Historians: Learning from the history of technical societies

Jonathan Coopersmith
Department of History
Texas A&M University
College Station, Texas
j-coopersmith@tamu.edu

***Abstract*: The history of technical societies provides a rich source of data about larger concerns in the history of technology and general history**.

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INTRODUCTION

Coal miners used to keep canaries in the mines with them, not just because they liked the cute birds, but because the canary served as proxies for larger issues, such as whether the air was safe to breath. So too can historians study the history of technical societies to learn about larger issues in the history of technology.

While the histories of technical societies are important in themselves, they are also important for the wider opportunities they offer about the evolution of engineering and the larger environment. By looking at when societies organized, how they evolved, changes in membership, what they did, and the issues its leaders considered important, historians can learn a great deal. As this paper will demonstrate, engineering societies have both reflected and shaped engineering and society.

THE SOCIETY AS ACTOR

Perhaps the most basic decision is when a group of engineers decided their area warranted organizing a new society. When did people consider themselves civil engineers instead of just engineers (the distinction to separate them from military engineering) or a circuit theory engineer instead of an antenna engineer)? The year of formation is a good indication of a critical mass of people active in the same area.

An interesting set of questions concerns the method of organization. Was it a new organization, a spinoff (or breakaway) from an existing society, a merger of existing societies, or did it remain part of an existing society? The IEEE was the result of a merger of the American Institute of Electrical Engineers (AIEE, established in 1884) and the Institute of Radio Engineers (IRE, established in 1912). Similarly, the American Institute of Aeronautics and Astronautics (AIAA) was created in 1963 from a merger of the American Rocket Society (American Interplanetary Society), established in1930, and the Institute of the Aerospace Sciences (Institute of the Aeronautical Sciences), established in 1932.

It's important to understand whether the challenge of forming a new organization changed over time. Why do some areas become subfields and other new fields? There can be bitter battles over staying part of one organization or creating a new one. One reason the IEEE has remained a successful umbrella organization is that it has created a set of procedures and policies to encourage new fields to stay inside the IEEE. These procedures grew out of the Professional Group System adopted in 1948 by the IRE.

What is the significance of competing or overlapping societies? The AIEE

established a Subcommittee on Large-Scale Computing in 1946. In 1951, the IRE created a Professional Group on Electronic Computers. After their 1963 merger, the two groups became the Professional Technical Group on Electronic Computers and then the Computer Group. In 1971, the Group became a Society. Now the Computer Society has over 83,000 members, making it the IEEE's largest society, a distinction it has had since the late 1950s when the Professional Group on Electronic Computers was the largest IRE group with nearly 9000 members.[1]

By coincidence, the Association for Computing Machinery (ACM) also has about 84,000 members. The ACM began in 1947 as the Eastern Association for Computing Machinery. The Eastern was quickly dropped as the new group became national in scope. What was more significant – the proximity of their creation, their separate existence, their similar membership sizes? How did the two societies cooperate and compete?

Establishing new societies may be easier than staying. My main society, the Society for the History of Technology (SHOT) grew out of dissatisfaction with the treatment of the history of technology (not, it must be noted, bad treatment of the historians) by the History of Science Society in 1958.

Sometimes, it may be easier to become part of an existing society than form a new group. The first electrical engineering society in Russia was the VI (Electrotechnical) Section of the Imperial Russian Technical Society formed in 1880 because tsarist regulations made forming a new organization very difficult. Here, the interesting analysis is of the environment, courtesy of the society. Not until the mid-1890s did the semi-paranoid government allow the formation of independent electrical engineering societies.

Another key decision is whether a society decided to ensure its future by becoming actively involved in educating new generations of engineers. Establishing student chapters and promoting professional education (e.g., providing continuing education and participating in ABET) are two such indicators. Student chapters indicate that the field is being taught in universities and attracting sufficient students.

The evolution of internal organization and functions of umbrella societies like the IEEE and AIAA can indicate changes in those fields. For example, the AIAA's annual overview of aerospace activities showed a steady rise in the number of technical committees, revealing increased specialization and the incorpation and creation of new areas.

