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## *On Realizing the New Paradigm for Engineering Education*

### PART II: The Challenge to Change

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#### Abstract

The new paradigm for engineering education goes beyond the need to keep students at the cutting edge of technology and calls for a better balance in the various areas of engineering school scholarship. There is considerable concern that perpetuation of the old paradigm by engineering schools will all but assure minor roles for engineers in the future as well as difficulty in adapting to the exigencies of the fast-paced global marketplace. However, the transition from the old to the new paradigm will not be easy since many of our research-intensive universities are faced with financial pressures while the wherewithal to make the change rests mostly with those who oppose the change in the first place. This situation, coupled with the fact that there is no "one-size-fits-all" transition paradigm, represents the challenge to change. Still, a number of engineering schools have made significant changes and have developed innovative approaches in their undergraduate programs. Taken together, the proven methodologies and knowledge gained should make it possible for most engineering schools to devise revitalization programs that fit the context of their institution, its student body, faculty, and objectives. This paper argues for an assessment study of the tools and methodologies developed by pace-setting engineering schools and the NSF Engineering Education Coalitions to lay the foundation for future reform initiatives.

#### I. Introduction and Purpose

The introduction of *Engineering Criteria 2000* by the Accreditation Board for Engineering and Technology (ABET) [1] and, beginning in the early 1990s, the funding of a number of programs

related to systemic engineering education reform by the National Science Foundation (NSF) [2] are considered seminal events on the path to a new paradigm for engineering education. The 1998 Engineering Foundation Conference (EFC'98) – *Realizing the New Paradigm for Engineering Education* – co-chaired by **Edward W. Ernst**, University of South Carolina, and **Irene C. Peden**, University of Washington, provided further impetus to engineering education reform. At EFC'98, Ernst reminded the participants that intense discussions beginning in the late 1980s, coupled with several conferences, workshops and studies "produced a consensus about what engineering education should be – what the stakeholders expect in the content of the curriculum, innovative approaches to teaching, and involvement of students. Achieving the change needed in engineering programs across the country has become the current barrier that must be surmounted for engineering education to realize the new paradigm for engineering education and to serve the stakeholders even better" [3].

One purpose of EFC'98 was to highlight a new program, *Action Agenda for Systemic Engineering Education Reform*, that stemmed from recommendations made at a July 1995 workshop convened by the NSF's Engineering Directorate [4], just after the publication of authoritative reports on engineering education reform by the American Society for Engineering Education (ASEE) [5] and the National Research Council (NRC) [6]. This new NSF program was to encourage proposals from the engineering education community [7]. However, following the conference, changes at the NSF Engineering Directorate led to changes in programmatic emphasis, and the Action Agenda Program was discontinued.

Achieving change via engineering education reform presents a formidable challenge. It is part of the overarching challenge of

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change, faced by universities and colleges throughout our nation, as described by **Duderstadt** [8] in his comprehensive analysis of the issues and the need for new paradigms. Others [9,10] have provided additional perspectives. This is a complex age of rapid change where different points of view and conflicting interests characterize the stakeholders who often resemble disconnected parties. Achieving change will not be easy given academe's bias toward preservation of the status quo where publications and research funding drive rewards and recognition. In the early 16<sup>th</sup> Century, **Niccolo Machiavelli**, a preeminent political observer and analyst, captured the essence of this type of situation when he wrote in *The Prince*: "There is nothing more difficult, to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things."

This paper is an updated version of the second part of a trilogy on engineering education reform [11]. In contrast to the first paper [12] that focused on *environmentally smart engineering education*, this paper addresses change related to the totality of attributes that define the new paradigm. The trilogy also includes a paper titled "*Engineering Education Reform: A Path Forward*." The specific purpose of the present paper is to provide some historical perspectives while renewing the call for a new paradigm in engineering education. The various stakeholders in the future of engineering education – administrators, faculty, students, parents, industry and government leaders, as well as many others – should better see the shape and dimensions of the dilemma in which they are immersed, be stimulated to debate, and motivated to continue acting along workable paths to implement widespread reform to ensure the vitality and currency of engineering education in the United States.

## II. The New Paradigm for Engineering Education

National Academy of Engineering (NAE) Chairman, **George M. C. Fisher** spoke at the 2001NAE Annual Meeting [13]. The implications of his remarks are profound. Along with the ASEE and NRC reports [5,6], Duderstadt's book [8] and the *Boyer*

*Commission Report* [14], they provide valuable insights relevant to deliberations on engineering education reform. Fisher ended his talk by saying: "In conclusion I would remind us that with recognition comes responsibility. As NAE members you are the most accomplished and most respected members of the engineering profession. It is up to you to: 1) Widen your horizons. Be a *Renaissance engineer* – that is, an engineer for the 21st century, 2) Get involved in public policy. Don't be afraid to run for office. Stand for practical, cooperative solutions. Bring your expertise to the table and make others want to listen to you, 3) Most important, go out and change the world. Make it a better place. Improve the quality of life for all the people of the earth. Isn't that what engineering is really all about?"

What are the profound implications of Fisher's call for renaissance engineering? Renaissance engineers – men and women who get involved with public policy; run for office; stand for practical, cooperative solutions; work to change the world to make it a better place and improve the quality of life for all the people of the earth – first need to be educated in accordance with a new engineering-education paradigm.

There is concern that the perpetuation of the old paradigm by engineering schools will all but assure minor roles for engineers in the future – in accordance with the old adage, engineers are always on tap, rarely on top. Engineers are there to solve problems defined by others, along with imposed constraints on the solution, but not to set the agenda for problems to be solved. **Samuel C. Florman's** remarks [15] are to the point: "When C. Wright Mills wrote his widely-read book, *The Power Elite*, in 1956, he reported that engineers were typically reduced to the role of "a hired technician" with true power being vested in the "corporation chieftains and the political directorate." That was more tactful than **Thorstein Veblen** had been in 1917 when he wrote that the public viewed engineers as "a somewhat fantastic brotherhood of over-specialized cranks, not to be trusted out of sight except under the restraining hand of safe and sane businessmen." "Nor," he added, "are the technicians themselves in the habit of taking a greatly different view of their own case."

The new paradigm for engineering education is keyed to the fact that current and future demands will be for the solution of problems involving human values, attitudes, and behavior, as well as the interrelationships and dynamics of social, political, environmental, and economic systems on a global basis. It goes beyond the need to keep students at the cutting edge of technology and calls for a better balance in the various areas of engineering-school scholarship [5-7, 16-18]. This basic view was also reflected in industry perspectives [19-25], and by Florman [15], "If we want to develop Renaissance engineers, multi-talented men and women who will participate in the highest councils, we cannot educate them in vocational schools – even scientifically distinguished vocational schools – which is what many of our engineering colleges are becoming."

