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THE ENGINEER IN TODAY'S WORLD

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TO

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UNIVERSITY OF TORONTO

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Thank you for the invitation to speak to you today. On behalf of the Association of Professional Engineers of Ontario, it is a pleasure to welcome the freshman class to the first stage of qualifying ^{as a registered professional engineer} ~~for APEO membership~~.

We look forward to seeing the majority of you arrive at the final stage, six years down the line. I assure you our initiation ceremonies are not as intimidating -- nor as exciting -- as those you have recently undergone.

May I also, as an old Schoolman myself, express my personal satisfaction that you have chosen to pursue your studies at the University of Toronto. After all, what other engineering school has a band to match the Lady Godiva Memorial Band? I understand they were a great hit at the opening of the new Roy Thomson Hall.

The LGMB, incidentally, was formed in my day as a student here and, as I remember, its first major engagement was at the chariot race where it played, "Where, oh, where has my little dog gone?"

Congratulations, therefore, on the wise choice you have made both of a career and a ^{school} college in which to begin it.

A well-known American garment maker, Sam Levenson, was once taunted by another American on being a Johnny-come-lately to the United States.

Boasted the earlier arrival, "My family came over on the Mayflower".

To which naturalized citizen Levenson replied, "It's lucky for you they did because when I arrived here the immigration laws were much stricter."

Engineering schools in Ontario have indeed become much harder to get into in recent years -- and easier to get thrown out of too, I might add. Some of us who entered at an earlier date can perhaps count ourselves lucky, in retrospect, to have been accepted and to have stayed on to complete the course.

The stricter entrance standards of today reflect a changing society with different pressures and different priorities.

It has become somewhat of a tradition now for the incoming APEO president to talk to incoming U of T engineering students about the profession generally and the Association in particular. Neither has been immune from change, nor has the university.

A former president of this university, Sidney Smith, president in my time too, once said: "Change within a university encounters all the difficulties of moving a cemetery; universities do not act precipitately."

Well, sometimes they have to. Such was the case when I entered in 1946. There simply wasn't room in the old St. George Campus, the little red schoolhouse, for the post-war engineering intake, a freshman class of 1,400. So the university created an "instant engineering school" at Ajax where I spent my freshman years.

This isn't the time or place to afflict you with nostalgic reminiscences of the Ajax days. Suffice it to say that for me it was an early and valuable lesson in adaptability to change. In engineering, as in other things, one either adapts to change and spearheads it, or one is overcome by it.

In choosing as a general title for this talk, "The Engineer in Today's World," I am acutely aware of how rapidly things can change these days -- whether for the better or worse is another matter.

You may recall the story of the little boy watching a TV western who asked his father if the white man was really that much smarter than the Indian.

The father replied: "When the Indian was running the country there were no taxes, traffic jams, parking tickets, professors, politicians or pollution problems, and the women did all the work. Son, nobody could improve on that."

INSERT → Your careers, as mine, ^{will likely} may undergo many changes in the years ahead as engineering practice expands and diversifies. Paradoxically, change is the one constant in the variables that make up an engineering career today.

To quote Sidney Smith again: "The purpose of education is not to prepare youth for their occupations, but to prepare them against their occupations."

To talk, therefore, about the engineer in today's world is like trying to nail jelly to a wall. Before I embark on that exercise, I would first like to tell you a bit about APEO, a body of somewhat more substance.

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I admit that is an unfair comment for the ladies in our midst. Indeed I am pleased to see increasing numbers of women entering the engineering profession. I understand women represent 12% of this year's freshman class, and I can't think of any engineering job that cannot be done equally well by a woman, in some cases better, than by a man.

Speaking of jobs which I know rank highly in your reasons for choosing an engineering education, it might be worthwhile to spend a moment talking about what factors might affect the job market four years from now. Every year, Canadian universities graduate about 6000 engineers. About 15% go on to graduate school and emerge 2 to 5 years later with masters or doctors degrees, the remaining enter the engineering labour force, adding to the current 110,000 engineers in Canada.

The ability of the labour force to absorb engineers in engineering work at engineering rates of pay depends more on capital spending than on any other economic variable. But capital spending, in turn, depends on prevailing interest rates - high if rates are low and visa versa. It is impossible to project interest rates four years away, but all signs point to lower rates in the near future and it is my belief that rates will be considerably lower over the balance of the decade -- good news for engineering graduates. Other factors that affect engineering jobs include government policies and the supply of engineers in the marketplace. For example, the National Energy Program has had a major impact on the engineering job market at the present time, lower^{ing} the number of such jobs in the oil and gas industry thereby creating upheaval in related job markets.

