COMMENCEMENT ADDRESS

Carlo J. De Luca
Dean, ad interim

BOSTON UNIVERSITY

COLLEGE OF ENGINEERING

THIRTY-FOURTH COMMENCEMENT

MAY 17, 1987

Engineering Education and Leadership: A Formula for the Future

Dean *ad interim* Carlo J. De Luca
Boston University College of Engineering
Thirty-Fourth Annual Commencement Convocation
May 17, 1987

Isn't this a great day? Everything that's said about graduations, all those sentiments that may have seemed outworn or overblown or overly sentimental--they all turn out to be appropriate. For you receiving bachelor's degrees, this is in the tritest, truest sense of the word a "commencement": it is the beginning of your professional lives. You may earn further degrees, have other commencements, but none will compare with this first degree, the bestowal of which is a rite, the public celebration of a new period of your life.

Others among you have had that first celebration and are moving on. Those of you who received master's degrees today have narrowed your specializations and equipped yourselves for continuing professional growth. And the Ph.D. degrees granted today represent a significant step not only for you five recipients, who have proven your capacity for sophisticated, creative, cross-disciplinary research--but also for the College of Engineering. These are our first doctorates, the initiation of a new period in the life of the College, our growth in both education and research.

Your parents are, of course, very proud. And you can be proud of them, as well. This is the culmination not just of your years at Boston University but of all your years until now. It is evidence of their success in teaching you to develop and use your intelligence, to set worthy goals and achieve them. It is evidence, too, of their own devotion to education and to your success--a devotion that they have demonstrated in, among other things, hard cash and the considerable work it takes to earn it. Financing education at a first-rate, independent university is a monumental achievement, which in itself is worthy of pride--theirs and yours.

We on the faculty are proud, too. We saw you come, fresh from high school or from undergraduate programs or from jobs, and we've watched you transform yourselves into confident men and women on the threshhold of bright careers.

Your record as a class demonstrates your potential. You have proved your abilities, in the classroom and the laboratory, and in College and campus activities. Many of you

have made significant contributions as members of your professors' research teams. The senior projects display an impressive range of skills and intelligent creativity, and I hear that several of them are now being expanded for presentation at professional meetings or in journal articles.

Your first steps away from us are already highly successful. The year has brought repeated good-news bulletins--offers of excellent jobs with bright futures, acceptances to leading medical schools and other graduate programs, prestigious awards. We were all particularly excited last December when Kathleen McLaughlin received the Rhodes Scholarship, both because it will open up exciting possibilities for a truly splendid young woman and because the selection was based on her excellence in those areas that we on the faculty believe basic to engineering education--knowledge of the field, breadth of interest and viewpoint, idealism, realism, integrity, dedication. These are the qualities on which you will build your success, in your professional, community, and family lives.

Today Boston University becomes your *alma mater*, your "nurturing mother." That relationship is eternal. Like any mother, she will continue to care about you, to help when she can, and to want to hear from you. Don't leave her waiting by the phone. We hope that this Commencement begins not only a new stage in your lives but a new, significant stage in your relationship with your *alma mater*. What the College becomes depends in part on what you continue to bring to it. So let us know from time to time what you've been doing. Encourage bright young people to come here. Join our alumni activities. The participation of our alumni has increased markedly this year, so particularly if you remain in this area, you will be offered an expanding range of social and professional activities, as well as the opportunity to work with current students. What you give us in time and interest will contribute to what we become.

The diplomas you are about to receive represent both the education that you've acquired here and your lifetime relationship with the College and the University. Throughout your career, your *alma mater* will be important not only for what she has taught you but for how she is perceived by those who hire, promote, judge graduate school applications, award grants, and otherwise influence the progress of your professional life.

By that measure, your diploma will grow in value as the College's excellence, and the national awareness of that excellence, continue to grow. Under President Silber's leadership the University--and with it the College--have achieved international leadership in education and research.

In your years here you've witnessed a significant part of the College's growth: new buildings with excellent new laboratories, undergraduate courses in technical areas barely known when you were in high school, a continually expanding research program.

Grants and contracts to your teachers have risen nearly 40 percent in the last two years and we expect them to double again within the next two.