In his remarks at EFC'98, **John Prados**, University of Tennessee, said [7]: "Massively integrated populations place environmental protection, health, and safety at the front end of design; mandates for zero discharge, the need to consider total life-cycle costs for new products, and the impact of social and political concerns on engineering decisions have dramatically changed the economic basis of project evaluation." **William Wulf**, National Academy of Engineering, then put it another way [26], "Engineering is creating, designing what can be, but it is constrained by nature, by cost, by concerns of safety, reliability, environmental impact, manufacturability, maintainability, and many other such ilities." Prados [7] also outlined the salient attributes of the *New Engineering Education Paradigm*. These attributes have been modified to reflect the industrial perspective of the author and others [5, 6, 19-25] as follows:

- Encouragement of diverse student academic backgrounds and faculty dedicated to developing emerging professionals;
- Connection of solid mathematics and scientific knowledge foundation with engineering practices;
- Maintenance of regular, well-planned interaction with industry – including industry-based projects;
- Integration of subject matter, concepts, issues and principles – including relationships to earlier subject matter;
- Emphasis on inquiry-based learning and preparation for lifelong learning, with much less dependence on lectures;
- Stress on integrative, systems thinking, coping with change, communications skills (listening, speaking, reading, and writing), teamwork and group problem-solving skills (from identification through analysis and resolution);
- Focus on design issues involving life-cycle economics, environmental impact, sustainable development, ethics, timeliness, quality, health & safety, manufacturability, maintainability, social, legal, standards and ad hoc concerns.

It is to be noted that the application of design constraints/opportunities relating to life-cycle economics, environmental impact, and sustainable development, render what has come to be known as ecoefficient design [12]. No doubt, some of the details in the above list of attributes will change over time. However, programs that reflect these attributes will not only yield renaissance-engineer graduates with the tools to face an unpredictable future with confidence in their abilities, but also yield untold benefits to the world in which they will live.

In the end, it is likely that students that attend schools with programs that do not reflect these attributes will be disadvantaged. Just as a lack of diversity in a stock portfolio can spell disaster during downturns in the economy, so too will overspecialization in the engineering disciplines. This is yet another argument for educating well-rounded engineers who can address the variety of design challenges represented by the highly competitive, global marketplace and can also develop the capacity to adapt to the ups and downs of business cycles. Unfortunately, "deprived" students and schools form a mutually reinforcing couple. The problem with institutional indifference to the real needs of engineering graduates is that students have become desensitized to real-world needs that reach beyond the technical, and, as a consequence, seem to be satisfied, regardless of conditions, so long as they graduate. Instead of being disappointed with their educational experience, the students are prone to rationalize – changing how they view their experience. The fact that students continue to attend such academic institutions is not indicative of anything in particular because they have adjusted to and accepted the condition as "normal," not realizing that they have been shortchanged.

### III. The Challenge to Change

**Alice Agogino**, University of California, Berkeley, who served as the Director of the NSF *Synthesis Engineering Education Coalition*, has said: "We need different forums to move the 60 percent (beyond the 20 percent that are already working as change agents)" [27]. Forums and the like provide the opportunity and the wherewithal to develop traction to help propel us along the arduous path to commonplace academic acceptance of requisite change. However, the transition from the old to the new paradigm is likely to be quite difficult since the wherewithal to make the change rests mostly with those with entrenched interests who resist change in the first place. This resistance to change, coupled with the fact that there is no "one-size-fits-all" transition paradigm, represents the challenge to change.

Ultimately, deans and their faculty will be critical to successful transitioning; however, as Wulf [26] has stated, "For the most part our faculty are superb "engineering scientists," but they are not necessarily folks who know a lot about the practice of engineering.... the current faculty are the folks with the largest say in engineering curriculum. Given this, it should not be a big surprise that industry leaders have been increasingly vocal about their discontent with engineering graduates." Furthermore, it is difficult for some deans and faculty to address the compelling need to educate their students in accordance with the new paradigm when their "benefits," new research funding and derivative prestige, faculty promotion, tenure, honors and corresponding high external rankings, by such as *U.S. News & World Report*, depend on an infrastructure in which "grantsmanship" is valued over the ability to educate undergraduates. These benefits also provide positive feedback in that "success" attracts more and better researchers, more benefits and a continued lock on their strategy. "They might claim otherwise, but research universities consider "success" and "research productivity" to be virtually synonymous terms [14]." This is yet another example of "you get what you reward!" A balanced strategy would recognize that a continued focus on traditional benefits can be counterproductive and so would demonstrate a commitment to undergraduate

teaching as well as research – reflected in promotion and tenure decisions. However, the rules of the “zero-sum” game seem to dominate the worldview of those opposed to change, governing the dynamic tension that characterizes most aspects of the research vs. engineering-education struggle – ranging from NSF program budgets to the “pecking order” at our engineering schools, and, for that matter, at award granting organizations

Apparently, what some of our deans of engineering and faculty may not realize is that they are a part of an academic business enterprise, and, as such, when and where appropriate, they ought to think and act as competitive businesspersons. Information Technology (IT) has changed the “rules-of-the-game,” for the engineering-education business [8, 17, 18, 28, 29]. Competitors are not limited to other universities and colleges. Alternate providers, enabled by IT and the awesome power of networking, can provide anytime, anywhere educational programs (to almost anybody) at relatively lower cost than most, if not all, universities and colleges. According to the *Wall Street Journal* [30] some \$6 billion in venture capital has flowed into the education sector since 1990 – almost half of it since 1999 when **John Chambers**, Cisco Systems, claimed that education would be “the next killer application on the internet,” and what analysts estimate to be a \$250 billion market.

Engineering schools need a decisive competitive advantage over all of their competitors if they are to continue as leading providers of engineering education. A decisive competitive advantage should differentiate the schools from alternative service providers. A competitive advantage in research is not considered sufficient, although it can complement an engineering school’s selected strategy. The education process itself can provide the basis for competitive advantage with graduates providing the real payoff in the marketplace by virtue of a superior selection, education and formation process that takes place in a learning environment engineered for excellence.

This excellence in engineering education would be manifested in instruction, mentoring, role modeling, and guidance that reflect the attributes of the new paradigm, wherein emphasis is placed on communications and leadership skill development, teamwork and close interaction, systems thinking, ecoefficient design, and lifelong learning – learning what to learn and how to learn it. **Noam** [29], put it another way: “The strength of the future physical university lies less in pure information and more in college as a community; less in wholesale lecture, and more in individual tutorial; less in Cyber-U and more in *Goodbye-Mr.-Chips College*.” It will be of interest to watch the progress at the new *Franklin W. Olin College of Engineering* as they start “from scratch” to implement the results of *Invention 2000*, Olin’s two-year effort to fundamentally rethink the way engineers are taught and the way colleges function [31].

Engineering deans and faculty are faced with the academic-institution variant of the innovator’s dilemma [12], manifested by the general challenge of innovation in successful organizations. It seems ironic that those deans and faculty who ardently defend the status quo could be unwittingly undermining the long-term viability of their engineering school in the engineering education marketplace. As illustrated in the following section, the NSF Coalitions and EFC’98 have served as counter forces to this influence.

## IV. Paradigm Shifters and Supporters

### A. Paradigm Shifting Engineering Schools

Many engineering schools have made significant changes in their undergraduate programs – on their own, or with the help of NSF and other grants. These changes encompass all or some of the attributes of the new paradigm. Additionally, some schools have developed cross-disciplinary programs involving engineering with: management, manufacturing, medicine, law, political science, biology, and other life sciences.

At EFC’98, numerous participants stepped up to the challenge to change. They did this by sharing their experiences with change at their institutions and focusing on the following three key questions in several workshop sessions: 1) How can we use the challenges of the engineering workplace, ABET Engineering Criteria 2000 and experiences of others to create change at my institution? 2) How can we use information technology and the experiences of others to create change at my institution? 3) What can we do to institute engineering education reform and what is my part in doing this?