The supply of engineers comes mainly from new graduates from Canadian schools, and from immigration. Thus immigration laws have an important impact on the job market, but the intent is to use immigration only for those jobs that cannot be filled

by Canadian talent. However, there sometimes can be a wide gap between intent and practice.

I believe the job market will be strong when you graduate; however, as I say, interest rates and government policies will be the determining factors. Because of these uncertainties, I would implore you to choose your options—both in coursework and in planning—to be flexible. Flexibility will be the key to survival in future, and even most earlier graduates had careers that went through many transitions between graduation and retirement.

First of all, let me make it clear I'm not here on campus on a membership recruiting drive. We will get you eventually, I hope. If you intend to practise your profession in Ontario on graduation you are required by law to become a registered member of APEO.

However, apart from the legal necessity of belonging to the Association, I hope you will find membership a highly desirable, worthwhile and personally rewarding experience. Moreover, I look forward to your playing an active role in the affairs of the Association through our chapter, region and Council system.

Going back to 1946 again, the year I entered the U of T, APEO had a registration of 5,414 members. By the time I graduated in 1950, reflecting the post-war surge in numbers through immigration and graduation, APEO numbers had risen to 8,294.

Before my term of office expires, I expect our registration to be very close to 50,000. Last June, for example, the peak period in the year for registration, Council approved 1,028 applications for membership. APEO is now the largest self-governing professional body in Canada -- in fact, I believe in the world.

For example, there are about three times as many professional engineers registered in Ontario as there are doctors or lawyers.

Size of itself, of course, doesn't confer any special merit or distinction. Indeed, it can create its own problems of discipline, continuing competence, professional development, adherence to a Code of Ethics, etc.

Some people maintain -- with some justification -- that small is beautiful. However, we are legally and morally obligated to admit to the practice of engineering in Ontario all who can qualify, nor would we want to maintain a closed shop, an exclusive, elitist group.

In your case, entry to APEO membership and practice in Ontario is through the examination route. If you can meet the examination standards, with some provisos I'll mention later, then you're in.

^{At} The U of T ^{is an engineering program of accreditation} ~~is an accredited~~ university. That is to say its engineering programs are examined through visitations of the Canadian Accreditation Board. The board is a committee of the Canadian Council of Professional Engineers, the national umbrella organization to which all the provincial associations, such as APEO, are affiliated.

As a result of this accreditation process, graduates of Canadian engineering schools can readily become licensed to practise throughout Canada, though each provincial association has its own jurisdiction. Obviously, maintaining uniformity of registration, licensure, professional standards and disciplinary procedures, as far as possible, is an important factor in facilitating mobility of engineers throughout Canada.

Canada owes much of its growth and development to the work of engineers, who have justly earned the title of nation-builders. Engineers are part of a great national fraternity. This calls for effective liaison between the various provincial bodies. Engineering is not divisible by political boundaries within Canada.

A national accreditation system, such as we have in CAB, is essential to maintain this mobility, impediments to which would seriously impair technological and economic development.

As the largest constituent member of CCPE, APEO pays the largest share of its annual budget, about 46 per cent or \$270,000 this year, a portion of which goes towards the cost of the accreditation process.

The general high quality of engineering programs at Canadian universities, coupled with the vigilance of the accreditation board in ensuring that high standards are maintained, has provided Canada with a level of engineering education which is the equal of any other in the world and superior to most. And without partisanship pride, I can say that remark applies particularly to the Faculty of Applied Science and Engineering at the U of T.

All this has simplified the work of our Council, Registrar and Admissions Committee in licensing graduates of Canadian engineering programs. However, we are concerned about admitting applicants whose academic credits cannot be as readily verified as yours from countries whose institutions do not undergo an accreditation process equivalent to ours.

A new admissions policy adopted by Council this year now virtually wipes out all of the concessionary policies that have previously existed and requires all applicants to pass confirmatory examinations set by our own Board of Examiners. The Association will, of course, continue to accept Canadian engineering graduates from programs accredited by CAB without further examination.

I would warn you, however, that the Admission Qualifications Committee is looking carefully at the position of so-called marginal candidates, those who have barely managed to squeeze through an accredited program. There is an old saying that goes this way: "Fifty per cent of engineers graduate in the lower half of their class." Somebody has to be last.

Nevertheless, we have to be convinced that every Canadian applicant meets the minimum standards of entrance to the profession in Ontario. I'm sure that won't give any of you here today too much of a problem.

After all, in gaining admission to the faculty in the first place, you have already had to meet some pretty exacting standards. You are now under starter's orders and are at the post and in most cases off and running, or will be when the examination schedule is posted.

