THE PROFESSIONAL HERITAGE OF INDUSTRIAL ENGINEERING

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1. Introduction

To those of you who have been on the faculty or staff of the NCSU Department of Industrial Engineering for at least five years, I apologize in advance because you are going to hear a graduation address that closely resembles the talk I gave at the fall departmental graduation in 1995. However, I think you will find some of these remarks are surprisingly relevant even today; and I promise there will also be some new stuff—so you shouldn’t go to sleep just yet.

To each of our graduates, I want to begin by congratulating you on your accession to the profession of industrial engineering. Recall that the word accession means “the act of attaining or coming to high office or a position of honor or power.” One of the main points of this graduation address is that the industrial engineer occupies a position of honor and power in our society—and the individuals graduating here today have an obligation not only to use the power of their technical knowledge in service to society but also to uphold the honor and dignity of their profession by adhering to the highest standards of ethical conduct. The second main point of this address is that in actively seeking a more complete understanding of and appreciation for the careers of great industrial engineers, each of us can find effective role models for our professional lives; and in the second part of this address I will discuss briefly the careers of Alan Pritsker and Salah Elmaghraby, two distinguished individuals who have made numerous significant contributions to our profession.

We live in a time when public esteem for many professions has fallen dramatically, and this state of affairs has ominous implications for the future of our society. In recent weeks and months, the press has been full of articles that suggest sharply declining public respect for politicians of all stripes, judges at all levels of the judiciary, major-league baseball players, and even university administrators—including university police chiefs! In all these cases, the nub of the problem is that many members of these professions are widely perceived to be placing their personal interests ahead of the larger interests of the community or society they are supposed to serve. By contrast, there has not been a similar decline in the public’s esteem for the engineering profession; and it is important to understand the reasons for this and to ensure that the present high ethical standards of the profession are maintained in the future.

2. Public Esteem for the Engineering Profession

It is worth noting that the British engineers of the Victorian and Edwardian eras were and continue to be highly regarded for their contributions to British society. Reverence for the engineers of that time was eloquently expressed by Rudyard Kipling in his poem “The Sons of Martha.” I am unaware of any comparable literary work in the English language that so honors any other profession. This poem is reprinted on the fourth page of your graduation bulletin along with a Biblical quotation that explains the context of the poem.

“The Sons of Martha” is based on a story from the Gospel of Luke (10:38–42) in which Jesus and his disciples visited the house of two sisters, Mary and Martha; and while Martha worried about how to serve all the guests, Mary preferred to sit at Jesus’ feet and listen to his teachings. When Martha implored Jesus
to tell Mary to help with the task of serving all the people in the house, Jesus replied that Mary had chosen to do the better thing. In the first two stanzas of the poem, Kipling establishes the Sons of Martha as a metaphor for engineers and the Sons of Mary as a metaphor for nonengineers:

The Sons of Mary seldom bother, for they have inherited that good part;  
But the Sons of Martha favour their Mother of the careful soul and the troubled heart.  
And because she lost her temper once, and because she was rude to the Lord her Guest,  
Her Sons must wait upon Mary’s Sons, world without end, reprieve, or rest.

It is their care in all the ages to take the buffet and cushion the shock.  
It is their care that the gear engages; it is their care that the switches lock.  
It is their care that the wheels run truly; it is their care to embark and entrain,  
Tally, transport, and deliver duly the Sons of Mary by land and main.

I think this is enough to give you a sense of the tone of the rest of the poem.  
Clearly the third stanza is a tribute to civil engineers, and the fourth stanza is a tribute to electrical engineers. For me, however, the most important passage is found in the next-to-last stanza:

Raise ye the stone or cleave the wood to make a path more fair or flat—  
Lo, it is black already with blood some Son of Martha spilled for that!  
Not as a ladder from earth to Heaven, not as a witness to any creed,  
But simple service simply given to his own kind in their common need.

I interpret this stanza to mean that the engineering profession transcends politics, religion, and every other aspect of life that divides humanity into various factions and that the engineer is distinguished by “simple service simply given to his own kind in their common need.” Although this high-flying Victorian rhetoric may sound quaint to us as we stand on the threshold of the twenty-first century, I believe that it forcefully expresses the key to the public’s high regard for the engineering profession even down to the present day—namely, selfless dedication to the service of society that has been and must continue to be the focus of our profession.

3. The Professional Heritage of Industrial Engineering

Intimately bound up with the public’s perception of the field of industrial engineering is our own appreciation for our rich professional heritage. In this part of my talk, I want to focus on the careers of two giants in the field who are role models for all industrial engineers.

3.1 Alan Pritsker’s Multifaceted Career

Alan Pritsker, one of the founders of the field of computer simulation, passed away on August 24, 2000. Over the course of his forty-five year career, Alan made seminal contributions to many areas of simulation and to the larger fields of industrial engineering and operations research. Foremost among Alan’s achievements was his work in discrete and combined discrete-continuous simulation. Alan also made fundamental contributions to the analysis of stochastic networks and general simulation experiments. More than any
other individual, Alan disseminated knowledge about industrial engineering in general and computer simulation in particular at all levels of academia, government, and industry through his personal “missionary” work, his twelve popular textbooks, and his numerous archival journal articles.

