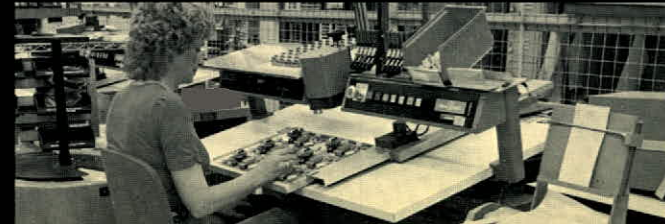
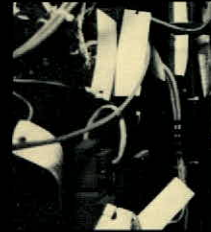
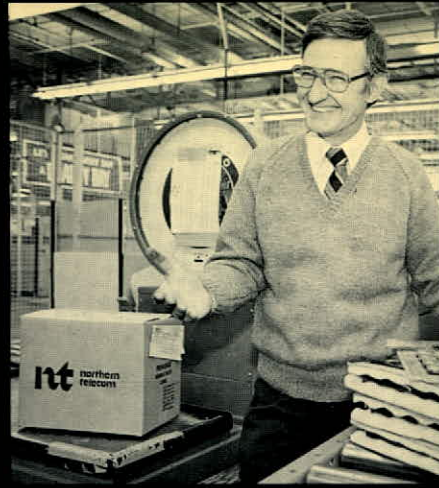


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ANNUAL REPORT TO EMPLOYEES 1982



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telecom



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Details of Northern Telecom's financial performance and The OPEN World are outlined in the 1982 Annual Report, available from local public relations and corporate relations offices, or from:

Northern Telecom Limited
Corporate Relations
33 City Centre Drive
Mississauga, Ontario, Canada
L5B 3A2

On peut obtenir la version française de ce rapport en écrivant à
Northern Telecom Limitée
Service des relations de l'entreprise
33 City Centre Drive
Mississauga (Ontario) Canada
L5B 3A2

A RECORD YEAR FOR NORTHERN TELECOM

BUT WE CAN'T AFFORD TO REST ON PAST SUCCESS

Last year was the most successful in the history of Northern Telecom Limited. The corporation passed the \$3-billion revenue mark with a record net profit of \$158 million. Such performance, at a time of severe global recession, should be a source of pride for every employee.

Pride can be a two-edged sword. When it motivates us to renew and expand on our level of achievement, it is a positive force. If it leads to complacency, it is a dangerous negative force. Innovative products and processes emerge almost daily from many companies, many countries. These products open up new markets and increase the competition for traditional ones. Companies that play a continuing leading role in this evolution, prosper. Those that limit themselves to yesterday's horizons, decline; even vanish completely.

Northern Telecom has played a leading role in the evolution of telecommunications and business communications equipment. We pioneered the application of digital technology that is now an industry standard. It is this innovative capacity that has transformed us into a truly international corporation.

The key to this growth – and our ability to contribute to the well-being of employees, shareholders, and society in general – has been the corporation's commitment to research and development. Between 1972 and 1982, Northern Telecom invested over \$1 billion in R&D. Last year alone, our expenditure was \$242 million, equal to eight percent of revenues. In 1983, our R&D spending is targeted to grow another 18 percent, to \$285 million.

In many ways these are impressive figures, but they are not grounds for complacency. Some of our competitors are industrial giants, with vastly greater resources. Also, these and other telecommunications equipment manufacturers are often provided by their national governments with research subsidies, tax credits, and export assistance way beyond that available to Northern Telecom. Currently, some 92 percent of our R&D investment is generated from corporate revenues, a high figure by international standards.

The challenge Northern Telecom faces is made even greater by the evolving communications needs of industry and government. At one time, the telecommunications, data processing, and office equipment industries were essentially separate, each serving its own well-defined market. This is changing radically.

Today, the need to transform these diverse functions into an efficient harmonious whole – an Intelligent Universe made possible by digital technology – means that no company can focus on just one area and expect to prosper in the long term. As a result, the range of our competitors, each attempting to be an innovative leader, is wider than ever.