There is, however, one other exam you will have to pass during your two-year graduate engineer-in-training period before registration. This is a three-hour, two-part test in professional practice and ethics and engineering law and professional liability.

Some of you, if you are typical of some of those who sat the first of these exams last May, will feel this final stage before registration to be a bit of an imposition. And, of course, you are right -- it is. But let me assure you, after much soul-searching Council has become convinced of the absolute necessity of applicants for registration being fully familiar with professional practice and conduct, legal liability, ethics and other such matters.

As a self-governing body, APEO is responsible by statute not only with issuing licences to qualified applicants but also with disciplining members who contravene the Professional Engineers Act. And disciplinary hearings have been increasing in recent years. In many cases they reveal complete unfamiliarity with what constitutes professional conduct.

To lose one's licence to practise, the ultimate penalty, is to kiss goodbye to one's career. APEO doesn't want to see that happen.

The self-governing powers granted by the statute to APEO were not designed nor intended to confer special privileges on an exclusive group for their own self-interest. As the act itself says, they were granted -- and this is vitally important and essential because it is their raison d'etre -- "in order that the public interest may be served and protected."

The Association Code of Ethics is most emphatic on that point. It says: "A professional engineer shall regard his duty to the public welfare as paramount."

This principle of the paramountcy of the public interest is embodied in our coat of arms -- servire et defendere, to serve and protect. The words are similar to those adopted by the Metropolitan Toronto Police Force, though the two roles, of course, are widely different. We don't put people in jail, ^{dr.} ^{we build} ^{the jails.}

Our commitment is to ensure and demonstrate to the public, responsibility, accountability and competence. We are not a law to ourselves. We are responsible to the people of Ontario, through the Legislature, for carrying out our statutory duties in a responsible way.

Moreover, the government keeps a watching brief over our activities. It appoints seven of the 23 members of the Council, the governing body of APEO, two of which may not be engineers. These appointed Councillors provide the public, through the Legislature, with a window into the profession through which its actions in serving the public interest can be clearly seen. No other profession has a similar public visibility.

APEO came into being with the passage of the first Professional Engineers Act in 1922 by the Ontario Legislature. This was a so-called open act which encouraged those who were qualified to join the Association to be recognized as members of the profession. In 1937 the legislation was amended to make membership mandatory for all who wished to practise engineering in the province.

There have been a number of amendments, mainly housekeeping, since then. Currently, however, the Attorney General's ministry is redrafting the act, following a study of a number of the professions in the province, including engineering.

If not in my term of office, certainly in the term of my successor, we can expect to see a number of changes in our act. From discussions we have had with the Attorney General's people, -- and I would like to emphasize that we have been fully consulted and asked for input -- we do not anticipate major changes in our self-regulating functions.

In our discussion with the drafters we have stressed, as strongly as we can, the need to avoid impediments in our act to the mobility of engineers across Canada. As I said earlier, in our view, engineering should not be divisible by provincial boundaries.

The report of the study group on the professions, to which I just referred, gave the professions under review, a clean bill of health. In general, they were found to be adaptable, commendably open to criticism and responsive to members and the public.

While it is gratifying for us to have received a favourable endorsement of our stewardship, APEO must continue to be an outward-looking body. Organizations and institutions, such as yours and mine, which operate in the public domain are increasingly open to criticism. We are under the gun and we must justify the position we hold in society.

There will be some changes in the act that strengthen public accountability and responsibility. These have already been enacted in the health field, and in this respect, our new act will embody procedures that will further assert the paramountcy of the public interest.

We have no quarrel with that. We have been moving in that direction ourselves for a number of years through the emphasis we have been placing on professional development and continuing competence. Our confirmatory exam policy and the introduction of a test in professional practice and ethics are examples which I have already cited.

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What I have given you is a broad-brush sketch of APEO, its scope and structure. There is much more, of course, to being a professional engineer, styling yourself P.Eng. and being able to affix the official seal of the Association to your drawings and specifications.

Adhering to the spirit rather than merely observing the law, however, is what distinguishes a true professional from a technocrat.

The engineer in today's world, the topic of this address, is a much more difficult subject to tackle. The practice of professional engineering is defined in the act. In fact, it is a long shopping list. In our discussions with the drafters of the revised act, we are adding to the list to include fields not in existence when the first act was drafted.

Many of you may never practise hard-core engineering, but will be employed in a wide diversity of fields within the business community. Your undergraduate training, your years of professional study, will simply be a stepping stone to other things.

Many engineers I talk to tell me they no longer do engineering because they now are "in management". This statement has perplexed me for some time and raises the question -- what is engineering?

