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Thank you for the invitation to be your guest speaker at the official opening of Engineering Week '83. Thank you also for your generous introduction, both for what you were kind enough to say about me and for what you were discreet enough to omit. I have always regarded it as a great honour and privilege to be an honorary member of the Engineering Institute of Canada, though on this occasion it entails singing for my lunch.

Today is Valentine's Day, which is not exactly the day in the year when, even for an engineer, the most pressing thing on his mind is high technology. It is not a subject you associate with hearts and flowers and Cupid's arrows. I assume, therefore, I am not being asked to take part in a hi-tech love-in.

However, on behalf of APEO, I would like to express my appreciation to the Engineering Institute of Canada for once again sponsoring Engineering Week in this community. In doing so, you are helping to make the public more aware of the role and contribution of our profession to society. And, of course, to have the proclamation of the week itself made by an engineer, Metro Chairman Paul Godfrey, is to add icing to the cake.

The annual slogan of Engineering Week is, appropriately, "Engineering is for people". APEO was granted self-governing powers by the Ontario government 60 years ago in order that, as the act regulating our profession says, "the public interest might be served and protected." Our Code of Ethics specifically states, "A professional engineering shall regard his duty to the public welfare as paramount."

We like to feel we have responded to this commitment and challenge.

The epitaph to Sir Christopher Wren, the architect of St. Paul's Cathedral and other magnificent London buildings reads: "If you seek his monument, look around you." These words could equally be applied to the works of engineers which are so visibly a part of communities such as this.

Engineers, traditionally, have been community and nation builders. In opening up Canada to settlement and development, we have left our stamp everywhere. Engineering in all its forms has played a central role in the growth of our nation and province. It is interesting to note that 21,000 of our 50,000 members live and work in an area somewhat larger than Metro Toronto. On their behalf, I thank you for the recognition you have extended them in Engineering Week.

The modern world is becoming increasingly dependent on technological systems of growing complexity, and engineers, of course, are part and parcel of it -- in fact, they are at the heart of it. Yet even engineers can be shocked by the rapid rate of change. Technological innovation keeps expanding the volume of knowledge to which engineers are exposed, further enlarging the diversity of disciplines in which we are engaged.

It is a basic tenet of economic theory today that technical progress is an essential ingredient of economic progress. Secretary of State Donald J. Johnston told the Canadian Council of Professional Engineers last November that "technology-based industry is the spearhead of economic renewal." We look to technology to bring about economic recovery and to maintain our position as an industrial trading nation.

Given then that the new technologies are powerful and essential instruments for economic advancement, as a profession we would be less than honest if we ignored their social impact. If engineers working with the new technologies are hard pressed at times to assimilate change, how can we expect the public not to be uneasy about some of the effects?

Confronted with developments with which many of them have not the knowledge or ability to accept and work with, people are being displaced in jobs which they thought were life-time occupations find themselves in a serious quandary.

In inviting me to speak to you about high technology, you are asking me to cover a wide waterfront in a very short space of time. For your sanity and mine, I must limit my terms of reference. Moreover, the all-embracing speech suffers from both longitude and platitude. It seemed best, therefore, to confine myself to the new technologies, the microelectronic revolution that is becoming so far-reaching and all-pervasive as to be the dominating force in society today.

Microelectronics, computers and data communications are all technologies we associate with the wave of the future - a future that holds great promise if we can find a way to overcome the transition from the present depressed state of our economy. The chip has created a disequilibrium in our society. The same thing happened two centuries ago when the steam engine's introduction marked the start of the industrial revolution and again at the turn of this century with the accelerated employment of electrical energy and the piston engine at the time when Canada's industries were starting to develop.

In each case, there were major structural changes in the makeup of the labour force. Initially, there were substantial shifts from the resource or primary industries into the manufacturing or secondary sector. This shift was caused essentially by machines replacing manual labour to improve productivity in resource extraction. As man's ability to harness energy from natural sources improved, we learned how to enhance the efficiency of our machines and increase productivity even further. This caused major improvements in the output of our economy, thereby expanding the labour force and more than compensating for job losses resulting from the expanded use of more energy-efficient machines.

Then came automation and further dislocations. Here, really for the first time, we started to use information and brains to substitute for energy and brawn. Automation led to improved productivity using sensors to replace people in manufacturing and other industrial processes. Any impact on employment was again made up for by the resulting growth of our whole economy.

But other more subtle changes were starting to take place during the 1960s and 1970s. As we learned to handled information more efficiently, manufacturing and resource companies found it less costly to subcontract significant proportions of their

routine activities to service companies - that part of the industrial fabric known as the tertiary sector. Unfortunately, in the same period, we experienced unprecented growth in government activities. The 1960s also was a period of major expansion of our universities reflecting the baby boom following World War II. By the early 1980s, the service sector had become the largest single component of our labour force - representing over two thirds of all employment in Canada.

Now comes the chip. It has the potential of creating a rennaissance no less significant than the introduction of electricity at the turn of the century, and at a scale that would rival the industrial revolution. It will alter our way of life. It already has invaded our lives. The chip can be found everywhere - in every room of your house, in the office and factory - everywhere. Home computers soon will be as commonplace as television sets and dishwashers.

At an APEO seminar just 10 days ago, a survey of 10 members of a panel discussion group showed that five had personal home computers. Computing to work rather than commuting to work may be closer than we think.

The application of solid state technology has dramatically reduced the size and cost of computer goods. One effect is

clear, as the Science Council noted: "Our expectations increase; we hunger for more."

Not surprisingly, Time Magazine saw fit to substitute its traditional Man of the Year with a Machine of the Year on its cover since in its view no human candidate symbolized the past year as significantly as the computer.

