

A Standards Education Survey

Prepared by

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The Center for Global Standards Analysis

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For information on permission, contact (1) Donald E. Purcell, Adjunct Faculty, CUA School of Law, at 202/319-5140, email: purcelld@cua.edu; or (2) Professor William E. Kelly, Ph.D., P.E., CUA School of Engineering, at 202/319-5514, email: kellyw@cua.edu.

Executive Summary

*"If you control an industry's standards, you control that industry lock, stock and ledger."*¹

The Center for Global Standards ("Center") was formed in 1999 as a non-profit corporation located at The Catholic University of America.² The Center was formed for the purpose of creating global standardization education programs for university graduate students, associations, corporations, government departments and agencies. During the period 1999-2001, a course on *Strategic Standardization* was offered to engineering and law students. Several standards development organizations, associations, corporations, government departments and agencies, law firms and testing laboratories provided speakers to help support the course. For further information on the Center and the course for *Strategic Standardization*, please consult the Center's internet web site:

http://engineering.cua.edu/StandardsCenter/center_for_global_standards_anal.htm

In the fall of 2002, the Center's Board embarked on a survey of individuals experienced in the development of private sector voluntary standards. The purpose of the survey was to gather information, ideas and concepts to help facilitate the further development of standards education programs. The Board requested each Member to contact at least 10 individuals and request them to participate in the survey. Participants in the survey included individuals from standards development organizations, associations, corporations, government departments and agencies, and testing laboratories.

75 individuals were contacted, 53 responded, a rate of approximately 70%. Many participants included comments in their response. These comments have been included in the survey. The survey is a "snapshot" that reflects the views and opinions of a very experienced group of individuals who devote considerable time and attention to the development of private sector voluntary standards.

The Center believes that preparing, conducting and evaluating the survey is of interest and value to the public. To facilitate the public's review, a discussion of the survey's 3 major conclusions is set forth below. The Center notes that, in addition to providing a good snapshot of views and perspectives of experienced standards professionals, the survey raises as many questions as it attempts to answer. The Center hopes to conduct additional surveys in the future to follow up on this initial research effort. If there are any questions or comments on this survey, please contact (1) Donald E. Purcell, Adjunct Faculty, CUA Columbus School of Law, telephone 202/319-5140 or email: purcelld@cua.edu; or (2) Professor William E. Kelly, Ph.D., P.E., CUA School of Engineering, telephone 202/319-5514 or email: kellyw@cua.edu.

¹ *Out of the Crisis* by W. Edwards Deming (1986 at 302, published by the Massachusetts Institute of Technology)

² For a discussion of the Center's formation, see two articles: (1) *Launching a "Center for Global Standards Analysis" at CUA*, Standards Engineering Society Journal (June 1999 at 1), and (2) *A New Center for Global Standards Analysis*, ASTM Standardization News (September 1999 at 26).

Major Conclusions

1. The United States continues to rely on an informal education and training system concerning the development of private sector voluntary standards.

The survey indicated that very few of the survey participants had received formal education or training in standards development. The vast majority learned about standards development through on-the-job training from their employer, and by participating on standards development technical committees.

The Center believes that several courses offered at colleges and universities probably address "standards" in their respective curriculums, however, it is generally rare to find an entire course specifically dedicated to studying the process and procedures, issues and implications of standards among most colleges and universities. Only recently has the Accreditation Board for Engineering and Technology ("ABET"), the organization that accredits engineering, technology, applied science, and computer science programs in the United States, required that standards become a regular part of the curriculum for all engineering graduates.³

The Center offers the following comments on this particular survey result. First, the field of standardization represents an area of "practice." Although a particular area of practice by professionals may be discussed at a college or university, the emphasis is frequently on development of academic skills rather than practice skills. For example, engineering graduates may have developed significant engineering design skills in their academic studies, and yet may not fully appreciate the impact of national or international standards associated with a specific engineering design project. In short, standards participants are expected to rely generally on their prior education, training and experience when they participate in the development of private sector standards.

Second, at present there may be few specific needs that require any formal programs of study beyond those that already exist. Compare, for example, that for a considerable period of time individuals who intended to practice law "read for the law" by studying in the office of a lawyer, in small groups or as Abraham Lincoln did, engaged in a self-directed study program in order to take the Bar examination which allowed an individual to practice law. Most law schools in the United States were not even formed until the late 1800s because circumstances had changed, the law was growing increasingly complex, and there was a specific need to establish accreditation for law schools. In short, absent specific needs such as the increasingly complex nature of global standards issues, or the creation of certification requirements for standards education, the field of standardization may not need to create formal education and training courses among colleges or universities to support those currently participating in the development of private sector voluntary standards.

