society maintains its voice in policy issues that affect all of the engineering community.

It has, however, long been a matter of substantive interest within the SME Accreditation Committee that mere maintenance of a static ABET position is not the best long-term strategy. Active promotion of college and university programs in manufacturing was very effective up to about a dozen years ago. This practice could be/should be re-instituted relatively readily. It would also serve the Society well to be more proactive in identifying SME as a leading player in many of the newly emerging disciplines. Such closely manufacturing-related areas as systems engineering, nanotechnology, automation engineering/technology and plastics/composites manufacturing are already developing at various levels of intensity. Over the past several years, virtually all of the SME activity devoted to developing relationships with these emerging educational programs has been carried out by volunteers, on their own personal funding. This is clearly, non-sustainable, but a niche has been created.

Suppose, on the other hand, SME should decide to abandon its historic role in ABET. That course of action would certainly save some money in next year's budget -- in direct dues and a few thousand dollars in travel expenses. Before such a drastic decision is taken, the ramifications should be carefully examined.

The most obvious question is what would then happen to the currently accredited manufacturing programs. The accreditation system does not permit programs to be left without a home society. Should SME withdraw from ABET, a new home for sixty programs would have to be found. As it happens, that would probably not be difficult. Both American Society of Mechanical Engineers and Institute of Industrial Engineers have long maintained that they do manufacturing engineering at least as well as SME. One or both would be a natural new home for the sixty manufacturing programs, although the current programs would be very unlikely to have any direct voice in that decision.

That eventuality would lead to a next level of ramifications. Educators and students in university programs are steered to the engineering society that supports their accreditation. Undergraduate education as a source of new SME members would be unlikely to continue above an accidental trickle. As the effects of a potential SME abandonment of ABET further permeate the academic community, the future of the Manufacturing Education and Research Community and of the North American Manufacturing Research Institute would be suddenly and sharply brought into question. It is unlikely that these arms of SME could continue to be associated with the Society.

It seems abundantly clear that whatever the other policies Society might adopt, its long-term future will be etched by the near-term decision regarding continuation in the professional accreditation process. Quite clearly, the continuation (and strengthening) the SME participation in ABET will be highly influential for future membership. Simply raising the question also provides an opportunity for us to freshly examine an SME strategy that embraces formal college and university manufacturing education as a long-term Society asset. An SME strategy of embracing a strong

^{vi} See Appendix III for a list of the SME members currently holding leadership positions in ABET.

commitment to excellence in manufacturing education holds substantive promise for the future of the Society -- and perhaps for the future of manufacturing in this country.

A Course of Action: While it is appropriate to reprise the disclaimer from the opening section that the views expressed herein are the sole responsibility of the author, it is a fair assumption that the views and recommendations presented here are echoed throughout the community of SME members who are stalwarts for manufacturing education.

SME should re-affirm its membership and participation in ABET. The Society should, furthermore, take steps to re-examine its commitment and to enlarge its influence in post-secondary education in manufacturing. The future of a Society of Manufacturing Engineers depends upon a sustained progression of young graduates from undergraduate programs in manufacturing engineering and manufacturing engineering technology. If we are wise enough and vigorous enough, new members may also flow from related undergraduate programs in newly emerging fields.