

## **2006-1041: ENGINEERING! THE "RODNEY DANGERFIELD" OF PROFESSIONS**

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# ENGINEERING!

## THE RODNEY DANGERFIELD OF PROFESSIONS

### Abstract

Why is it that in the United States engineering gets the least respect among all the professions? Did you know that every member of the Chinese Politburo is an engineer? In Germany, engineering is one of the most prestigious professions, ranking before the medical profession. According to “Marilyn”, a columnist in Washington Post, Sunday Magazine Section, engineers represent one of the most important professions and at the same time one of the least respected. Here in America the populace does not know the difference between the person who drives a train and a professional engineer (P.E.). In fact they think PE stands for Physical Education (no slight intended to this admirable profession).

This paper will speculate on why this situation is as it is, and provide some suggestions for improving the image of engineering and engineers and for the role engineering education could play in improving the image and influence of engineers and engineering in American Society.

We all found humor in the famous line of the well-known comedian (of fond memory), Rodney Dangerfield, “...I don’t get no respect!” For Rodney it was funny (and made him a lot of money). For engineers it is sad and costs society a lot of money.

This paper is intended to take a serious look at the professional status of engineers and engineering with a little bit of humor in the style of Rodney.

### Introduction

*I have not come to bury engineering but to praise it!* As we all may know the famous quote from Shakespeare's play *Julius Caesar* in which Mark Antony, when eulogizing Ceasar, says, “I have not come to praise Ceasar but to bury him.” Of course we know that Mark Antony proceeded to do just the opposite.

Why does engineering command such low respect? In today’s society there is virtually nothing that we enjoy that is not the result of the work of engineers and engineering. While the health professions deal primarily with the well being of individuals, the engineering professions are primarily responsible for the well being of society.

Where would we be without clean water? What would be the condition of society without waste treatment? What would be the quality of life without modern means of transportation and what would be the work environment without modern structures? Who do you know who doesn’t have a wireless communication device in their pocket or high-speed Internet connection at work or home?

Who knows how to communicate by smoke signals or carrier pigeons? Yet no one “beats the drum” for the engineering profession. It was not that long ago that early settlers took months in their trek westward in covered wagons drawn by horses with people walking most of the distance, taking three months to traverse the country. But today, at a moment’s notice we can fly from east to west in a matter of hours, without giving it any thought. In fact if the computer system goes down in a store, no one knows what to do; they may even close the store.

Today we have a burgeoning economy with fields of technology such as biotechnology and nanotechnology, fundamentally new branches of engineering. Society accepts this as the norm. In fact people get “ticked off” if things don’t work to perfection.

So, why do engineers and the engineering profession receive so little respect and esteem? Let us exam four professions that have an essential common aspect, Architecture, Engineering, Law, and Medicine (AELM). These four professions all require a license to practice. There are virtually no architectural design projects that do not require that the architect be a Registered Architect (RA). All constructed engineering projects require that the engineer be a Professional Engineer (PE), but unfortunately most manufactured engineering goods are designed and manufactured with out the protection of Professional Licensure (the industry exemption). While it is possible to provide services related to the theory of the law as an employee in a firm, it is not possible to “practice” law before a court with out having passed the Bar and being licensed to practice before the court. Finally, no one may practice Medicine with out a Medical License (MD). Each of these professions requires that one have a license from the state in order to practice the profession. This is to protect the public from injury by the actions of incompetent practitioners. This is the common thread among these professions. At this point the characteristics of these professions diverge, with the prestige and stature of each polarizing along with the divergence. The remainder of the paper will examine each of the four professions in a search for similarities and differences that may hold the clue to why Engineering is at the bottom of the hierarchy of professions in both stature and compensation.

### **Format of Poster**

As this paper is a “Poster” session paper, the format of the content is set up for poster presentation (8x4). The four professions are the rows (1. Architecture, 2. Engineering, 3. Law, and 4. Medicine) and six “aspects” of these professions are the columns of the presentation Poster (1. origin of practice, 2. post World War II indoctrination to practice, 3. acceptance of the profession by the public, 4. formal educational requirements, 5. licensure (reasons and consequences), 6. specialization). The last two columns of the poster will deal with reasons and suggestions for bring the practice of engineering more on par with that of the learned professions of our society.

### **Origin of Practice**

AELM can trace their origin to the beginning of recorded time. The architect and the engineer are witnessed in the antiquity of the pyramids and the roads and aqueducts of the ancient Roman Empire. Circa 25 BC, Vitruvius described the role of an architect as: “... a man of letters, a mathematician, familiar with historical studies, a diligent of philosophy, acquainted with music,

not ignorant of medicine, learned in the responses of juris consultis, familiar with astronomy and astronomical calculations.” The practice of law may be traced to the Code of Hammurabi almost 2000 B.C. The hieroglyphs of the Egyptian tombs record the earliest manifestation of the practice of medicine.