There are, however, two interesting policy issues that need to be considered by the public. First, in October 1999, Raymond Kammer, Director, National Institute of Standards and Technology, reported more than 80% of world product trade, over \$4 trillion, is affected by

³ ABET's web site is: "www.abet.org".

standards and technical requirements.⁴ In addition, a global marketplace is rapidly emerging that will require reconciliation of many technology standards for virtually every industry in the world. In short, conflicting standards have to be reconciled so that the global marketplace can continue to grow and develop. Given these circumstances, is it reasonable to expect that the United States can continue to rely on an informal education and training system for individuals who participate in the development of private sector voluntary standards?

Second, the United States has the most diversified standards system in the world today. The United States system tends to be based on individual industrial and economic sectors. In the United States, the government plays a supporting role in the development of private sector standards. All other countries in the world have a centralized, top-down standards system in which the Government plays a significant and sometimes dominant role. Given the critical nature of standards and the need to resolve global standards conflicts to facilitate development of a global economy, can the United States diversified standards system flourish in the years ahead? Important related questions are (1) what role, if any, should standards education and training play in helping the United States to promote or perhaps improve its diversified standards system? (2) Given such diversity, what are the education and information needs of those directly involved in the development of global standards, and what is the best way to meet such needs in a cost effective manner?

2. The survey indicated a very strong consensus for development of a multi-disciplinary approach to standards education.

Survey questions 7 and 8 were intended to solicit views and perspectives of participants on the multidisciplinary nature of standards development. There was an overwhelming number of survey participants who believe that a multidisciplinary standards course would be valuable. In survey question 7, 95% of the respondents saw the need for such a course at the university level, and in survey question 8, 81% saw the need for such a course for employees. To create a multidisciplinary course, those involved in the development of such course should carefully consider the appropriate balance of standards education issues best suited to meet the specific needs of university students or professionals that will participate in the program. The philosophy, "one size fits all," will not work. For example, technology and engineering issues may be particularly important in a given program while regulatory issues may deserve special attention in another program.

3. Fairness is critical to the standardization process.

When considering which standards issue is the most significant, Members of the Center were surprised to see the survey indicate that "fairness" is an issue that has the same relevant significance as "technology" issues, and was considered to be more significant than "economic" issues. It was not surprising to see "technology" issues identified as the most important factor in a standardization program, and for the most part, Members of the Center expected that "economic" issues would be a strong second to "technology" issues. One interpretation of this

⁴ See Raymond Kammer's October 1999 speech, "Standards in the Global Market System: A U.S. View of the 21st Century," to the Conference on Transatlantic Regulatory Harmonization and Global Standards held at George Washington University.

survey result is that "if participants do not believe in the integrity of a private sector standards program or process, nothing else matters." Clearly, individuals and organizations responsible for development of voluntary standards need to pay careful attention to the "process" associated with development of a private sector standard.

The emphasis on "fairness" may reflect an understanding by participants in the survey that serves to confirm the economic significance outlined by Dr. Edwards Deming at the beginning of the Executive Summary:

*"If you control an industry's standards, you control that industry
lock, stock and ledger."*

Standards frequently have great economic significance in the marketplace, therefore, the development of standards should be given significant attention by participants. It is essential that all participants have a common understanding of "fairness" in the standards development process. Failure to address the issue of "fairness" may lead to delays, a misallocation of resources, or in the worst case, a collapse of the standards program. In short, fairness and confidence in the standards process are essential.