Alan’s first love was teaching. While serving on the faculties of Arizona State University (1962–69), Virginia Tech (1969–70), and Purdue University (1970–98), Alan supervised the graduate work of eighteen doctoral students and over sixty master’s students. I had the rare privilege of doing my graduate work under Alan’s guidance—and I must add that I have spent my entire professional career trying to measure up to the example that he set in everything he did.

By his leadership in various commercial enterprises, professional societies, and governmental organizations, Alan contributed significantly to the dramatic growth of the fields of simulation, industrial engineering, and operations research over the past forty-five years. He was a cofounder of Pritsker & Associates (1973); and subsequently he led FACTROL (1986–89) and Pritsker Corporation (1989–98). In 1968 he cofounded the Operations Research Division of the American Institute of Industrial Engineers (AIIE, now called IIE); and he served as the director of that division from 1968 to 1970. He received the “AIIE Distinguished Research Award” in 1966, and he was elected a Fellow of AIIE in 1978. It is especially noteworthy that in 1991, Alan received from IIE the “Frank and Lillian Gilbreth Industrial Engineering Award,” the highest and most esteemed honor presented by that organization. Moreover, in 1999 the Institute for Operations Research and the Management Sciences-College on Simulation presented Alan with its “Lifetime Professional Achievement Award,” which is the highest honor given by that society. Elected to the National Academy of Engineering in 1985, Alan enjoyed the distinction of being the second industrial engineer to join that organization. Over the past fifteen years, Alan actively served the National Academy of Engineering in many positions of great responsibility. We are indeed fortunate to have benefited from Alan Pritsker’s multifaceted contributions to our profession over the past five decades.

3.2 The Career of Salah Elmaghraby

Next I want to survey briefly the career of Salah Elmaghraby, an individual who is still very much with us—and in fact he is with us here today. Since he joined the faculty of North Carolina State University as a Distinguished University Professor thirty-four years ago, Salah Elmaghraby has served the University as a devoted teacher, as a researcher and scholar of the highest class who is universally held to be a leader of his field, and as an administrator who founded and for twenty years led the Graduate Program in Operations Research (OR)—one of the oldest and most successful interdisciplinary programs not only within the University but also throughout the world. Appropriate recognition of Salah’s contributions to the University came last spring when he was awarded the “Alexander Quarles Holladay Medal” by the NCSU Board of Trustees.

The Holladay Medal is named for Col. Alexander Q. Holladay, the University’s first president. It is the highest recognition given to a faculty member for contributions to the institution in teaching, research, and service that are sustained over most of a professional career.

Salah’s achievements as a teacher and educator would by themselves constitute sufficient qualification for the Holladay Medal. Over the past thirty-four years, he has originated and taught four undergraduate courses in the Department of Industrial Engineering (IE) as well as eight graduate courses in the IE and OR Graduate Programs. He has supervised fourteen doctoral candidates and twenty-two master’s students; and all these students are now serving with distinction in academic, governmental, and industrial positions in the U.S. and abroad. In recognition of his remarkable contributions to graduate education, the University conferred on Salah the “The Alumni Association Distinguished Graduate Professorship Award” in October 1999.
Because of his extraordinary achievements as a researcher and scholar, Salah is widely regarded as one of the great leaders of the fields of IE and OR. Alan Pritsker (about whom I spoke earlier) made the following statement on page 203 of his professional autobiography *Papers, Experiences, Perspectives* (Systems Publishing Corporation 1990):

Salah Elmaghraby is one of the most innovative industrial engineers. Throughout this book, there are many instances where my activities build on Salah’s developments. He has made significant contributions to the industrial engineering field while maintaining a broad perspective.

Salah was elected a Fellow of IIE in 1986. Among the many other honors and awards that Salah has received for his groundbreaking research in a broad diversity of areas, particularly noteworthy are the following: (a) “The AIIE Distinguished Research Award” (1970); (b) “The IIE Operations Research Division Award” (1980); (c) “The R. J. Reynolds Tobacco Company Award for Excellence in Teaching, Research, and Extension” from the NCSU College of Engineering (1987); (d) “The Kuwait Foundation for the Advancement of Science Distinguished Research Prize” (1990); and (e) an Honorary Doctorate from University Claude Bernard Lyon I, Lyon, France (1998). Salah Elmaghraby’s career epitomizes the highest ideals of both the engineering and academic professions, and we are privileged to have him as a colleague in the Department of Industrial Engineering.

4. Being a Professional

The last topic I would like to address to the new graduates falls under heading “Being a Professional.” Although many of the things I have to say are tied directly to previous parts of the talk, for the most part my remarks are just personal observations on what I believe it takes to be successful in any career.

The first thing I want to discuss is your attitude toward your work. In the recording *Let's Get Small*, the comedian Steve Martin closes one of his songs with what I believe are the half-joking, half-serious lines,

But the most amazing thing to me is,  
I get paid for doing this.

