



Editorials by guests and Engineering Trends regarding issues in engineering education. Visitor comments welcomed.

## The New Engineer? (February 2004)

**W**hat is the public's general perception of an engineer? Do people consider engineering as a profession like law or medicine or do they consider engineering as a sort of technical oriented job category like repairing or operating machinery (trains, for example) or perhaps doing routine technical work in a company? The photograph below illustrates why there is confusion about the field of engineering.



The billboard of the Howard Johnson Inn near the UMass Amherst campus displayed an advertisement for employees, in this case for their engineering staff!! Do engineers really repair and operate hotels, trains, buildings, etc. or do they invent products to make our environment cleaner, to save lives, or to improve the life style of the public?

Lack of a clear understanding of what an engineer does is not our only problem. Engineers are often portrayed as nerds, socially isolated, incommunicative, etc. This general view is of course absurd, but the impression is strongly emphasized in the media. If we are to recruit the best and the brightest to enter our profession, many of whom have no role models to

follow (e.g. large numbers of women and minorities), we need to educate the public about what engineers do as professionals and what an important contribution we make to society. Getting this message out to the general public is a challenge for the engineering professional societies, the media, and the engineering colleges across the country.

In addition, our field is changing like it never has before and many of us haven't realized the implications of the changes. With the development of sophisticated computers and software, some types of design activities which employed large numbers of engineers have become more like commodities. Computer simulation and design packages can often be applied to solving engineering problems, reducing the need for engineers, particularly engineers with the education we now provide. In addition, there is no reason why many engineering activities need be carried out by native US engineers when there is quite

capable and often less expensive engineering talent available world wide. At the same time our engineering colleges seek the best and the brightest to educate and to enter our profession, many of the high paying engineering jobs are going off shore. In reality our problem is two fold: we need to differentiate our profession in the public eye, and we need to educate "The New Engineer", an engineer who will provide technical leadership for the future. In my opinion, we need engineers who are concerned not only with the process of design but with the total system, engineers who are leaders in a team environment, and engineers who are people oriented.

It is always much easier to recognize a problem than to offer solutions for the problem. Let me outline a few ideas here. These ideas are actually not so revolutionary as they have been discussed for decades. It is just that the time has come for engineering educators to take some bold steps and change our curriculum.

We need to embrace the idea that engineers serve people. Engineers can provide technical leadership when they begin to take a systems engineering approach to their work. One important aspect of The New Engineer is in understanding in what way his or her design will interact with the end user. This aspect of engineering was driven home to me this year at the time that UMass was selected to lead a new NSF Engineering Research Center for Collaborative Adaptive Sensing of the Atmosphere. This Center will develop new radar systems which will allow much better advanced warning of severe weather conditions. A critical part of this research involves working with first responders and with the public to make sure that the information produced is of high quality and presented to the public in a way that will maximize the use of the data. Another unique aspect of this Center is the involvement of students who will work on a complex systems oriented problem which directly involves the end users. These students will have the opportunity to serve people. I have no doubt that students will line up to be part of the action.

The New Engineer will need to be more interactive with people – have an understanding of a multicultural environment, have at least one direct experience working with people, have a working understanding of the global environment, and have several direct experiences working in a team environment on a technically oriented problem. Not only will The New Engineer be comfortable working with end users but he or she will need to understand the business – economics of the design process. Most engineers will work in an environment where products must be designed to minimize cost. One course in economics will not be sufficient for The New Engineer; there is much more to learn in the area of business if engineers are to tackle systems oriented problems.

In summary, The New Engineer will need more background in understanding various cultures, languages, history, business, sociology, etc. than the typical BS engineering curriculum allows. Add to that the need to have experience in solving complex problems, in having at least one international experience, and perhaps in having an undergraduate research experience. This type of education for The New Engineer cannot be accomplished within the typical BS engineering curriculum of today.

In order to prepare The New Engineer, one option is for engineering education to embrace the concept that the first professional degree will be the MS degree. The BS degree will no longer include all the technical courses that we now provide. However, the BS degree will provide the necessary background – education for The New Engineer. The MS degree will be the professional degree that will define the engineering specialty. Such an educational sequence will also help to define the profession of engineering. I assert that the educational background, described above, will be much more exciting to minorities and women whom we wish to attract to the profession. The educational sequence will still be

technical in orientation but our core courses will be more interdisciplinary. The BS curriculum will include the concept of “engineers serving people” and will provide a much broader liberal arts type of background which will be critical for the engineer of the future.

For most colleges of engineering, the changes I suggest will not be hard to accomplish. The changes will not cost the University a lot of money. The investment of the student and his or her parents will probably be significant unless scholarship aid for the MS degree becomes available. The non-engineering courses are already available in other parts of the University and the engineering courses needed for the MS degree are already being taught. What will be needed is more attention to providing problem solving activities and international experiences. There are a few colleges of engineering who have already moved in this direction and can serve as role models. Most of the difficulty in making the change is philosophical; engineering education is slow to change and has been so for some 40+ years. The real challenge is in convincing our colleagues that change is necessary if we are to attract the best students and educate students in such a way as to provide our country with the type of technical innovation which has made our country so strong.



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