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Standards Services Division
U.S. National Institute of Standards and Technology

STANDARDS EDUCATION SURVEY

1. **Please consider the following definition of "standard" before you answer questions below:** "A standard is a term that applies collectively to codes, specifications, recommended practices, classifications, test methods, and guides, which have been prepared by a standards developing organization or group, and published in accordance with established procedures."
2. **Do you agree with the definition of "standard" above? If not, what definition would you use?**

Yes: 29

No: 24

Comments

[Alternatives and Editorial Recommendations]

Alternatives

- A standard is the documentation of decisions that result from a standardization process. Common types of standards include those concerned with definitions of terms; classification of components; delineation of procedures; specification of dimensions, materials, performance, design or operations; measurement of quality and quantity in describing materials, products, systems, services or practices; or descriptions of fit and measurement of size.
- The definition of what constitutes a "standard" gets a bit cloudy since the term "standard" is used to encompass what is given above plus a standard also. Thus, for example, the AIAA defines standards publications as: Standard, Recommended Practice, Guide, and Special Project Report. The NASA Technical Standards Program defines standards products as: standard, specification, handbook, guideline, regulation, and code. What is given in the definition for a standard as expressed in the Standards Engineering Society's Recommended Practice for Standards Designation and Organization. DOD defines a MIL-STD as separate item from a MIL-SPEC. While I have not made an extensive search, best I recall ANSI does not provide a specific definition for a standard, like that quoted above. Probably because with over 600 SDOs, many different definitions of a "standard" exist. Thus, does the term "standard" apply to a "standard" or only to the subjects listed in the definition above collectively being a "standard"? I can live with the definition but prefer the term "standards products" that we use in the NASA Technical Standards Program where a standard is one of the products.
- I feel the definition in MIL-STD-962 should be included: "A standard is a term that applies collectively to codes, specifications, recommended practices, classifications, test methods, and guides that establishes uniform engineering or technical criteria, methods, processes, and practices, prepared by a standards developing organization or group, and published in accordance with established procedures."
- The definition should be consistent with OMB A-119 & OL 104-113: ...performance-based or design-specific technical specifications and related management system

practices that are developed and adopted by voluntary consensus standards bodies . . . to include (1) common and repeated use of rules, conditions, guidelines, or characteristics for products or related processes and production methods, and related management systems practices; and (2) the definition of terms; classification of components; delineation of procedures, specification of dimensions, materials, performance, design, or operations; measurement of quality and quantity in describing materials, processes, products, systems, services, or practices; test methods and sampling procedures; or descriptions of fit and measurements of size or strength.

- I would use the term contained in ISO/IEC Guide 2 which defines a standard as: “Document established by consensus and approved by recognized body that provides for common and repeated use, rules, guidelines or characteristics for activities or their results aimed at achieving the optimum degree of order . . .”
- It is a reasonable definition, however, when I have taught definitions, I use three different ones and point out that "standard" means something different to everyone. You have totally neglected company and industry specific standards.

Editorial Recommendations

- Many definitions are possible, and each reflects its intended meaning. I agree with the above definition for the purposes of completing this questionnaire.
- I agree with the definition, except it should be expanded to add a phrase: “... for the purpose of establishing minimum acceptable levels of quality or performance.”
- I agree with the definition, but add the phrase “prepared by a standards developing organization or a group of parties with knowledge of the subject.”
- Add the following to the definition: “... for the purpose of promoting standardization.”
- I would limit the definition to technical specifications, and would definitely not include guidelines and recommended practices. I would probably not include classifications or test methods as well. Others might quibble about whether just any organization or group as opposed to a *de jure* body (e.g., ANSI, ISO, IEC, ITU) can product standards. I would not limit the definition of standards in this manner.
- I have some reservations about the phrase “which have been prepared by a standards developing organization or group and published in accordance with established procedures”. There are *de facto* standards out there that weren’t developed by self-proclaimed standards developing organizations (many of these begin as or still are company documents of some sort).
- I would make the following revisions: “... applies collectively to *widely accepted* codes ...” “... organization or group, *by committees representing themselves as individuals rather than for their employers’ benefit*,* and published ...”
- I would agree with the above definition except for what defines standards developing organizations. These organizations can be independent groups, business consortiums, and/or accredited SDOs (i.e. ANSI SDOs). I feel that needs to be added to the definition somehow.
- I would not include recommended practices or guides. In my view, “standard” has the implication of “shall”, while those [practices or guides] do not.
- For the most part, yes. Two issues/matters not addressed here are product (line) conformability and inter-product (line) compatibility set by a company or companies or

an industry sector, but without a “developing organization or group.” Similarly, insurance industry requirements associated with product (use) liability protection impact design. Tort actions have comparable impact on design.