Presentations (documented in the EFC’98 Proceedings) were made by the following “paradigm-shifting” engineering schools: Massachusetts Institute of Technology, Harvey Mudd College, Colorado School of Mines, Worcester Polytechnic Institute, Drexel University, Texas A&M University, Rose-Hulman Institute of Technology, Columbia University, and the University of Colorado at Boulder. Each of the presentations illustrated that, given the right circumstances, change is indeed possible. The presentations also reflected on “what works” and revealed innovative approaches to achieving the new paradigm in engineering education. In fact, **Eli Fromm**, Drexel University was awarded the Inaugural *NAE Bernard M. Gordon Prize* for the Enhanced Educational Experience for Engineers program that led to the *NSF Gateway Engineering Education Coalition*. EFC’98 Workshop deliberations and conclusions were summarized by Ernst [32] who also assembled and edited a review of references on engineering education for the period 1981-1997 [33].

Specific actions and new approaches have also been taken at: Georgia Institute of Technology, Mississippi State, Northwestern University, Stanford University, University of Illinois at Urbana-Champaign, University of Notre Dame, University of South Carolina, University of Tennessee at Knoxville, and Virginia Tech. Although by no means exhaustive, the programs at these research universities represent approaches that can be used to accelerate change. A brief description of these programs has been compiled by the author [34]. Still more examples of change are “side-barred” in the Boyer Commission Report [14].

### B. NSF Engineering Education Coalitions (EECs)

The goal of the NSF EECs has been to stimulate the creation of bold, innovative, and comprehensive models for systemic reform of undergraduate engineering education [2]. A further goal has been to increase the retention of students, especially women and those minorities underrepresented in engineering. To accomplish this reform, eight NSF EECs worked to develop education tools, curricula, and delivery systems aimed at increasing the successful participation of under-represented groups in engineering education and to improve linkages to K-14 educational institutions. The NSF EECs were instrumental in realizing na-

tion-wide efforts in improved outcomes assessment of learning and the development of ABET EC 2000. Of the eight original NSF EECs, six have completed their work while two are in the process of completion.

Through cross-coalition collaboration, the NSF EECs developed intellectual exchange and resource links among undergraduate engineering programs. Annual *Share the Future* Conferences were initiated in 2000. These conferences offer a variety of workshops centered on topics relevant to the NSF EEC's goals – providing the extended engineering education community an opportunity to share in the research findings and experiences of the EECs. For example, the titles of some of the workshops offered at the March 2002 *Share the Future III* Conference, were as follows: Course Evaluation for Measuring Learning Objectives, Reality-based E-learning Activities, Curriculum Integration: How and Why, Comprehensive Assessment of Design Projects, Instructional Technologies in the Classroom, Course Objectives and Classroom Assessment, Effective Teaching with Technology, Building a Freshman Engineering Program, Designing Innovative Classrooms, Facilitating Change in First-year Engineering Instruction, Active Classroom Learning with Media, A Unified Approach to Engineering Science, and Writing Stronger Engineering Education Proposals. Information on the March 2003 *Share the Future IV* Conference, sponsored by the *Foundation, Gateway, Greenfield, and SUCCEED Coalitions*, can be found at the onference Web site [49].

### C. International Engineering Consortium (IEC) Initiatives

A review of the IEC's educational and other programs [36], led to discussions on the potential of Web-based environmental education in connection with an educational and environmental initiative [12]. Discussion centered on development of asynchronous-learning resources to provide materials/courseware, similar to the IEC's *ProForums* and *iForums*, that could be used by all engineering schools to provide environmental education for engineering students in every discipline if they elect to do so. In addition, the IEC and the Electrical and Computer Engineering Department Heads Association (ECEDHA) [37] are working together to extend the *ProForums* into the classroom for all engineering schools. This on-line resource capability could also be used to enrich the student's learning experience in ethics, health & safety, legal and other "real-world" aspects of engineering.

### D. NAE Educational Initiatives

The stated mission of the NAE's Committee on Engineering Education (CEE) is to ensure the vitality and currency of engineering education in the United States. To this end, the CEE has launched several projects, the following three of which relate to realization of the new paradigm in engineering education [38].

- Engineer of 2020: Visions of Engineering Work and Education in the New Century
- Information Technology in Engineering Education
- A Center for Scholarship in Engineering Education at the NAE

## V. Looking Forward

The root question, What is an engineering education for? – and its corollary, What is engineering really all about? – should be on the table for an evolutionary debate re: the future of engineering education. What engineering students need to learn and

how/where can they best learn it, as well as what engineering schools should teach and how/where can they best teach it are among the "questions" to be considered. The "what" lies at the crux of the matter. It is my view that what is taught and learned at the undergraduate level should include much more than the technically circumscribed material that is sometimes presented in studies of the future of engineering education. Certainly, there are other views and conflicting interests. That is why all stakeholders need to come together to better understand opposing interests and work to evolve the best path forward.

Answers to the "what" questions require an infusion of wisdom, understanding, breakthrough thinking, and perseverance. As evidenced by the set of previous references, considerable thinking and effort has already been put forth. To this infusion can be added the work of still others [39-45]. Perhaps more important will be the voice of industry – one of the prime "customers" of academia. **Karl Martersteck**, a former vice president at AT&T Bell Laboratories and former president and CEO of ArrayComm, put it this way: "without forceful input from industry, academia will not be very motivated to institute changes in their engineering curricula. Industry must establish the "requirements" for the quality and education of the engineers they hire. Unless, and until, major industrial leaders whose views are generally respected speak out and say that they will not hire engineers unless the engineers have the broader "new paradigm" education, academics will continue to pursue their present course [46]." Engineering school advisory boards can serve as voices of industry; however, many existing boards will likely require a restructuring to accomplish this mission.

Eventually, the extant barriers to real progress in the quest to achieve ubiquitous realization of the new paradigm in engineering education will break down. Building on the wealth of knowledge and experience of others, change agents will continue working to catalyze widespread reform aimed at fundamental change – systemic change that lies well beyond rhetoric and cosmetic experiments. Abundant guidance for this work-in-progress can be found in the Action Plan set forth in the ASEE *Green Report* [5], the NRC Report's Call to Action [6], the Action Agendas suggested by Peden, Ernst, Prados and Duderstadt [4,8], the Boyer Commission's Ten Ways to Change Undergraduate Education [14], and the Wulf-Fisher Agenda for Change [45]. The NSF, ASEE, NAE, ABET, NCSE, as well as industry leaders and forward-looking university faculty and administrations can contribute to the effort – each in their own way. As discussed in *Engineering Education Reform: A Path Forward* [11, pp.15-21], the NAE is particularly well positioned to provide leadership by example. Engineering professional societies, organizations, forums, department heads associations, and the IEC can contribute as facilitators and agents of change.

Although, there has been good progress over the three years since the publication of the Boyer Report [47], resistance to change continues, notwithstanding increasing competition from alternate service providers as well as apparent "student-pipeline" and job-security problems that have now been brought to national attention [48-50]. The time is right to initiate a follow-up study, similar to that of the *Committee on Evaluation of Engineering Education*, coincidentally just after the 50th-anniversary year of the formation of the original Committee, appointed by ASEE President **S. C. Hollister** in May, 1952 and

chaired by **Linton E. Grinter**. The idea of another study, similar to the one that led to the Grinter Report in 1955, is not new. A pathfinder study committee to guide the development and reformation of engineering education was suggested in 1994 by **William Grogan** and echoed by Irene Peden and John Whinnery in a *Journal of Engineering Education* Roundtable [51]. Most recently, **Jerrier Haddad** suggested a formal study addressed to the related issue of the significant decline in enrollments for engineering programs [52].