You were among the very best classes ever admitted to the College; the classes to come will be, by those quantitative measures on which we must depend, even better. Applicants to next fall's freshman class have an average high school grade point of 3.36 and a cumulative SAT score of 1174--a gain of nearly 100 points in the last decade. The average score for college-bound high school students a year ago was 906; our applicants' average is some 270 points higher. These outstanding young people have chosen the College of Engineering because they have learned about the excellence of the education available.

Your engineering courses have introduced the tools of your profession. Notice that I say "introduced." An engineering education is a life-long process. If you consider today the formal end of your education, then your engineering education up to this point will have been wasted. Technological knowledge is expanding at a rate never before even imagined; your career depends on your continued study.

Today some educators are suggesting that the rapid growth of technological knowledge demands adding a fifth year to the undergraduate curriculum. That idea is hardly new: it was proposed half a century ago and challenged on this very campus. In the late thirties, Arthur G. B. Metcalf was a Boston University assistant professor, teaching courses in aeronautics. His name should be familiar to you: he is now Chairman of the University's Board of Trustees.

In 1939, he wrote:

> With respect to a five-year program, I would say definitely no; the engineering student's need for industrial and business contact seems to me to be considerably greater than his need for the storing of a few more professional facts. Indeed, without a knowledge of the practical aspects of the subject, the student cannot, beyond a certain point, intelligently assimilate engineering information, nor can it have meaning for him.[1]

What was then a discussion among a few forward-thinking engineering educators has in the intervening years become a lively national debate. Engineering and hence engineering education have changed, but Chairman Metcalf's stand remains valid. Four years *is* sufficient time in which to learn the fundamentals, and teaching fundamentals *is* the university's responsibility.

The next step--the maturation of the practicing engineer--must come through work experience. Just as a research-oriented engineer continues to grow in a University-based graduate program, so must a practicing engineer grow in the work environment. The evolution of engineering education--in fact, the recovery of our nation's industrial leadership--requires a stronger partnership between education and

industry. Industry must assume responsibility for the post-graduate education of practicing engineers. It is only in the industrial laboratory that they can achieve specific expertise. The choices are too wide, the changes too rapid for colleges to provide the highly specialized and advanced education necessary, not only for professional success but for the world's well-being.

As the technical powers of the engineer advance, so must the ability to use that power wisely. The work that you will do will touch the lives of every man, woman, and child in this world. How you use your engineering ability will depend on your understanding of the human condition, your historical and cultural perspective. For that reason, while the technical-scientific component of engineering education evolves to accommodate rapidly changing, ever-more-sophisticated areas, we must also strengthen the sociohumanistic component of the curriculum. However, the sociohumanistic component should not be enhanced at the cost of the technical-scientific component.

I propose a three-prong design for the national engineering curriculum.

First, we must have a program of cross-disciplinary courses occupying essentially the same portion of the curriculum but specifically crafted to establish the breadth of vision that will be demanded of effective, socially-responsible engineers. Immediate attention must be addressed to the selection of material and the design of courses that will enlarge the outlook of engineering students and provide the knowledge and awareness on which, ultimately, the safety of the world depends. We of the engineering colleges call on our colleagues from other disciplines to assist us in this vital task.

Second, the technical-scientific component of the curriculum must impart the fundamentals of engineering concepts on which life-long learning can be based, and must have the dynamic structure that responds to the evolution of engineering knowledge and practice. That flexibility is best achieved by providing opportunities for undergraduates to join in research with the faculty and graduate students. Such experience provides what classes and laboratories cannot--a sense of the research experience, in which there is not steady movement toward a defined "right" answer, but rather a gradual, sometimes frustrating, often rewarding progression toward a shared goal.

Third, the more practical, the more immediate, and the more engaging aspects of engineering education must be completed in industrial and postgraduate programs.

Changes in these three areas will require the close cooperation of colleges of engineering, liberal arts faculties, and industry. Working together, we can create a national engineering curriculum responsive to the challenges of the coming decades.

Let there be no confusion: engineering education in this country is already the best in the world. Even those nations that demonstrate their engineering excellence by besting us in the international marketplace send their outstanding students to study in U.S. engineering colleges, including our own.