- I agree with the definition as stated but might add that it represents the best agreement regarding the subject matter that can be obtained at the point in time that it is developed. My commentary would be that all standards have a “shelf life”, some long and some short.
- Compliance with state-of-the-art, feasibility aspects.
- I agree with this definition to the extent that it applies to private sector standards. Note that public entities prepare standards which do not meet the definition above.
- Make sure the words “prepared and maintained” are part of the definition.
- I concur with the definition. I note that a MIL-SPEC (specification) or MIL-PRF (performance specification) defines a product, while a MIL-STD (standard) defines a set of tasks. Therefore, we end up with both specifications and standards being a subset of standards.
- A standard is a very specific document, having undergone a specific process for development and review. A guide or recommended practice should not be classified as a standard.
- A proposed standard, in order to be acceptable to an industry, its clients and/or legal watchdogs, should bear relationship to legitimate authority. Mere compliance with established procedures may not offer a sufficiently reliable premise upon which to deem a proposed standard to be capable of serving the best interests of an entire marketplace or of society in general. The term established procedures needs to be more clearly defined.
- A standard is more than a term. A standard is a rule, a regulation; often it is in effect a law. It is a device used to control the actions of parties to whom the rule applies. It serves as a means to justify the imposition of penalties for non-compliant actions.
- A standard is a regulation which establishes the basic parameters that are deemed acceptable for controlling the activities of parties engaged in a legal commercial, civil, and/or governmental pursuit. A standard is developed by the consensus of participants representing all interests concerned with the specific pursuit. Because of ever-changing situations in society, standards are routinely subject to review and updating at prudent intervals of time.
- I recommend to clarify, that not only the publication of a standard has to be in accordance with established procedures, but that the development of the Standard of Technical Report must follow similarly strict procedures in an open and public process.
- Standards can come from multiple sources including industry consortia-we have to distinguish between de-jure and de-facto. The definition also promotes the continuation of the "accredited standards body" as the only method of developing and approving standards.
- Must include relationship of standards to regulatory policy and trade restrictions.
- Change “guides” to “guidelines.”

3. Have you ever participated in the development of a private sector standard?

Yes: 48

No: 3

4. How many years of experience do you have with development of private sector standards?

- Less than 1 year 2
- 1-5 years 6
- More than 5 years 41

5. What type of standards training or education have you received? Please check all that apply.

- College or university..... 11
- Internal courses provided by employer..... 21
- Informal on the job training..... 40
- Standards Developing Organization courses (e.g., ANSI, ASTM)..... 30
- Informal training by participating on standards committees..... 39
- Other, please specify: research - 2, journalism - 1.

Comments

- I believe, that an association's training can be a major source of mandatory education in the standards development process and that more people get their education there than in ANSI. Association training programs should have their own bullet above.

6. If you have participated in the development of a private sector standard, whom did you represent?

Manufacturer	21	Government	23	Academia	2
Distributor	3	Public Interest	3	Other (please specify):	
Retailer	3	Testing Laboratory	6	User	3; SDO 4; publisher 1

7. Do you think a multidisciplinary (e.g. engineering, law, business, library science) standards course would be valuable? (Yes - 45)(No - 2) If you answered yes, please rate the importance of addressing the following issues in such a course:

Standards Issue	High Importance	Medium Importance	Low Importance
Standards development process	37	8	2
National standards policy issues (e.g., U.S. National Standard Strategy, National Technology Transfer & Advancement Act)	27	19	2
Legal issues	32	14	2
Regulatory issues	30	16	2
Trade issues	23	18	3
Technology & engineering issues	28	18	2
Access to standards	16	20	12

Comments

[Policy, Process, Strategic Management, Trade]

Policy

- All these issues are important and, in some institutions, may warrant a course because of the nature of the program. However, I would generally argue to spread them across the curriculum.
- Issues depend on the purpose of the degree. If someone wants to join the USTR, for example, they may want some training in diplomacy. Others may look at standards in relation to management issues.
- The course must relate to the business value of standards, and not to the techniques of generating standards.

Process

- In addition to fundamentals like balance of representation, the need for transparency, alternative development processes and methods of achieving consensus, Performance vs Design Based approaches and their pros and cons, one important area would be Standards as a Competitive Tool. Perhaps you lumped those with Trade. Another might be Standards from a Consumer perspective.
- Copyright and licensing, intellectual property, rationale behind charging for standards documents.
- Need to touch on IPR and copyright issues if these aren't covered under legal.
- Conformity assessment and standards.
- Safety considerations.
- Technical versus process standards (ISO 9000, BS7799, CSR).
- Management system v. technical; product v. process standards.