A Time inside story notes that a New York real estate executive uses his Apple in business deals, to catalogue his 4,000 books and to write fund-raising letters to his Yale classmates. But he also uses it to wake him in the morning with soft music, turn on the TV, adjust the lights and make the coffee.

A further story outlines the role the computer plays in medicine. One model, CADUCAEUS, knows some 4,000 symptoms of more than 500 diseases. It sees patterns in what patients report and can then suggest a diagnosis.

Comments the Time article: "The process may sound dehumanized, but in one hospital where the computer specializes in peptic ulcers, a survey of patients showed that they found the machine 'more friendly, polite, relaxing and comprehensible' than the average physician." So much for bedside manner.

What are the implications of this chip revolution for the individual and the engineer? Microelectronics is creating

structural changes to our employment patterns. A recent series of Globe and Mail articles on the chip refers to these displaced persons as "techno-peasants".

It has been said the toughest decision a purchasing agent may face is when he is about to buy the machine designed to replace him. Computers can solve all kinds of problems except the unemployment problems they create.

One of the human consequences of the current economic slump is that companies are laying off workers whose jobs may not reappear when recovery takes place.

Hitherto we have looked to the service industries to provide employment for those displaced in primary and secondary manufacturing. But service industries in the future are going to be profoundly affected as word processors, electric filing and other information systems take over in the work-place, some jobs are going to become redundant. The automated office and the automated factory are facts of life.

However, there is the other side of the coin. The chip can and will contribute to our productivity as an industrial and exporting nation. Thus, while the chip is creating unemployment principally in the service sector, it should be contributing to our overall output sufficiently to re-absorb appropriately trained workers in all segments of the economy.

Moreover, all the evidence is not in about worker displacement. There is a shortage of reliable information. There are those who hold that if we had growth in the economy, unemployment from technology would dissipate as in the past. Technological change is unfortunately, taking place at a time of recession and its job-creating potential cannot be properly assessed.

There is a message too for engineers. The chip is invading all walks of engineering--and on an international scale. It will have an impact on virtually all new products of the 1980s, and even on the design process itself. The development of sophisticated software has made possible the automation of the draftsman's task as well as the engineer's.

Through CAD/CAM and robotics technology, we are entering the era of the fully automated factory. So rapid is the pace of technological change, obsolescence can quickly overtake us. The half-life of an engineering curriculum today has been estimated as about five years, that is to say, half the course material will be obsolete in five years.

In my opinion, the profession needs to recognize this revolution, embrace microelectronics to the fullest extent, using the systems approach, and inculcate the necessary knowledge and awareness among our budding engineers during the formation process.

I am deeply concerned about our young engineers at the dawn of this microelectronics revolution. A crisis is developing in Ontario engineering schools. University funding has failed to keep pace with inflation so that the operating budget per engineering student is now $1100 less than the average for engineering students in the rest of Canada. The shortfall has been taken up understandably by reduced spending on equipment in order to have sufficient budget to retain key faculty members. As a consequence, equipment budgets have now fallen to 20-30% of what is desirable.

If the situation is allowed to continue, the resources available to our engineering schools will dwindle to the point where we will no longer be able to deliver the quality programs now being provided to Ontario engineering students. At a time when microelectronics is about to change our very way of life, and when engineers using microelectronics must play the role of bringing our society into the brave new world of the 1990s and beyond, it is critically essential that we must redress the imbalance now developing in engineering education. We all have a responsibility - industry, government and the universities - but I call upon industry now to assume a greater role.

A start has already been made with industry and CODE - the Committee of Ontario Deans of Engineering - using assistance from the Association. The APEO is prepared to help in any

meaningful way it can to assure continuing high quality in engineering education.

Another area that concerns me is the older engineer. I have been amazed to discover a widespread fear of computers among many of our senior engineers in key decision-making positions. To some extent, the rapid spread of home computers among this group should soon allay some of the anxiety I have detected.

As former U.S. Secretary of Defence Robert S. MacNamara once put it: "A computer does not substitute for judgment any more than a pencil substitutes for literacy. But writing without a pencil is no particular advantage."

As people who work with the new technologies and who in many cases are the catalysts from which new technologies emerge, engineers must bear concern for the social impact they create. If we truly believe that engineering is for people we have to consider the human dimension of what we do.

This problem has been well summed up by William Boggs in the EIC Ontario Region bulletin for February/March. Writing about Managing in Turbulent Times, he says;
"What is critical in this revolution (the new technological revolution) is the people dimension.
"How we adapt this new technology to the deeply rooted needs of human beings.

"How we organize our offices and factories to take advantage of the changes.
"How we train people in the skills required.
"How we motivate people and overcome their inevitable fears."

Overcoming fear of the unknow, to my mind, is a major problem. If even engineers can be shocked by the rapid rate of change, how much more difficult it is for others to assimilate change and overcome their natural resistance to it. We need innovation, not just in technology itself but also in dealing with human factors involved in technological change.

The real danger is not that computers will begin to think like men, but men will begin to think like computers.

We cannot ignore the human dimension.

My remarks today about economics are admittedly oversimplified. Also they are biased because they have been developed through the eyes of an electrical and aerospace engineer. Nevertheless, I believe them to be generally true from the posture of most if not all branches of engineering which will be affected by the new technologies.

If technology-based industry is the spearhead of economic renewal, then we must make the fullest and most effective use of the new technologies. Canada has the opportunity to be

a world leader in the new technologies, as we are now in communications satellite technology.

The silicon chip and software will dominate our future industrial development and we must strive for leadership in these new technologies. In doing so, we must, as engineers, accept social responsibility for their impact on society and play a full part in lessening any adverse effects.

The Science Council report from which I quoted earlier is subtitled, "tomorrow is too late". In fact, the future is already here, and we have a lot of catching up to do.

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Philip A. Lapp