This study would follow through on the assessment effort outlined in the preface of the 1994 *Green Report* [4]: “Over the next few years, the ASEE Engineering Deans Council will lead the effort to assess what engineering colleges are doing to affect change, refine the action items of the report, and set milestones for assessing future progress toward their implementation.” Much has happened in the eight years since the release of the *Green Report*. Of specific interest, would be an assessment of the breath and depth of adoption/penetration of the tools and methodologies developed by pace-setting engineering schools and the NSF EECs. Also of interest would be the establishment of an agenda for catalyzing change as well as assessing future progress toward systemic and sustainable engineering education reform. The study would be best conducted by an “arms-length” group working with the benefit of the wealth of knowledge and experience gained over recent years. The charge to the pathfinder group would be: to recommend the course, or courses, that engineering schools should take in order to keep pace with the rapid developments in science, technology, and global affairs and to educate students who will be competent to serve the needs of and provide leadership for engineering and other professions, industry, and government.

## VI. CONCLUDING REMARKS

The introduction of ABET EC 2000 and the establishment of the NSF EECs are considered seminal events on the path to a new paradigm for engineering education. As was seen at EFC’98, a number of engineering schools have made significant changes in their undergraduate programs – on their own, or with the help of NSF and other grants. These changes encompass all, or some, of the attributes of the new paradigm. In addition to these “success stories” a number of other universities and colleges are involved with innovative approaches to change in undergraduate education. Taken together, the proven methodologies and knowledge gained as to what does, and does not work, should make it possible for most engineering schools to tap into and devise revitalization programs that fit the context of their institution, its student body, faculty, and objectives.

Finally, we cannot know exactly what the future will bring; however, we can predict with certainty that engineering schools and engineers will be called upon to satisfy a multiplicity of needs in the years to come. These needs may relate to knowledge and expertise, for example, in more secure and efficient physical facilities and information networks, advanced asynchronous learning systems, earth systems, and ecoefficient design of complex systems. Engineers will not only ponder problems involving new technologies, but world cultures, religions, ethics, and economics as well. They will also be concerned with other unforeseen questions of local, national, or global significance. Commitment to the realization of the new paradigm in engineer-

ing education will not only yield renaissance-engineer graduates with the tools to face an unpredictable future with confidence in their abilities, but also yield untold benefits to the world in which they will live. Despite the challenging environment and the difficulties involved, resiliency can be seen in the effort to realize the new paradigm in engineering education – resiliency that is essential in responding to what ought to be considered among the grander challenges of the 21st Century.

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## From the IEEE Vice-President for Educational Activities

# Accreditation: A Continuous Improvement Process

By James M. Tien  
 j.tien@ieee.org

It is at the university that the undergraduate engineering student is first introduced to the profession. Responsibilities, ethics, written and oral communications, as well as math, physics, computing and design are all part of engineering. It is right and proper that the profession oversees this crucial phase for the nascent engineer. For that reason a system to evaluate engineering programs has come into being.

With the advent of *Accreditation Board for Engineering and Technology (ABET) Criteria 2000* an alliance of mutual support between evaluator and engineering program faculty became possible. The continuous improvement and self-auditing that the university faculty carry out in between ABET visits free the ABET evaluators to delve deeper into the educational programs. Thus each side of the evaluation strengthens the first line of defense for the engineering profession.

The *ABET Criteria 2000* is cogent and applicable to the 21st Century, as it includes the so-called soft skills of communication and team building, so essential to getting projects started and keeping them moving in the real industrial world. Both faculty and evaluators believe the new criteria reflect what an incoming engineering professional needs.

To see how well this has worked in the engineering program community, one only has to check out *The Picker Engineering Program at Smith College*. The program is now three years old. The first year saw 19 students in the engineering program. Picker's latest class is 50. Dean **Domenico Grasso** said, "We took into account the accrediting process from day one [when designing the program], so we didn't have to retrofit to any of the new criteria." Since Smith encourages all its graduates to seek graduate degrees, it is particularly important that they be accredited at the undergraduate level.

Students and their parents, employers and university faculty depend on accreditation to assure that students, potential employees, and future graduate students are receiving the body of

knowledge – and how to apply it – as a requisite for the profession. A lack of a program's accreditation reflects on its university, as well; calling into doubt the university's own credibility.

"Even rumors that a program is not accredited for the full period can cause a significant loss in students," Dean of Engineering, University of Nevada – Reno, **Theodore Batchman** has said.

In an interval not exceeding six years, each already accredited university engineering program prepares to be audited by a team of engineering volunteers trained in the ABET methods. It is so important to the programs and their universities that they pay for this privilege.

Preparation for the evaluation begins the year before the actual visit with a request from the engineering program to ABET. ABET proposes a team to be assigned the evaluation. The university administration is able to vet the team for possible conflicts of interest. A faculty member – usually someone from the engineering dean's office – is assigned project management of the evaluation for the university side.

The program enters into a healthy self-analysis, taking stock of the mundane (i.e.: classrooms, hardware) to the course based (i.e., student led team based inquiry). The criteria for ABET evaluation ranges from verifying basic student /professor ratios to providing a roster of those to be interviewed. Most importantly, as a part of ABET 2000 criteria, evidence of a continuous improvement process must be documented for the period since the last ABET visit.

ABET forms have to be filled out, questionnaires completed, alumnae input gathered, evidence of employer satisfaction with recent graduates, and examples of course ware for each program (i.e., course outlines, text books). Demonstrations of oral and written competence from student work are needed. This gathering of evidence is abstracted from actual course assignments. It





is the sort of record that an undergraduate needs to know how to keep for his eventual employer. And so, the evaluation serves an additional function by impressing on the student the need for clear written communication.

The faculty administrator must also arrange workspace for the ABET evaluation team, housing, and meals.

Volunteers are the backbone of the accreditation system. Seasoned professional engineers coming from industry, academia, and government service donate their time and energies to the engineering profession. Their reward is work well done and the satisfaction of having helped keep high the standards of the profession. This may not be the hardest job they ever loved, but those who have done it mention the intensity, the rigor, and sense of accomplishment that they feel at the end of an evaluation. The evaluators get to see the future of the profession: the engineers-to-be. They also get to review the new work done at the university and come away with a fresh and enthusiastic perspective.

Volunteers donate about 30 hours a year in preparation plus three and a half days to travel and evaluate. In those few days,

they work ten-hour days. At the end, the team meets together for a cross calibration. The team approach allows the experienced evaluators to mentor those on their first visit. An evaluator may donate up to 5 years to this activity.

Evaluators and those being evaluated are not often seen as anything other than adversarial. But this is not the case in engineering.

Feed back from the evaluators cross-referenced with the self-analysis done before the visit can inform a program as to its strengths and weaknesses. The regularity of evaluation can be used as a balance point, allowing those in charge of engineering programs to focus on the future and take stock of the program's improvements. Often, the press of real life does not permit the time it takes to do this "soul searching."

Those who do the work of accreditation share the same goal: keeping the level of engineering professionalism high starting with university programs that are in a continuous process of improvement.