Beware of those persons who, looking down from lofty influential and authoritative positions, blame the economic ills of this country on a failure in engineering education. Such blame is misplaced. These critics would better serve our country by using their energies to identify and repair the bureaucratic web and rigidity of our corporate leadership and the outmoded attitudes within government agencies. *Those* are the forces that confine the nation's technical and manufacturing powers.

Our world position can be regained only with the leadership of the technically and scientifically competent. Managers and decision makers *must* understand products and production. In Japan and West Germany, the overwhelming proportion of top executives are trained engineers, while in the United States, nearly 80 percent have been educated instead in law, finance, and marketing.[2] Managers without technical competence often seek the solution to production problems in altered management rather than in improved conception, design, and production.

Look, for example, at how over the last decade we have allowed the rape of our automotive industry, an industry that once exemplified the power and elegance of American ingenuity. Today it is dominated by executives such as the managerially-competent Lee Iacocca, who in his recent autobiography declared the important features of an automobile to be "great styling, strong performance, and a low price."[3] A product so conceived sells only when there is no effective competition, as has been the case in the U.S. automotive industry. A decade ago consumers, finding reliability and economical operation in foreign-made products, began spending their hard-earned dollars on them, even when it meant paying a higher price. Now approximately one-fourth of the passenger cars on American roads bear Japanese names, and nearly all the video equipment, audio equipment, and electrical appliances in our homes are made in Southeast Asia. This unilateral shift in buying has rendered an American trade deficit for the last five consecutive years. Last year alone it was 105 billion dollars, approximately one-half of the federal deficit.

Thus stands the greatest industrial power in history.

Meanwhile, some of our corporate and political leaders in their wisdom are developing into neo-Aristotelian logicians. Captivated by the elegance of their own arguments, they forget to look beyond, to the measurable evidence. Their epi-circle equivalent solutions have no reasonable hope of righting the system. Modern history provides one example of the catastrophe inherent in such a course. Great Britain, once the world's greatest industrial power, has within two generations declined to fifth place in international productivity.

This lesson is important for each of you graduating today. Not all of you will become corporate or governmental decision makers, but as individuals and as leading

members of a class of some 70,000 young engineers graduating around the country this spring, your impact on the future will be great.

We in the engineering profession must now assume responsibility. We must look beyond our immediate technical projects to the evolution of society. This social responsibility must not be left to politicians, however well-intentioned. Emerging technology will impart the power to redesign human lives, humanity itself, but also the power to maintain human values in the face of danger, to use human intelligence at its highest potential. As engineers, we bear the responsibility for creating a future in which technology serves rather than controls.

The engineering profession must now assert itself by providing leaders: leaders both technically competent and morally responsible. We at Boston University understand that. Your Boston University education has been designed to impart leadership and intellectual and moral courage.

From today forward, remember this: you are an engineer.

Engineers are the artists of technology. They mold ideas and concepts into reality by interrogating and applying the laws of nature. . . To solve a problem, to design an instrument, to construct an artifact, to build a machine for the purpose of enhancing the well-being of mankind: these aspirations reflect the most noble qualities of the human spirit.

You accept with your diploma a fearsome charge. You are among the nation's best, educated by a remarkable group of teaching engineers who have equipped you to move to the forefront of engineering knowledge. We are entering a period of societal dislocation, a time when common technology will overpower the ability of the average person to cope unaided with changes in daily life. Controling those changes will be your responsibility. You have it in your power to create a technological horror beyond imagining or a safer, happier, more humane tomorrow. We who have been your teachers have confidence in your abilities and your good will. May God's hand lie gently upon your shoulder.

Notes

1. Arthur G. B. Metcalf, letter to Dr. R. H. Smith, The Daniel Guggenheim Aeronautical Laboratory, M.I.T., February, 1939. Boston University College of Engineering archives.

2. Jonathan Rowe, "Back to Economic Basics: Make Better Products, *The Christian Science Monitor*, April 3, 1987, pp. 21-22.

3. Lee Iacocca, *Iacocca, an Autobiography* (Bantam Books, 1984), p. 65.