Strategic Management

- The level of importance for the above items may change sector by sector, e.g., the ICT industry versus power generation may have different needs depending on the status of their industry.
- These answers would vary by the technology or business sector being addressed.
- The business model of standards organization themselves should be addressed. In particular the degree of engineering effort "volunteered" by their members. Additionally, I interpret legal issues to have a strong component of contract law.
- Best practices for developing standards.
- Implications for nonparticipation.
- Need to know how to build a business case for standardization.
- Cultural differences that affect standards.
- How to assess benefits of standardization (i.e., cost reduction, increased customer acceptance, etc.)

- Use of standards.
- Levels of standards (i.e., broad-based vs. product specifications).
- Hazardous materials and other environmental issues.
- Business considerations (e.g., VHS vs. BETA).
- Economics of standardization.
- Types of standards and their applications.
- Pros and cons of business and economic impact of standardization.
- Understanding the different industry standards and how they are developed.

Trade

- Relationships to international standards & standards development processes.
- Use of standards as trade impediments. How to move beyond national standard status to global use.
- National vs. international standards development and control.
- International standards activities and how the U.S. fits into them.
- Export control issues relative to standards.
- ITAR issues.

8. Do you think a multidisciplinary (e.g. engineering, law, business, library science) standards course would be valuable for employees in the work force? (Yes - 33)(No - 7) If you answered yes, please rate the importance of addressing the following issues in such a course:

Standards Issue	High Importance	Medium Importance	Low Importance
Standards Development Process	23	11	5
National standards policy issues (e.g., U.S. National Standard Strategy, National Technology Transfer & Advancement Act)	15	19	5
Legal issues	24	12	3
Regulatory issues	22	14	3
Trade issues	17	15	7
Technology & engineering issues	24	12	4
Access to standards	22	11	6

Comments

[Policy, Process, Strategic Management, Trade]

Policy

- No training of is required for employees. If you are in the work force, you are either involved in standards on the job or you are in a field that uses standards. At this point, the employer is best suited to impart specific knowledge that may be required of employees.

- I would include all the topics. However, I believe they should be modularized for web-based delivery, earning credit (or continuing education units) only if all modules are completed.
- The art of resolving issues, building consensus, documenting results/actions/and making progress towards actually creating standards.
- It is not possible to answer this question generically, e.g., employees with responsibilities for standards development will put higher importance on the process than plain users of existing standards.
- Impossible to rank without a sense of what their job level would be. It would differ, for example, between mid and upper management.
- The answers to the questions above are dependent on the audience, e.g., executive or technical staff. I answered the questions as a technical person.

Process

- Conformity assessment should be addressed unless that is implied in the legal and regulatory areas.
- Conformity assessment and standards.
- Need to touch on IPR and copyright issues if these aren't covered under legal.
- Safety considerations.

Strategic Management

- Understanding of the industry standards your organization participates in or helps develop.
- These answers would vary by the technology or business sector being addressed.
- Implications for nonparticipation.
- Economic impact and benefit of standardization (return on investment).
- Pros and cons of business and economic impact of standardization.
- Business considerations (e.g., VHS vs. BETA).
- How to assess benefits of standardization (i.e., cost reduction, increased customer acceptance, etc.)
- Need to know how to build a business case for standardization.
- National vs. international standards development and control.
- Cultural differences that affect standards.
- Use of standards.
- Levels of standards (i.e., broad-based vs. product specifications).
- Types of standards and their applications.

Trade

- International standards awareness and how it differs from North America.
- Export control issues relative to standards.

9. What are the three most important issues related to standards education? (Please select 3 of the following possibilities, and list them 1-3, 1 being the most important.)

- Goals and objectives of the organization being represented by the individual
 - 1 13
 - 2 4
 - 3 6
- Know ledge of policies and procedures for the development program
 - 1 11
 - 2 9
 - 3 11
- Knowledge of technical and engineering issues
 - 1 12
 - 2 10
 - 3 6
- Knowledge of the needs for the industry or organization for which the standard is intended
 - 1 11
 - 2 18
 - 3 9
- Knowledge of potential legal issues
 - 1 5
 - 2 9
 - 3 15

Comments

- “Most important to whom? The student/participant (if yes, from a specific industry or in a heterogeneous class)? The Instructor? I assume that you mean information that should be imparted to (potential) participants in an industrial setting (i.e., all from the same company or at least the same industry).”
- Knowledge of the regulatory, trade and policy issues - 1.