I am confident that Northern Telecom can meet this challenge and succeed. This is why the corporation is devoting an increased share of its revenues to the R&D that is the basis of our competitive edge. For several years, our research spending averaged 6.5 to seven percent of revenues. In 1982, it was eight percent. Our goal for coming years is to average nine percent or more.

For Northern Telecom to compete successfully, however, our research spending alone is not sufficient. The commitment of our employees is just as crucial.

Other firms have attempted to match our success in digital systems, spending hundreds of millions of dollars in the effort. We remain the world leader because our products are the result of market-driven research. This means that we are committed to designing and manufacturing products that meet the customer's present and future needs, that can be manufactured efficiently and economically, that are delivered on time, and that provide the quality of performance clients expect for their investment.

If Northern Telecom fails to meet these conditions, our existing customers, and the new ones we pursue daily, will simply go elsewhere. The competition is fierce, and will not hesitate to capitalize on our mistakes. Even the most technologically advanced product cannot win markets if it is not reliably supported by its manufacturer.



It is a tribute to Northern Telecom's employees that our reputation for productivity, quality, and service is among the finest in the world. This has been confirmed not only by our sales success, but by independent research. The effort our people invest in their work, combined with the corporation's investment in research and development, has made us what we are today. With continued mutual commitment, we can all look to a rewarding future.

Another factor supporting our international capability is the corporation's close relationship with Bell Canada, widely recognized as one of the world's most advanced telephone companies. Through this connection, Northern Telecom has acquired the special understanding of customer needs and concerns that are the basis of market-driven research and product innovation. This relationship has allowed the corporation to provide all its customers with the advanced, economical products so important to their businesses. It is a relationship that benefits every employee in all parts of the world.

I expect most Northern Telecom employees, if asked what the corporation does, would describe us as a manufacturer of telecommunications and business communications systems. There is a better answer. This corporation is in the business of investing in the technological and human resources that are the basis of commercial success.

Our OPEN World initiative, which president Ed Fitzgerald will describe in the next article, is an example of such an investment. Our recruiting of top quality people at competitive salaries is another. Given such commitments by the corporation, our horizons are limitless.

W.F. Light
Chairman of the Board and
Chief Executive Officer

OPEN WORLD: THE CHALLENGE

A KEY TO CONTINUED MARKET LEADERSHIP

At Northern Telecom, 1982 will be remembered as the year of The OPEN World. Last November, we unveiled our plans for building information management systems around digital communications controllers that will accommodate most makes of business equipment and will allow major office communications functions to be undertaken in a single integrated system.

The OPEN World announcement was a public commitment to make Northern Telecom the leader in integrating information management systems for the office. The corporation pledged \$1.2 billion on research and development over the next five years to create a host of new OPEN World products and services. That program was backed by a strong marketing thrust to demonstrate how our digital systems can evolve through the development of new software features and enhanced voice/data terminals.

OPEN World is important to all of us. It asserts Northern Telecom's leadership at a time when there is confusion and disarray in the information management industry. It tells our customers that we recognize the world of information management is changing, that we can help them adjust to the changes, that we are investing heavily to stay ahead of these changes, and that we are the logical supplier for them to look to in the years ahead.

As OPEN World progresses, there will be profound implications for every employee. As Peter Drucker says, "Business has only two basic functions - marketing and innovation." The marketing of OPEN World relies upon our ability to create innovative products and services. Every employee contributes either to one area or the other, and our success depends upon each employee's contribution. Our present technological leadership is the result of the efforts we all made to see Digital World succeed.



Leadership is not an intangible quality. Our technological leadership can be measured: we have now installed, or on order, more fully digital telephone lines than any other manufacturer in the world – over 10 million equivalent lines. Our SL-1 has become the most successful fully digital PBX in the world – more than 5,000 systems sold. We will be putting a new DMS-10 in service for every day of 1983. Total DMS revenues in 1982 were \$646 million, up 24 percent over 1981.

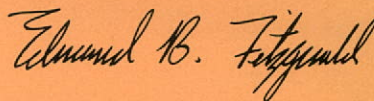
When we announced Digital World, we took an enormous chance. We counted on the demand and market being there. Most of all, we were counting on everyone at Northern Telecom to make those products possible, so that we could fulfill our promises. In turn, every employee has shared in the success of Digital World, which fueled our growth into international markets, increasing our export sales and the jobs they represent.