Conventionally engineering is thought to be related to "technical work," so that as soon as a P.Eng. is promoted from work directly involved in technical matters, he is proclaimed to have "left engineering". I would argue that engineering embodies far broader concepts than those involving strictly technical elements.

The ethos of engineering is design; and design has been defined as rational, iterative decision making. It would be arrogant in the extreme to suggest that engineers have a monopoly on rational decision making, but nevertheless it is in fact a necessary characteristic required of all engineers.

Leadership in most organized endeavours requires rational decision making, and so it is not surprising that engineers often wind up in leadership positions.

A study which I did in 1972 in connection with your engineering centenary showed that while most engineering graduates start in non-supervisory, technical jobs, within ten years over two-thirds move into supervisory, management or executive positions. Within 25 years of graduating, 60 per cent were in either management or executive roles, and nearly one-third ultimately reach executive ranks.

Where does engineering stop and management start? I believe there really is no such line, but rather a continuum running from graduation to retirement. I have concluded that engineering is what engineers do.

Let me run that through you again. Engineering is what engineers do. There is something breathtakingly simple about that statement. It is almost akin to saying the way to end unemployment is to put people to work, a statement, I believe, attributed to Calvin Coolidge. However, I think it is a little more profound than that if you stop to consider its implications.

I don't know whether first-year students have had the opportunity to browse through the Engineering Alumni Hall of Distinction in the Sandford Fleming Building. It should certainly be part of your initiation ceremony. Looking at the honour roll there of outstanding graduates of the School of Practical Science and the Faculty of Applied Science and Engineering, one is struck by the magnitude and diversity of their achievement.

Who would deny what they did was engineering though their accomplishments covered a broad field of design, research, invention, innovation, teaching, production, organization and administration?

I referred to engineers earlier as nation builders. Transportation and communications provide the physical bonds that unite this vast land into a single nation. Engineers played a pioneer role in that work and their role continues today in that field.

But many other engineering building blocks have also been used in the creation of this nation. Engineering in all its forms has played a central role in the material development of Canada. I can't go into detail now, but take a walk through the Hall of Distinction and read something of the accomplishments in diverse fields of the 60 members so far enshrined there -- all U of T engineering alumni -- but just a fraction of the many Canadian engineering nation builders.

Engineering is what engineers do. The career paths of engineers show many common elements. We need to know more about them. Every new APEO president has its own pet project, a mission he would like to undertake during his year of office. Mine is to make a study of the engineer in the work place. The Ontario Engineering Advisory Council, which is linked to APEO, will be holding a seminar on this topic in February.

We need to know more about how employers and users of engineering services feel about our product. We need feedback. It would be foolish to believe that new graduates are being used the same way as they were 10 or 20 years ago. While it is true that many things do not change -- the principles of practice, the code of ethics and the basic science underlying our technology -- there is also much that does -- the technology itself, the rate at which responsibility is loaded on to new engineers entering the work force and the expectations of employers and engineers themselves.

The last point is particularly important -- the expectations of engineers themselves. In these uncertain economic times, the day is long past when employers lined up on the campus to literally press gang the graduating class into accepting job offers. Concern over finding a job and the difficulty of matching that job to one's expectations are the problems that today confront students in every discipline.

Graduates today -- and I commend them for it -- are looking for jobs that satisfy ^{not only} their own needs ~~as well as~~ ^{but also} ~~fulfilling~~ the needs of society. Technology has come under fire as the root cause of ^{many} ~~any~~ of our problems, especially environmental. And we must find a way to harness our technology to the needs of society, to be its master, not its servant.

As your president, and an engineer himself, Dr. James Ham, has so aptly put it, "In designing technical means; engineering is concerned with human purpose and does not stand simply on the shoulders of science."

That's a far cry from the day when mining students used to chant:

"We are miners seeking riches.

We are Haultain's sons of bitches."

In fairness, that was ^{not} Professor Haultain's philosophy. He richly deserves his place in the Hall of Distinction, both for his teaching lore and his considerable contributions to mining technology.

And now, as Lady Godiva remarked as she neared the end of her ride, "I am reaching my clothes (close)." An engineer, as you will recall, was the only one who noticed that Godiva rode a horse.

It has been a pleasure to talk to you today about APEO and in a somewhat rambling way to get a few things off my chest about the engineering profession. I look forward to the day when you become fully fledged APEO members and I wish you every success in your studies.

You won't all end up in the Engineering Alumni Hall of Distinction, but you can all follow in the footsteps of those who are there now and, applying the fundamentals of engineering that you will learn here, make your own distinctive contribution to nation building. That task is far from being completed.

Thank you once again for your invitation.