*Jim Tien*  
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## ***IEEE Accreditation News***

*Ken Cooper, Chair*  
*IEEE Committee on Engineering Accreditation Activities*  
*k.cooper@ieee.org*

One of the primary objectives of the IEEE *Committee on Engineering Accreditation Activities* (CEAA) is to provide sufficient training and updated information to program evaluators so that consistent, high quality program evaluations are performed. In order to succeed in this objective, active communication between CEAA and the program evaluators is required.

Our experience to date with EC2000 has presented the expected challenge in meeting the consistency part of the objective. The significant change in the accreditation criteria and the requirement that the program evaluator pass judgment on how a program interprets and implements the criteria has been the biggest challenge. The issues are being addressed by CEAA by minor modifications in the criteria which are being made by ABET and analysis of the program visit reports submitted by the program evaluators. The analysis of the program visit reports has not produced the results desired because of a lack of depth of understanding of the issues which led to the conclusions and consistency of criteria interpretation. In order to address these shortcomings, the IEEE Program Evaluators will be asked to provide the CEAA with additional information beyond the visit report. Specifically, they will be asked to provide:

1. A brief description of the institutional context and circumstance that led to the recommendation.

2. A brief comment on the consistency of criteria interpretation by members of the visiting team and how differences were resolved.
3. A brief comment on the collaboration between IEEE members, if applicable, of the visiting team.

This information will be combined with that gathered the last few years and used to update the CEAA training and mentoring materials.

If the CEAA is to succeed in meeting our objective, it is very important that we gather these data from the program evaluators. We are aware of the significant effort required of the program evaluators and do not want to significantly increase the burden. It is my belief that the program evaluators have the information being requested as part of the evaluation process and that knowing it is to be documented will make it easy to capture and submit.

With this understanding of what the IEEE program evaluators are being requested to do, the programs being reviewed can organize the information to be presented to facilitate success. This is a process that we need to continue to refine so there is adequate value for the programs and we meet the objectives of ABET.

I hope this information is useful as we prepare for another season of program reviews.



## ***EAB Seeks Industry Professionals to Serve as Program Evaluators for Accreditation Activities***

The IEEE Educational Activities Board (EAB) seeks professionals in industry, government and academic sectors to serve as program evaluators for the following Accreditation Board for Engineering and Technology Inc.-accredited programs at U.S. colleges:

- Biomedical Engineering and Biomedical Engineering Technology
- Computer Engineering and Computer Engineering Technology
- Electrical Engineering and Electrical and Electronic Engineering Technology
- Software Engineering and Software Engineering Technology
- Electromechanical Engineering Technology
- Information Engineering Technology
- Laser-Optics Engineering Technology

- Telecommunications Engineering Technology

Applications for the 2004-2005 academic year are due by **15 Nov.** They will be reviewed during the January/February IEEE meetings. Notification will be sent to applicants by 1 March 2004.

Service as a program evaluator gives members of the profession an opportunity to contribute to the achievement of high quality educational standards of engineering and engineering technology programs.

Nomination and application forms for people interested in **engineering** are available at: <http://www.ieee.org/organizations/eab/apc/ceaa/eacinfo.htm>; forms for those interested in **engineering technology** are at <http://www.ieee.org/organizations/eab/apc/ctaa/tacinfo.htm>.

For more information, contact Carolyn Solimine at +1 732 562-5484 or [c.solimine@ieee.org](mailto:c.solimine@ieee.org) or [Mailto:eab-accred@ieee.org](mailto:Mailto:eab-accred@ieee.org).

## ***From the Chair of the ASEE ECE Division***

*S. Hossein Mousavinezhad, ASEE ECE Division Chair*  
([h.mousavinezhad@wmich.edu](mailto:h.mousavinezhad@wmich.edu) or  
[hossein.mousavinezhad@ieee.org](mailto:hossein.mousavinezhad@ieee.org))

At the time of writing this column (13 June 2003), we are preparing for the ASEE 2003 Conference in Nashville, June 22-25, 2003. The Nashville program will be another high quality, active ECE program following our successful Conference in Montreal, June 2002. In Nashville the ECE sessions include: Research & New Directions, Trends in ECE Education, Accreditation, Capstone Courses, Labs & Curriculum Innovations, Pre-College, ECE Mathematics, Panel Discussion (Teaching & Learning with Technology), Online Courses, Business, ES AdCom meetings. We like to acknowledge the encouragement/support provided by Dr. **Daniel M. Litynski**, Provost, Western Michigan University, V.P., IEEE Education Society. Dan has been an active member of ASEE and IEEE and still finds time to attend conferences despite his extremely busy schedule. I would not have been able to continue my increased activities in ASEE and IEEE without Dr. Litynski's continued recognition of the importance of professional societies and the important role they play for universities, faculty research and professional activities. Another individual I like to thank is Dr. **Michael B. Atkins**, Dean of Engineering at Western Michigan University. Both Dan and Mike are chairing ECE sessions in Nashville.

Regarding the IEEE activities, I am happy to report that our third *eit* Conference in Indianapolis, June 5-6, 2003 ([www.cis-ieee.org/eit2003](http://www.cis-ieee.org/eit2003)), was very successful. Electro/Infor-

mation Technology Conferences were started in Chicago in 2000. Keynote speakers for these conferences include: Drs. L. Zadeh (UC Berkeley), V. Varadan (PSU, NSF), Mark Smith (Purdue), H. Adeli (OSU), Martha Sloan (Michigan Tech). I am honored to serve as general chair of these *eit* conferences. Future conferences are tentatively scheduled for Milwaukee (2004), Michigan State (2005), Lincoln, Nebraska (2006) and Windsor, Ontario (2007.) Please contact me if you are interested in receiving more information regarding *eit* conferences.

The 2004 ASEE ECE Division call for papers (CFP) has already appeared in *ASEE Prism* (May/June 2003, page 37). Let me know your ideas for sessions and panels. Our team (**Stan Burns**, Vice Chair and **Paul Devgan**, Sec./Treas. + many other committees) are working with me to put together outstanding programs for 2004 and future years. We are happy with the increased interests in ECE Division activities (record number of papers submitted, good attendance at our business meetings, are just two examples.) Please contact me or a member of the executive committee with any comments or feedback you may have for continuous improvement of the quality of the ECE Division's programs.



*Sincerely,*  
*S. Hossein Mousavinezhad, 2002/2003 ASEE/ECE*  
*Division Chair*

## Book Review: *The Art of Changing the Brain*

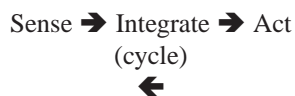
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Although we don't usually think of it in such stark terms, the aim of education is, after all, to change learners' brains! Now, teachers don't change brains, at least not directly. Only learners can change their own brains. The teacher's job is to create conditions under which the learners' brains can be changed in the specific ways intended by the associated educational activity.

In the *Art of Changing the Brain: Enriching the Practice of Teaching by Exploring the Biology of Learning*,\* biologist **James Zull** brings together research results from neuroscience and his considerable experience as a teacher to relate how the human brain and body receive and process stimuli to effect change, i.e., learning. Enlivened by tales from his own teaching experiences, Zull's account of the biology of learning is packed with insights on how even a rudimentary understanding of the structure and function of the brain can be utilized to make the practice of teaching more effective.

In the end, effective learning involves seating information as thoroughly as possible in the brain, i.e., establishing neuronal networks in the brain that are extensive and strongly reinforced. As Zull points out, "Learning is deepest when it engages the most parts of the brain."