The Architecture, Engineering, and Law initiated by the Romans more than 2000 years ago, continue to influence the practice of these professions today. The early studies of the anatomy of the human body by DiVinci are still viewed with admiration. So historically we see that these professions have been an essential part of the growth, development, and well being of society. Those that practiced these professions were persons of stature and respect in their communities.

### **Indoctrination to Practice**

In antiquity, indoctrination to the practice in virtually all fields of endeavor was through internship (apprenticeship, mentoring). To pick a point in time, consider the Post Colonial period in this country. Indoctrination to the practice of architecture, engineering, law and medicine (AELM) was quite mixed. In the 1800’s the complexity of buildings, in terms of their structure and utilities gave rise to the engineering profession necessary to design and construct our modern multistory buildings.

### **Acceptance by the Public**

The field of building architecture has always been accepted by the public as witnessed by the classical homes of the wealthy and the ornate structures of the early urban landscape. As these structures became taller and required more intricate utility systems (plumbing, mechanical, electrical, etc.) the need for engineering services increased. However the acceptance and stature of the engineer remained subservient to the architect. At this point in time the practice of medicine for general health care could be portrayed as in competition with the practice of pharmacy. A significant amount of health care was received on the advice of pharmacists. In fact, childbirth more often than not was performed by midwives.

### **Formal Education**

Beginning in the 20<sup>th</sup> century, the practice of the professions began to progress towards the requirement of formal education for the full practice of the profession. As the scope of knowledge increased, the mentorship or tutorial introduction to the practice of the disciplines became problematic. Here we begin to see a divergence of educational philosophies. The architecture and engineering professions moved toward the inclusion of discipline-specific education within the structure of baccalaureate education, while law and medicine moved toward a preparatory baccalaureate education and specialized education at the graduate level.

It is the authors’ conviction that this was the beginning of the change in stature and perception of the professions with law and medicine assuming a more prominent position in our society and architecture and engineering a lesser prominence, with engineering being at the very bottom. We proffer that one of the reasons for this was that out of necessity, in order to adequately expose the students to the rigors of the discipline at an undergraduate level, in the engineering subject credit

hours for the degree increase. In response, there was a “chipping away” of instruction in those areas that enrich the very essence of being, those referred to as general education subjects. This resulted in those prepared for practice in medicine and law being in a better position to positively influence society’s perception of their disciplines. Higher social regard for these professions leads to higher compensation for doctors and lawyers.

The erosion of the enrichment of basic intellectual skills is reflected in the humorous comment of 50 years ago “... *four years ago I couldn’t spell engineer, but today I are one.*” This comment has more truth than humor in that we have sacrificed an important aspect of our education at the “altar” of specialization.

## **Licensure**

As initially cited, licensure is the common thread among these four professions. Many professions require a license. The primary reason for licensure, as stated for engineering registration, is the protection of the health, safety, and welfare of the public by those practicing the profession. The four disciplines we have highlighted are unique in that their practice also requires a high degree of intellectual prowess.

In 1897, Illinois became the first state to adopt an architectural licensing law. It would take more than 50 years for all of the states to follow suit and adopt licensing laws.

The first engineering registration in the United States was in the State of Wyoming, which passed the first engineering registration law in 1907. Here again history dealt engineering a negative blow. The recognition in the licensure laws for architecture, law, and medicine of the importance of protecting the health, safety, and welfare of the public from the incompetent practice of the profession resulted in virtually all aspects of these professions requiring licensure. It is only the practice of engineering that excused a major component of the practice of engineering from the requirement of licensure through the so-called “industry exemption.” Only those aspects of engineering dealing with structures (buildings, bridges, etc.) were required to be licensed. The entire spectrum of engineered works—vehicles, commercial products such as toasters etc.—need not be designed or manufactured under the supervision of a licensed professional.

In the United States, some state bar associations are operated by their respective state governments which make membership in their state's bar association a requirement to practice before that state's courts; such states are said to have a "mandatory" or "integrated bar." Membership in such associations is synonymous with being admitted to the bar or being licensed to practice law in that state or being admitted to practice before the courts of that state. The first State to integrate its bar was North Dakota in 1921.

Virginia enacted the earliest health professional licensure law in 1639. That law dealt with the collection of physician fees, vaccination, the quarantine of certain diseases, and the construction and management of isolation hospitals. Other early colonial acts denied non-physician practitioners any standing in civil courts to collect fees. In 1760 New York City became the first American jurisdiction to prohibit practice by unlicensed physicians.

The protection of society and in turn the “protection” of the profession has a long history in this country. Beginning in 1639 for Medicine (practically speaking in 1760), and then following in relatively close succession, Architecture in 1897, Engineering in 1907, and Law in 1921.