Table 1. AIAA areas of coverage

1979	41
1989	49
1999	58
2008	82

Source: Aerospace America December 1979, 5; December 1989, 2; December 1999, 1; December 2008, 1.

IEEE membership grew from 334,811 in 1998 to 365,483 before dipping to 347,003 in 2007.[2] In 1949, the IRE had 7 groups; today, the IEEE has 38 Societies and 7 Technical Councils in 10 Divisions, 8 Technical Communities, and scores of online communities. What

do these changes tell us about the world of engineering?

Table 2. 1949 IRE Groups
Antennas and Propagation
Broadcast and Television Receivers
Broadcast Transmission Systems
Circuit Theory
Nuclear Science
Quality Control
Vehicular and Railroad Radio Communications

Unfortunately, what exists can be misleading. Numbers need interpretation and context. If membership in a society suddenly expands, is that because the field is becoming more interesting or a new president launched a successful membership drive? If membership is declining, is that because the society is becoming less relevant, dues increased, or the rules on tax deductions changed? Looking at changes over long periods of time can cancel some of these specific causes.

Name changes may reflect changes in a field, as the Signal Processing Society demonstrates. In 1948, the IRE contemplated creating an Audio, Visual and Acoustic Group and established the Audio Group in 1949. In 1965, the name changed to the Group on Audio and Electroacoustics. In 1974, it became the Acoustics, Speech, and Signal Processing Group (and Society in 1976). Finally, in 1990, it became the Signal Processing Society. The transition from Audio to Signal Processing show the shifting self-identification and external presentation to other engineers and a broader audience.

The Audio Group had two competing societies, the Acoustical Society of America (established in 1929 and one of the three founding societies of the American Institute of Physics in 1931) and the Audio Engineering Society (established in 1948). Both are active today. What were the initial distinctions among them? How did the three societies manage to remain independent? What would an analysis of their activities tell us about the history of the overall field?

The Industrial Electronics Society began in 1951 as the IRE Professional Group on Industrial Electronics. The 1963 merger with the AIEE's control instrumentation section created the Professional Group on Industrial Electronics and Control Instrumentation, which became a Society in 1978. In 1982, the name changed to the Industrial Electronics Society.[3] Did the change mark the retirement of the last of the AIEE control instrumentation cohort or a more substantial change in the industry?

In 2009, the Laser and Electro-Optics Society changed its name to the Photonics Society to improve its recognition inside and outside the IEEE. That was the latest evolution of a story that began in 1965 with the creation of the Quantum Electronics Council, its 1977 upgrade into the Quantum Electronics and Applications Society, and a 1985 transformation into the Lasers and Electro-Optics Society (LEOS).

The journals, newsletters, conferences, standards, annual reports and other publications can also provide a great deal of information about the evolution of a field and its relations with other areas of engineering as well as the larger

society. The IEEE hosts over 800 conferences annually. By tracking conference themes and papers, we can track the growth of specialties and contemporary excitement and interests.

Similarly, analyzing journal articles can show patterns of development and interest, providing a sense of what was considered important at the time, as Table 3 shows. Editorials and other commentaries may be equally valuable in outlining concerns and activities. Special issues may indicate growing interest in an area such as the June 1976 Proceedings of the IEEE dedicated to microprocessors.

Table 3. IEEE Spectrum contents

February 1988
Optical disks become erasable
Electronic banking goes to market
Gordon Bell calls for a US research network
Ways to verify the US-Soviet arms pact
The beauty of `almost standard' VLSI

February 1998
Firewalls fend off invasions from the Net
Recycling batteries
The ideal light source for datanets
The practical engineer

February 2008
Spectral Lines - One Format War is Over. Is Another Beginning?
Untangling a New Breast Cancer Screening Technology
Intel Makes A Big Jump In Computer Math
Can Wind Energy Continue Double-Digit Growth?
Microchip Enables Electronic Gene Injection

For the last few years, Spectrum has run January predictions of upcoming "Winners and Losers" in electrotechnology. The journal's accuracy may be less important than the technologies and firms considered economically viable or not at that time.