10. What is the single most important issue in development of a private sector standard? (Please select one issue)

- Technology & engineering 17
- Fairness 16
- Economic considerations 5
- Policy considerations 2
- Potential legal issues 1
- Other (please specify):
 - Timeliness 3
 - Market relevance 2
 - Balance 2

○ Consensus	1
○ Cost	1
○ Reliability	1
○ Safety	1
○ Strategic Tool	1
○ User needs	1

11. If there any other issues or factors that you believe need to be considered for a multidisciplinary standards course not already addressed by this survey, please discuss them below.

Comments

[Policy and Strategic Management]

Policy

- By course, are you talking about a (1) one semester or quarter course or (2) one week short course or both? If (1) then it would apply to undergraduate or graduate engineering or other discipline curriculums, perhaps at the 1 or 2 credit level I would guess. For (2) the focus would evidently be on currently employed individuals in any discipline that has an interaction with standards products usage. (2) Could be a compression of (1) but should have a structure that is balanced across the engineering, legal, and business sectors, including both private and government sector activities on standards. It seems for the educational thrust (1), to be successful will require considerable “awareness” type exposures via professional organizations and societies in engineering, legal and business, plus articles in university education publications so as to reach the faculty. No small undertaking to generate faculty interests so they will embrace and accommodate a standards multidiscipline course into their curriculum. The course structure should address the “value” of standards from all elements given in question #6 since they do not look upon standards from the same “value” perspective. Enhancing engineering legal, or business capabilities should be stressed relative to value of standards, not as a money making proposition which is the case for distributors and retailers, even for some SDOs in my opinion.
- While a course solely dedicated to standards is great, it would also be good to have short units and material that could be easily inserted into existing curricula for engineering, business, law, etc.
- Such a course should include the American cultural aspect of why standards from some sources are automatically considered acceptable, while in other instances, they are initially treated as suspect. One of the values of beginning standards education at the college level is to develop an appreciation for the overall partnership approach to preparing technical documents to support regulations and product approvals at numerous levels.
- A specific career field should be established for the writing and approval of standards. Part of the responsibility of the individual would be the review of existing standards and revision as needed.

- College graduates come to industry with virtually no understanding of standards and are thrust into positions that require them to use and understand these documents daily. In most cases older more experienced engineers that also had little formal training in the standards field mentor them. Poor practices are then handed down from one generation to the next. To break this cycle it is critical that education be done in the universities where our technical people will come from. Industry invests thousands of dollars in the standards process and needs to see a return on that investment. The benefits are enormous, but like any proposal it has to have a sound business plan that quantifies the return.
- I left Nos. 9 and 10 blank because I think you're missing a KEY issue - who are the people you're training and for what role. Once again, if they're going to be involved in mid-to-upper corporate management that would be one thing; public policy or a government role would be another and engineering yet another. There would be a tremendous difference in emphasis in the long run.
- Considering the purpose of this survey (see below), I wonder if I am the only one that misses questions such as (1) why do you participate in the standards development process?; (2) why do you think, your company participates in the standards development process?
- Risk assessment. Anticipating how a reader might interpret the detail contents of the standard. Recognizing how the Users' situations might affect their interpretation and use of the document. Determining the consequences of deviations from what is intended or mandated in the document.
- The only other major issue would be the costs and challenges of standardization (which goes back to the business case analysis as to whether or not standardization is justified). Emphasis is usually based on the benefits of standardization and not on the investments and other costs.

Strategic Management

- The history of my involvement in the development of standards is to rely on others for technical expertise. A technical understanding of the product for which a standard is being developed is necessary, but the engineers that "design" the product are the real experts. My experience indicates most of the engineers I'm referring to do not get involved in the standards development process itself. They advise rather than attend the standards meetings.
- Now, more than ever, it seems the development of a standard has become a very tedious process and the person involved in this process MUST have a good understanding of ALL of the issues (technical, legal, political, regulatory, global harmonization). Taking this into account, in most cases, having the engineer discussed above sit on the standards committee that is developing the standard may not be the best choice.
- Unfortunately in the U.S., legal issues have quickly become one of the highest priorities to consider when developing a standard. Consideration of the language used within a standard is now more critical than it was 20 years ago.
- The [standards] environment is evolving at an unprecedented rate. The dynamics of SDOs, corporations, and governments are going to be interesting to teach in such a course!