The newborn child enters the world with an already active brain, a set of neuronal networks ready to adapt and grow in response to external stimuli. Changes in the brain – learning – are then effected through learning cycles consisting of



Sensing comes not only from the familiar five senses – vision, hearing, touch, taste and smell – but also from the sense of body position (e.g., seated or standing, relaxed or tense) and from our feelings (e.g., afraid, confident, excited, calm). Specific regions of the brain integrate the various sensory inputs with information already stored in its neuronal networks to create new information that usually is held first in working or short-term memory. When it is acted upon, this new information is then routed to and stored in parts of the brain that generally depend on the nature of the information as well as other conditions of the body and its environment. The action phase can be physical action such as motion or it can be mental action such as reasoning and reflection. The cycle is closed when the brain senses the results of the action and the cycle repeats. The cycle does not necessarily begin with sensing; it can begin at any point in the cycle.

Every cycle produces changes in the brain. These changes may consist of adding new neurons, modifying the interconnection patterns among neurons, or changing the strength or polarity (excitatory or inhibitory) of the interconnections.

Zull stresses that a live brain is always active and therefore always learning something. However, a student in a classroom (or other learning situation) may not necessarily be learning what the teacher intends. He or she may be learning the subject matter – or that the teacher is boring, the room is too hot, or the student two seats away has a new significant other! The teacher's success depends on gaining the student's attention (for example by convincing the student that the subject matter is important), providing opportunities and support for the student to be exposed to the content, and arranging for the content to be stored as firmly and ubiquitously as possible in the student's brain.

A sample of key points for the teacher's attention:

- To find a foothold in the brain, new knowledge must connect with prior knowledge.
- If the learner's prior knowledge is erroneous, care is needed to correct the errors rather than reinforce them!
- Reflection integrates information, leading to comprehension and "deep learning" – and reflection requires time!
- Emotions play a powerful role in learning: "Plasticity in the brain probably depends more on signals from the emotional centers that it does on sensory input." Corollaries:
  - Learning is best when it truly matters in a person's life.
  - Positive feelings – pleasure, feeling in control, achievement, security, confidence – enhance learning. Negative feelings may distract from learning.
- Working memory is relatively limited and should not be overloaded. Extensive material should be "chunked."
- Different people favor different parts of the brain, so variety and alternatives in presentation are important to enhance learning of members of a group.

In a short but pointed epilogue, Zull underscores five ways in which understanding the brain in the context of teaching and learning is especially enriching. First, it helps us see more clearly why people learn. Second, it makes educational theories more real. Third, it helps us recognize and appreciate the importance of the separateness of teacher and learner. Fourth, it helps us generate ideas concerning how we can teach more effectively. And finally, it can clarify our values, such as enhancing our appreciation of the diversity of human beings.

As a veteran engineering professor who has had only a modest exposure to theories of learning, I found this book both fascinating and helpful. While, as Zull says, "our growing understanding of the brain [may] not necessarily produce a revolution in education – at least not yet," this is an important book for educators of all stripes.

[James E. Zull is Professor of Biology and Director of the University Center for Innovation in Teaching and education at Case Western Reserve University.]

\* James E. Zull, *The Art of Changing the Brain: Enriching the Practice of Teaching by Exploring the Biology of Learning*, Stylus Publishing, 2002. ISBN 1-57922-054-1

# *IEEE Education Society for the Joint Norway/Denmark/Finland/Iceland/Sweden Sections*

Porsgrunn, Norway, 13 May, 2003

## MINUTES FROM THE IEEE EDUCATION SOCIETY "NORDIC" CHAPTER BOARD MEETING

Place: Uppsala, Sweden, 9 May, 2003

Time: 6.30 PM - 7.30 PM

Present: Flemming Fink (Aalborg University, Denmark), Mats Daniels (Uppsala University), Trond Clausen (Telemark University College, Norway)

### 1. Next arrangements, duration 2 days

2003 (fall): Aalborg, Denmark.

2004: Porsgrunn, Norway

Date, fall 2003: To be proposed by IEEE Education Society President, David Kerns

### 2. Proposed priority list of topics

- 1) Continuous Professional Development including Industry/University Cooperation

- 2) "State of the art" for Project Based Learning (PBL) in Scandinavia

- 3) How to Cope with the International Education Market Board member Jorma Kyrää (Finland) has supported this proposal via email.

### 3. Other business

- a) Uppsala workshop report or note: Mats Daniels.

- b) Minutes from this Board meeting: Trond Clausen

Both documents will be sent electronically to members, the five IEEE Nordic Sections, Education Society President Kerns and "The Interface" by editor Bill Sayle.

*Trond Clausen*

## *Engineering Education Research*

### First IEEE Nordic Education Society Chapter Workshop

*Uppsala May 9-10*

The first IEEE Nordic Education Society Chapter workshop was held in Uppsala on May 9-10. The theme was Engineering Education Research. **Trond Clausen** from Telemark University College, the chair of the *IEEE Nordic Education Society Chapter*, opened the workshop with some words about the newly founded chapter and a greeting from **David Kerns**, the president of IEEE Education Society. **Mats Daniels** gave some general information about the workshop before leaving the floor to the keynote speaker Dr. **Jennifer Turns** from Center for the Advancement of Engineering Education at University of Washington at Seattle, USA. Her talk was entitled:

Linking Research in Learning Sciences and Engineering Education:  
A Sample of Empirical Studies

The presentation gave good insight into how educational research can be done and difficulties with it. The presentation, and the interaction it inspired to, set the workshop off to a good start. Most of the 21 attendees were in the field of computer science, but traditional engineering and physics were also represented.

The first block of presentations were around the CS learner project lead by professor **Michael Thuné** at Uppsala University. The focus of the presentations by **Anders Berglund** and **Anna Eckerdal** were on how and why phenomenography can be used in researching students learning of object oriented programming and network protocols.

The second block of presentations were around different efforts to understand what goes on in a course, e.g. introductory object oriented programming at Umeå University presented by **Jürgen Börstler** or how students describe their emotions in relation to programming at Blekinge Tekniska Högskola presented by **Christina Björkman**. **Sirpa Torvinen** and **Jarkko Suhonen** from University of Jyväskylä talked about the ViSCos project and trying to find out where the students have difficulties leading to drop off and how to prevent this.

The day was concluded by **Peter Gates** from the Swedish council of renewal of higher education talking about how they looked at the difference between research and development. Their view is that the projects they fund should use existing research results and implement them and in close collaboration with the students.

The first block of presentations at Saturday had presentations that looked at different aspects of animation and visualization. **Andrea Valente** from Aalborg University talked about a "tool"

that could be used to introduce mathematical thinking to kids aged 8-12, without them first having to learn a lot of mathematics. **Philippas Tsigas** and **Boris Koldehofe** from Chalmers presented ideas behind their simulation and animation tool, LYDIAN, and demonstrated how it could be used in the context of distributed algorithms. **Jarmo Rantakokko** from Uppsala University presented a project aimed at implementing animation interactions based on previous findings in a parallel programming course. The block was ended with a presentation by **Lars Pettersson** from Uppsala University who demonstrated how a special pen and paper could be used via *Bluetooth* technology to store information on how and when things got on the paper. This information could then be replayed.

The last presentation block was held by Mats Daniels from Uppsala University presenting the Runestone project and a pro-

cess model for how to structure a study in computer science, or any other subject, educational research.