The awards given by a society can provide valuable information about the individuals and fields it considers important. Seeing who received awards is a good way of learning about prominent actors, especially important in areas where publications (and citation analysis) may not be as useful.

Or awards may reflect that someone wealthy enough had an interest in a field to endow an award. What does it mean that the IEEE medals are sponsored by five IEEE groups, seven American firms, three Asian groups, and two European firms? A general award, like the IEEE Medal of Honor, may reflect larger recognition (or negotiations among the judges about what is most important). Some awards, especially those for lifetime achievement, may lag behind the person's contributions by decades.

A breakdown of recipients of the IEEE Medal of Honor shows that radio clearly dominates until the 1960s with a broader perspective since the merger. Analysis of recipients of other awards would be equally rewarding.

In 1928, the AIEE introduced the Benjamin Lamme award for 'meritorious achievement in the development of electrical apparatus or machinery,' which Lamme funded in his will It was last awarded in 2002 and officially discontinued in 2008. Does that imply something about the status of power

engineering? From 1991 to 2002, four Americans, four Europeans and three Japanese received the medal. Before 1990, only American received the medal. Did the criteria shift or prize committee membership shift after 1990? Did the geography of innovative engineering expand? Will the new Toyota-sponsored medal for Environmental and Safety Technologies, to be awarded in 2010 "for outstanding accomplishments in the application of technology in the fields of interest of IEEE that improve the environment and/or public safety" replace the Lamme?[4]

The IEEE first awarded the Heinrich Hertz Medal "for outstanding achievements in electromagnetic waves" in 1988 and last awarded it in 2001. Did research and accomplishments in electromagnetic waves suddenly end? The IEEE medal for engineering excellence had a similar run from 1988 to 2004.[5] Has engineering stopped being excellent or did a sponsor disappear?

A society's working groups, special commissions, and other organizational efforts may illuminate larger societal concerns as the society tries to solve socially important problems and show its relevance. In 2008, the IEEE Power Engineering Society became the Power and Energy Society, a change "expected to reflect greater relevance to members' interests and support global needs, as well as ensure an environment for embracing emerging energy technologies."[6]

Technical societies are valuable for international comparisons. For electrical engineering, was a better indication of domestic development and diffusion of electrotechnology the creation of a national electrotechnical society or the first central power station? They were closely correlated. But not completely – did the earlier organization of the first Russian electrical engineering society really indicate a more active pursuit of electric power than in Germany and America? Membership may provide a more accurate picture of a country's engineering effort, as Table 4 shows. Understanding who could become a member and the costs and benefits of membership, however, is necessary to place the numbers in context.

Table 4. Membership in 1910

Society	Members
VI Section (Russia)	243
IEE (UK)	4010
VDE (Germany)	4653
AIEE (US)	7100

Source: Jonathan Coopersmith, The Electrification of Russia, 1880-1926 (Ithaca: Cornell University Press, 23-24).

What sort of international cooperation did societies engage in? Could those activities tell us about engineering as an international as well as domestic venture? The IEEE has agreements with over 70 national technical societies worldwide.[7] What would a history of these agreements tell us about the development of electrical engineering worldwide?

How much of this international activity is particular to the organization and how much to wider American political, engineering or social trends? Why and when did the IEEE become an international organization while its counterparts elsewhere (VDE, IEE)

remain more national societies? Are other U.S. engineering societies as international?

Societies provide broader information about their members. There is much gold in mining their demographic, gender and geographic data. Geographical diffusion can be seen by the spread of regional chapters and looking at the addresses of members. A challenge here is whether the expansion reflects membership drifts and other pushes or new people joining.