Now I may be reading more into these lines than Steve Martin ever intended, but I think his point is that he finds his job to be so much fun that he is astonished to find he also makes a living at it. Whether or not this is really Steve Martin’s attitude, he has memorably articulated an attitude that I have held consistently over the past thirty years—and I sincerely believe that this is an essential ingredient to professional success. Your work should be fun, and you should regard it as one of the great and permanent sources of happiness in your life.

My second point is that professionals must learn about every part of their profession—that is, they must immerse themselves in their profession and live it as best they can. This means continuous reeducation to keep up with the latest developments in the field and to avoid obsolescence. This also means establishing professional certification; and for most of you, this means beginning now the process of becoming registered professional engineers. If there is anything my experience has taught me, it is that you cannot predict the course of your career or what professional competencies and certifications you may need in the future. Thirty years ago when I graduated from Rice University, I never dreamed I would be doing anything remotely resembling the job I have now; and I strongly suspect many of you will experience similar unpredictable changes of direction in the course of your careers.
My final point is that you should take an active role in professional organizations like the Institute of Industrial Engineers, the Society of Manufacturing Engineers, the Human Factors and Ergonomics Society, and the Institute for Operations Research and the Management Sciences. This is the best way I know to ensure that you continue to grow professionally and that you have a means for effectively serving the engineering profession as well as the rest of society.

5. Conclusion

To close these remarks, I come back to the last two lines of Kipling’s poem “The Sons of Martha.” In speaking of the nonengineers in society (that is, the Sons of Mary), Kipling says:

They sit at the Feet—they hear the Word—they see how truly the Promise runs.
They have cast their burden upon the Lord, and—the Lord He lays it on Martha’s Sons!

Although there is a certain irony in these lines, they underscore the almost sacred role of engineers in society.

Finally I want to say that if the children of Martha provide an appropriate metaphor for all engineers, then the eldest child of Martha—the one charged with the overall integration and coordination of Martha’s various enterprises on earth—must surely be an industrial engineer. We in the industrial engineering profession can take great pride in counting among our ranks Alan Pritsker and Salah Elmaghraby, two of Martha’s most distinguished descendants. Again I congratulate each of you on becoming an industrial engineer.
LUKE 10:38-42

Now it came to pass, as they went, that he entered into a certain village: and a certain woman named Martha received him into her house. And she had a sister called Mary, which also sat at Jesus’ feet, and heard his word. But Martha was cumbered about much serving, and came to him, and said, Lord, dost thou not care that my sister hath left me to serve alone? bid her therefore that she help me. And Jesus answered and said unto her, Martha, Martha, thou art careful and troubled about many things: But one thing is needful; and Mary hath chosen that good part, which shall not be taken away from her.

THE SONS OF MARTHA

Rudyard Kipling

The Sons of Mary seldom bother, for they have inherited that good part;
But the Sons of Martha favour their Mother of the careful soul and the troubled heart.
And because she lost her temper once, and because she was rude to the Lord her Guest,
Her Sons must wait upon Mary’s Sons, world without end, reprieve, or rest.

It is their care in all the ages to take the buffet and cushion the shock.
It is their care that the gear engages; it is their care that the switches lock.
It is their care that the wheels run truly; it is their care to embark and entrain,
Tally, transport, and deliver duly the Sons of Mary by land and main.

They say to mountains, “Be ye removed.” They say to the lesser floods, “Be dry.”
Under their rods are the rocks reproved—they are not afraid of that which is high.
Then do the hill-tops shake to the summit—then is the bed of the deep laid bare,
That the Sons of Mary may overcome it, pleasantly sleeping and unaware.

They finger death at their gloves’ end where they piece and repiece the living wires.
He rears against the gates they tend: they feed him hungry behind their fires.
Early at dawn, ere men see clear, they stumble into his terrible stall,
And hale him forth like a haltered steer, and goad and turn him till evenfall.

To these from birth is Belief forbidden; from these till death is Relief afar.
They are concerned with matters hidden—under the earthline their altars are—
The secret fountains to follow up, waters withdrawn to restore to the mouth,
And gather the floods as in a cup, and pour them again at a city’s drouth.

They do not preach that their God will rouse them a little before the nuts work loose.
They do not teach that His Pity allows them to drop their job when they dam’-well choose.
As in the thronged and the lighted ways, so in the dark and the desert they stand,
Wary and watchful all their days that their brethren’s days may be long in the land.

Raise ye the stone or cleave the wood to make a path more fair or flat—
Lo, it is black already with blood some Son of Martha spilled for that!
Not as a ladder from earth to Heaven, not as a witness to any creed,
But simple service simply given to his own kind in their common need.

And the Sons of Mary smile and are blessèd—they know the Angels are on their side.
They know in them is the Grace confessed, and for them are the Mercies multiplied.
They sit at the Feet—they hear the Word—they see how truly the Promise runs.
They have cast their burden upon the Lord, and—the Lord He lays it on Martha’s Sons!