The workshop was ended with a general discussion about engineering education research. Issues like the close interaction between research and practice came up, e.g. Jennifer Turns placed the presenters on a circular graph with two nodes, “research” and “teaching”, highlighting how research effects teaching and how teaching inspires research.

Further information about the different projects presented can be found via links from the webpage of the workshop,

*Mats Daniels*

*Vice chair*

*IEEE Nordic Education Society Chapter*

*matsd@docs.uu.se*

## *From Eta Kappa Nu*

*Tom Rothwell, President*

*T and V Rothwell <k6zt@juno.com>*

Eta Kappa Nu (HKN) is the national honor society for Electrical and Computer Engineering (ECE). We are pleased and honored at this opportunity to share information about our mission and programs with *The Interface* readers.

Founded at the University of Illinois in 1904, the organization has grown and has now chartered 210 college chapters at colleges and universities with accredited Electrical and/or Computer Engineering curricula across the nation, and alumni chapters in major population centers. Eta Kappa Nu is a member of the Association of College Honor Societies, which serves as an “accrediting agency” and a valuable information exchange mechanism for about 65 similar honor societies spanning the academic spectrum.

Our mission, as stated in our Articles of Incorporation in Delaware, and in the Preamble of our Constitution, is: *“To encourage excellence in education for the benefit of the public by: Marking in a fitting manner those who have conferred honor upon engineering education by distinguished scholarship, activities, leadership and exemplary character as students in electrical or computer engineering, or by their attainments in the field of electrical or computer engineering; Providing educational and financial support to said students; and Fostering educational excellence in engineering colleges.”*

Simply stated, Eta Kappa Nu is in the Recognition and Awards business for fostering scholarship and related achievements in the fields of electrical and computer engineering.

Recognition through membership:

- The constitution empowers college chapters to select and induct new members from the top 1/4 of the Junior class and top 1/3 of the Senior class of Electrical or Computer Engineering.
- College and Alumni chapters are empowered to select and induct into membership an Electrical or Computer Engi-

neer who has done meritorious work in the profession and allied pursuits.

Student Recognition and Role Models

- Annual selection of the nation’s most Outstanding ECE Junior Students. Winner and Honorable Mentions.
- Annual selection of the nation’s most Outstanding ECE Students. Winner, Honorable Mentions, and Finalists.



Recognition through HKN college chapter activities

- Annual Outstanding College Chapter Activities Awards. Winner, Honorable Mentions, and Certificates of Merit.

Role Model Recognitions

- Annual Outstanding Young Electrical or Computer Engineer Awards. Winner, Honorable Mentions, Finalists.
- Annual Distinguished Young ECE Teacher Awards. Winner, Honorable Mentions.
- Annual Outstanding Technical Achievement Award. Winner.
- Distinguished Service Award. Winner (aperiodic).

The Ultimate Role Model Recognition

- Induction into Eminent Membership in Eta Kappa Nu. (Induction as Eminent Member is reserved for those individuals who, by their technical attainments and contributions to society, have shown themselves to be outstanding leaders in the field of electrical or computer engineering, and great benefactors to society.)

Eta Kappa Nu is essentially the honor society for ECEDHA. It took us a long time to recognize that fact, and we are delighted that they have been fully supportive of building a close working relationship with us. We have asked HKN Board Director Dr. **J. David Irwin**, who is also the ECE Department Chair at Auburn

University, to serve as our representative in working with ECEDHA. It represents a very special and unique opportunity for us to keep the leaders in our customer community current with our activities, and enlist their help when needed. We are excited about the possibility that we may be able to make the HKN Distinguished Young ECE Teacher Award presentation at the ECEDHA annual meeting, and recognizing the Outstanding

College Chapter Activity Awards at the ECEDHA annual meeting by having the appropriate department heads receive the awards. Together, we will be looking for other such mutual benefit opportunities.

Tom Rothwell, President  
Eta Kappa Nu

T and V Rothwell <k6zt@juno.com>

## *U.S.A. High School Seniors' Performance Compared Worldwide*

### **(“S&T in the Workplace” seminar appraisal)**

George Rodgers

(another in a series of articles...)

**Background:** 2002's Spring Conference for the **U.S. Department of Education** was marked by dolorous commentary and poor worldwide comparisons for our high school (HS) seniors' performance (W.T. OPED, 4/5/02). The USA came out very poorly in this evaluation.

Although Columbia Univ. Prof. **T. Bailey** reported favorably at this conference on “dual-credit” programs in which *high-achiever seniors* were given access to college course work, the prevailing winds blew ill for the USA. Bailey also reported that “Tech Prep” was a promising venue. Community colleges, local business groups, high schools, etc. offered students career paths into high tech fields. These innovations were hopeful signs midst dire reviews of America's troubled secondary schools. Our HS graduates feature a 25% dropout rate currently and 1 out of 4 graduates require remedial college work in freshman years. The *National Association of Manufacturers* (NAM) reported deficiencies noted by 600 members for its entrant workers in critical reading, writing and math skills. Cornell Prof. **J. Bishop** of the *Educational Excellence Alliance* promoted special features for lagging students such as extra tutoring, summer sessions, and Saturday school. A request for more funding, attached to these remedies, was supported by Department of Education Chief **R. Paige**. Meanwhile in the quest for accountability (for past support) in the teaching pipeline and spurred by a national effort to raise test scores, the *New American Foundation* has leveled a charge of using the “fake way” to raise standards; “teaching to the test” besmirches the “dumbing down” of classes as a bogus approach. Teacher unions give an appearance of indifference for remedial actions.

Two decades ago cries for dollar-relief were raised in response to a need for higher K-12 standards. Thus an early Reagan administration made such moves following its educational task force recommendations. From a national average of \$6K/student-year, that figure has increased 55% over 18 years. Sadly this investment has not successfully addressed deficiencies set out in that timeframe; these continue today in comparable statistics partially cited. The **National Assessment of**

**Educational Progress** (NAEP) notes that 83% of HS seniors have not reached proficiencies established.

**Roles for all educational levels:** Midway in the 1990s for the classroom phase of the seminar *S&T in the Workplace*, we attempted to begin multiple dialogs with local school boards, city and county governments, various teacher organizations, Virginia State offices, and with the federal Department of Education. We used interim results in the evolution of our seminar on an entree basis to pose suggestions for cooperative changes. We joined the local County and State teachers' associations; we attended local PTA and area-wide conferences; we gave video, handout and booth presentations. We also approached the local community college and one local university (where I and some of our volunteers were teaching) with an aim of more coordination on pre-college preparation. We were greeted on all these attempted interfaces by a half-decade of bureaucratic indifference to the point that our efforts at outreach were fruitless. It seemed that an aura of hidden inertia existed in those educational organizations to counter this 1990s workplace experiment for S&T program enhancement. This shows that more work for IEEE is needed.

**SPUTNIK era exhibited total support:** The passive reaction was opposite to that experienced in the SPUTNIK era by many of our IEEE member-volunteers back in the late 1950s effort to install calculus in secondary curricula (undertaken while I was teaching EE full time to college juniors.) We sought to expand on this: Indeed our 1990s choice of the name, *S&T in the Workplace* was purposely adopted to shape our complementary IEEE role with HS faculties. We of the workplace were simply reporting on a few vital technical tools currently in place for the job market; such tools were common to all three sciences and their engineering support. Five math topics—complex matrices, Fourier and La-place transforms, probability and statistics—were taught by workers and teachers from class notes. Each topic segment, covered in 3-5 sessions, featured a current local application by industry or government. Early sessions for each topical segment were used to build up mathematics background for the feature speaker who came at segment midpoint. Following the feature speaker, ending sessions for each topic were used to “groove-in” basic techniques for extraction of information from muddled input S&T data. Photocopied handout class notes of

10-20 pages, prepared by presenters, were generated for each two-hour session. Orthodox teaching.