The IRE had nine Regions – seven in the US, Region 8 for Canada, and essentially everywhere else as Region 9. After the IRE-AIEE merger, there were six American regions, Canada became Region 7, Europe, the Middle East and North Africa became Region 8, and everywhere else was Region 9. In 1966, Region 9 became South America and everywhere became Region 10.

Since 2004, the IEEE added 16 new sections, bringing the total to over 320 sections. Six sections formed in China. One chapter each was added in New Zealand, Vietnam, Washington/Idaho, Estonia, Japan, Malta, Oman, Lebanon, Morocco, and Qatar. The growth of new sections outside the United States is supported by broader membership data. In the last decade, the IEEE has grown from 335,000 to 347,000 members. The percentage in the United States has dropped from 67% to 57%. Sections 8 and 10 have seen the largest increase with the former growing more than the latter.

While impressive, the data need interpretation. The rapid growth in Chinese sections seemingly reflects that country's rise as an economic, technological, and scientific power. Until very recently, however, the Chinese government refused to allow the IEEE to establish sections outside Beijing despite many attempts. The expansion of sections is not just rapid growth but a recovery from arrested growth. The history reversal of the refusal may tell us about internal Chinese government perspectives about the need for technical communications and a greater level of government comfort about the activities of some of its engineers.

What do these data mean? Do they reflect the growth of electrical engineering outside the United States, economic growth in those regions, domestic prestige by joining an international organization, professional self-advancement, the opportunity to learn technical English, an increase in IEEE efforts to organize internationally, or higher incomes so IEEE membership is more affordable?

SOCIAL TRENDS.

One of the most effective ads I have seen was for IEEE life insurance. Societies can tell us about the professional career concerns of their members: What economic benefits, if any, are important to attract members? How do societies try to improve their members' social and financial status? If we look at legislative priorities over time, what has changed? Do engineering societies cooperate more on professional personal issues (e.g., pension portability) than technical issues? By considering such issues, historians can look as engineers as a group.

We think of technical societies often in terms of publications, conferences, and other forms of professional development. Yet benefits are often an important part of a society. How many members join for the benefits such as insurance that their firms may not provide? How do societies create, fund, and promote their benefits? Examining the evolution of benefits offered by societies and their popularity with members should illuminate larger economic and social concerns.

Presidential elections and addresses are useful mirrors into the concerns of a field's representatives. What do the election statements focus on? What, if anything, changed over time? What are the themes of presidential addresses? The same approach would be useful for other officers and section heads.

CONCLUSION

Like histories of technology in general, this paper has focused on success, not failure. We know so much about the IEEE because it still exists today and its records are reasonably good. What we particularly don't know is the societies that failed, either for organizational reasons or the fading of a field. The Audio Group in the 1960s changed its orientation and name in the 1960s to remain relevant and later moved into DSP. What about the groups that did not evolve? What can we learn from them?

Technical societies consist of engineers who join. What about engineers who do not join technical societies? What percentage of various fields do they consist? What are the differences, if any, between, for example, electrical engineers who join the IEEE and those who do not?

Looking at the history of the IEEE is a rewarding pursuit in itself. Analyzing technical societies for what they tell us about the larger engineering field and society can be equally if not more rewarding.

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[1] http://www2.computer.org/portal/web/about/history (downloaded September 3, 2009).
[2] IEEE Annual Reports (Piscataway: IEEE, 1998, 2000).
[3] http://en.wikipedia.org/wiki/IEEE_Industrial_Electronics_Society (downloaded July 15, 2009).
[4] http://www.ieee.org/portal/pages/about/awards/sums/lammesum.html; http://www.ieee.org/portal/pages/about/awards/sums/environmentmdl.html (downloaded September 3, 2009).
[5] http://www.ieee.org/portal/pages/about/awards/sums/hertzsum.html; http://www.ieee.org/portal/pages/about/awards/sums/engexcsum.html (downloaded July 14, 2009).
[6] IEEE Annual Report 2007, (Piscataway: IEEE, 2008), 13.
[7] http://www.ieee.org/web/aboutus/agreements/regional.html (downloaded September 15, 2009).