## **Specialization**

Here again we have similarities and differences that separate the learned professions we are examining. Specialization is developed and enriched in various ways. The architect specializes through graduate studies (planning, development, etc.) and through practice. (office buildings, residential structures, etc.). The attorney may begin specialization in law school and continue honing his/her expertise through graduate studies and/or practice. The medical doctor begins some focus of specialization in medical school but completes the concentration in a specific area through an internship or fellowship resulting in recognition by a group responsible for ensuring the qualifications of those practicing in that specialty (e.g. The American College of Surgeons, etc.).

On the contrary, engineers, at each point where it became necessary to provide additional training in a specialization, have proliferated additional undergraduate degrees. This practice has continually sacrificed basic knowledge and skills and has resulted in a “Tower of Babel” approach where each separate engineering discipline is an entity unto itself. All architects are architects, all lawyers are attorneys, all medical doctors are physicians, but all engineers are **WHAT?**

Another reason for the lack of prestige and stature of the engineering profession is its failure to recognize its common core. In the words of the famous adage “*United we stand, divided we fall.*” Or to paraphrase the words of Rodney Dangerfield “**We Don’t Get no Respect!**”

## **Engineering: A Learned Profession**

Is engineering a learned profession? Certainly the knowledge necessary to practice any field of engineering is extensive. Does that make us a learned profession? No! The skill with which knowledge is applied to the solution of society’s problems is an essential part of a learned profession. Is skill in the application of the knowledge of engineering required? Most certainly yes! Is this sufficient to qualify as a learned profession? We don’t think so.

The Knowledge, Skills and Aptitude (KSA’s) necessary to master the practice of a profession, its skillful application with the understanding of its impact on society, with integrity (ethics) is essential to be considered a learned profession. The practice of engineering can meet this test. We think it has been weak in fully complying with these requirements. Yes, engineering is a learned profession. If it wishes to command the respect and the stature of a learned profession it needs to make adjustments in the formal preparation for practice and to change the requirements for licensure.

The result of our examination the AELM, we suggest the following roadmap for moving the engineering profession in the direction that will hopefully result in parity with these other professions and the stature and compensation to which we are rightfully entitled.

## **Education**

First and foremost engineering must rethink the academic roadmap required for the practice of all fields of engineering. The authors propose that there should be a common undergraduate degree that prepares a student for entry into graduate study in a specialty of an engineering discipline. The undergraduate degrees that focus on the specialization of a given discipline should be the domain of technology. The undergraduate degree in preparation the practice of engineering as a profession should be a pre-engineering degree like pre-law and pre-medicine.

This fundamental change in educational philosophy would provide those who practice engineering as a profession with a well-rounded education encompassing breadth and depth of intellectual knowledge. As already suggested by the American Society of Civil Engineers (ASCE) the first professional study for the practice of civil engineering should be at the graduate level. It is our conviction that for all engineering disciplines, professional study should be at no less than the master's degree. This is to provide those who will lead the profession with an adequate and proper education rendering them suited for leadership positions both in the profession and the political realm influencing their work. It is only through a foundation of communication and reasoning skills that one is prepared take on a leadership role.

Engineers must be able articulate their position on both the technical and the social ramifications of their work as well as, if not better than, the other professions if they are to participate in leadership roles in our society. The engineer must have tempered his/her reasoning skills to adequately influence the political decisions that are so critical to the success of the profession and a modern technical society. For example, the inadequacies of levees in New Orleans most likely will be discovered to have been the result not of technical decisions made by engineers but of political decisions made by politicians. The failure to take advantage of the defense satellite system to take pictures of the damaged space shuttle that was lost on the entry to the earth's atmosphere is another example of a decision made by a person who was ignorant of fundamental engineering principles. Engineers should be the responsible people in charge of these projects. But this will not become a reality until we produce engineers that have the KSA's necessary to succeed in these roles. Another "thorny" issue is the professional recognition of Engineering Faculty. Do the faculty of Architecture, Law, and Medicine for the most part hold the appropriate license for practice in their area? They do. Why, then not the Engineering Faculty?

## **Elimination of the Industry exemption**

The "thorn" that has for over fifty years adversely affected the practice of engineering is the industry exemption. The industry exemption permits the design and control of production to be accomplished without the assurance that professionally competent individuals are in responsible charge of these works. The engineering annals are full of examples of the failure of engineered works with no clear claim for the responsibility for these failures. For example space shuttle accidents, automobile design failures, numerous inadequate electrical designs. Nowhere in the judicial system is there leadership by other than attorneys. Nowhere in the health is industry there non-medically trained leadership. Only in the critical areas of engineered works do we find non-engineers in leadership positions. This is truly a travesty! Medical Doctors and Attorneys

appropriately head Agencies in our federal government that are primarily concerned with medicine and law. Why then are Agencies at all levels of government that deal essentially with engineering issues often not led by engineers (**most often not**)? This must change. The leaders of these areas of society, which are primarily concerned with engineering works, must be led by licensed Professional Engineers.