**Better Communications with Organizations Needed:** In our USA schools, pre-college S&T population comprises only a small percentage of total student population, perhaps in the range 7%- 15%, omitting magnet schools. There are about 4 dozen such special schools in the nation; we had HS dialog with others beyond **Thomas Jefferson High School for S&T**, in which we gave seven semesters of the experiment. We felt that a

decade of alternating “classroom-revision-classroom-” would give us a modicum of credibility for the effort. We extended the course to other Fairfax County (Virginia, USA) schools with less success through electronic learning (EL), and to a nearby Maryland magnet school. Similarly we reached out to Virginia State magnet schools for EL ties. A more structured and organized effort would be useful in the future.

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## Report on the Education Society's Web Site

To: David V. Kerns, President

From: Rob Reilly, the office temp, reilly@media.mit.edu

Date: June 13, 2003

I would like to commend you for your leadership in appointing an *ad hoc* committee to renovate the Web site. I'd also like to acknowledge **Bill Sayle**'s efforts and guidance during this project.

From a mechanical standpoint, the renovation project has been completed. Now I am focusing on working with the various committee chair's to update/review their material.

These items have all been reviewed and/or updated:

- Chapter and Regional Activity has no Chair, so I did the update/review with the aide of Hq IEEE.
- Transactions on Education material is now current/reviewed (per **David Conner**),
- the Constitution and By-Laws are now current/reviewed (per **Burks Oakley**),
- the Supplement(s) to the Transactions on Education (per **Marion Hagler**) are current/reviewed and they now reside on the EdSoc/IEEE server,
- the Nominating Committee is satisfied with the state of the Web site (per **Marion Hagler**), and
- the Strategic Plan seems to be current (but I am not absolutely certain—no chair).

I am currently working with **Dan Litynski** (Awards Committee) and the chairs of the individual award committees (**Ed Jones**, **Chalmers Sechrist**, **Jim Rowland** and **David Conner**)

to review/update the Awards page (e.g., outline what each award is for, publish the nomination procedure(s), etc.). I'm also in-contact with **Seyed Hossein Mousavinezhad** (Membership Committee) and he is reviewing/updating the membership material.

The AdCom material (i.e., minutes of previous meetings, agenda of future meeting) seems to be in good shape. But I will talk with you about any AdCom items that need to added/changed on the Web site and receive any other suggestions you have after the Nashville AdCom meeting if that's acceptable to you?

Some of the new features include:

- A **language translator**. In addition to English site is now available in Chinese, Japanese, Korean, Spanish, French, Italian, German, and Portuguese,
- A **search engine** for the entire EdSoc Web site,
- A **calendar of events** to which anyone can add EdSoc-related happenings (we'll see how this *works out*),
- A **floating menu** so that a user always has a navigation bar on-screen,
- **The Interface** info is now available on the Web site,
- A **hit counter**. In addition to counting the number of 'hits,' it will provide very useful statistical information, and,
- **More pronounced visibility** for the: *FIE conference*, the Chapters and Regional Activities, and the *Interface*.
- We have had 861 hits from May 12<sup>th</sup> through June 12<sup>th</sup>

## From Your Editor

Bill Sayle

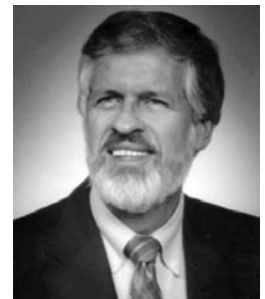
wsayle@georgiatech-metz.fr

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### The Education Society Web Site

Elsewhere in this issue of *The Interface*, you will see a letter from **Rob Reilly** to **David Kerns**. Rob has assumed administration of the Education Society Web Site, much to my relief.

As editor of *The Interface*, I had inherited the maintenance of the Education Society's web site. With “maintenance” to be performed every several months, I found that “re-learning” how to upload and edit material was a “new learning experience” often stretching to several hours at a time.



One day last May, I had an email message from Rob Reilly at MIT who noted some “ragged edges” in our display and who, even better, offered to help. And HELP he did! I do believe Rob took on the cleaning up, maintenance, and upgrading of our web site as a full time job for several weeks.

Please visit the site at <http://www.ewh.ieee.org/soc/es/> and see what a fantastic job Rob has done. A big thanks!

Elsewhere in this issue of *The Interface*, you will find interesting articles, including **Frank Splitt**'s second part of the trilogy on engineering education. A call for program evaluators for IEEE EAC/ABET and TAC/ABET programs should remind us how important accreditation activities are to maintaining and improving the quality of engineering education. We are in particular need of program evaluators from industry and government.

## Transitions

*“You can't be old enough? What will you do with all your free time? And, you really aren't retiring. This is just a “budget transfer”. You will work just as hard and for too many hours, for less income.”*

If we are lucky enough, we have the opportunity to “retire” someday. For me, that opportunity is scheduled for 31 July 2003. Of course, as my colleagues have repeatedly told me, “you aren't really retiring, you will just be emphasizing different things”. And, to a certain extent this is a true statement.

Thanks to an excellent State of Georgia Teachers Retirement System, I have the opportunity to retire from Georgia Tech. This same system will let me “come back to work on a part-time basis at less than 50% time”. I have chosen this option and will “come back to work” at our *European Platform, Georgia Tech Lorraine*, in Metz, France.

As regular readers of this column will note, I have spent the summers of 2001, 2002, and now, 2003 here in this northeastern corner of France, teaching in our Summer Undergraduate Program. With 162 students from Georgia Tech (Atlanta), two from

Virginia Tech, one from Universidad Panamerica (Mexico), and two from the University of Georgia, we are providing a rigorous academic program featuring 12 Georgia Tech faculty members teaching 23 courses. The focus is upon engineering courses at the sophomore through senior level, along with French, management, economics, art history, and history, technology and society courses. For those of us used to very large classes, it is a welcome relief to have class sizes ranging from 15 to 30 students.

Beginning this fall semester, we are expanding our undergraduate program at Georgia Tech Lorraine to the academic year. With successful masters and PhD programs in electrical and computer and mechanical engineering for a number of years, the expansion into the undergraduate arena is a natural one. As with the graduate programs, we will begin with electrical and computer and mechanical engineering courses. My “coming back” is to initiate this program and teach the senior ECE offerings.

I mentioned above we have a total of 167 students in our summer undergraduate program. We had deliberately “overbooked” with the idea that some students would withdraw from a summer program in France because of the-then-pending conflict in the Middle East. We were also concerned about how American students would be received by the French, given the highly-publicized attention provided by the media in the USA.

We were pleasantly surprised. All of our students and all of our faculty members have reported nothing but “nice treatment” from everyone with whom they have come into contact—restaurants, stores, transportation, etc. It's as if the French people do not understand why we would worry about being treated well. After all, they don't always agree with their government and seem to understand that on a person-to-person basis, we are friends.

*From Metz, France*

*Bill Sayle*

*w.sayle@ieee.org*

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