As the telecommunications industry converges with the data processing and office equipment industries, we see the market changing. The OPEN World is the direction in which we see all of business and industry moving.

It is also the framework for our future. We now have proposed the means to create information management networks, and we have outlined the products and services necessary to make them a reality. As with Digital World, we have drawn up a demanding timetable for all of us.

In so doing, we have again outpaced our competitors. They will follow our lead, as they followed Digital World. Because of that move, we gave ourselves a two-year advantage; but we cannot afford to lose it. The OPEN World draws upon the technology of Digital World and evolves beyond it. It is also a marketing strategy that perceives the changing needs of our customers and projects a means of satisfying them. It presents a resolution to the constant and expensive problem of technological obsolescence.

The opportunities are enormous if The OPEN World strategy succeeds. Those opportunities are there for all of us. Like leadership, opportunity may be intangible; but it is nonetheless real. The dictionary defines it as "a favorable juncture of circumstances, a good chance for advancement or progress." It is like a promise with conditions: if we make the best use of that opportunity, then we can all share in its rewards.



E.B. Fitzgerald
President

The Five Cs: Keys to The OPEN World

OPEN World promises to create integrated communications networks that open the technological barriers to user-controlled systems by offering the SL and DMS families of digital switches as the hub of such systems, giving the user the opportunity to install whatever equipment is most cost-effective for his purposes.

The following five key concepts, called the Five Cs, define The OPEN World in terms of its chief concerns.

Continuity: The ability to design equipment that is "evergreen," renewing itself and remaining abreast of the latest technology through modularity, which permits growth and change without obsolescence.

Compatibility: The goal of unimpeded communication among diverse makes and models of intelligent equipment by universal standardization of protocols and interfaces.

Congeniality: To enhance the quality of usability by designing equipment whose technology is essentially "transparent" to the consumer, inviting rather than repelling his use of it.

Control: That which, by right, belongs to the user, who should be able to decide for himself what his system's needs are and have the freedom to choose whatever components best suit his needs.

Cost-effectiveness: The bottom line that measures the efficiency and usefulness of a system while taking into consideration each of the above-four conditions; the absence of continuity, compatibility, congeniality, and control lead inevitably to reduced cost-effectiveness.

WHERE THE MONEY CAME FROM

Any business must make a profit to survive, create jobs, and pay taxes. In 1982, Northern Telecom achieved its best financial performance ever, despite the worst global recession in 50 years.

This is largely the result of Northern Telecom's multi-million-dollar R&D investment to create a complete line of fully digital telecommunications products. The corporation's ability to control costs and improve productivity also contributed to its success.

As a result, net earnings, the bottom-line difference between revenues and expenses, including taxes, were a record \$158.2 million, or \$4.50 a share. This was a 16 percent increase over 1981 earnings of \$136.7 million.

Consolidated revenues, the money received from the sale of our goods and services worldwide, exceeded \$3 billion. This was 18 percent higher than 1981 revenues of \$2.571 billion, and double the \$1.5 billion revenues in 1978.

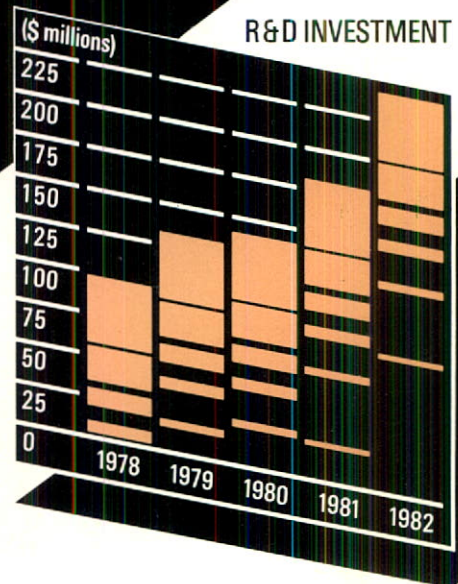
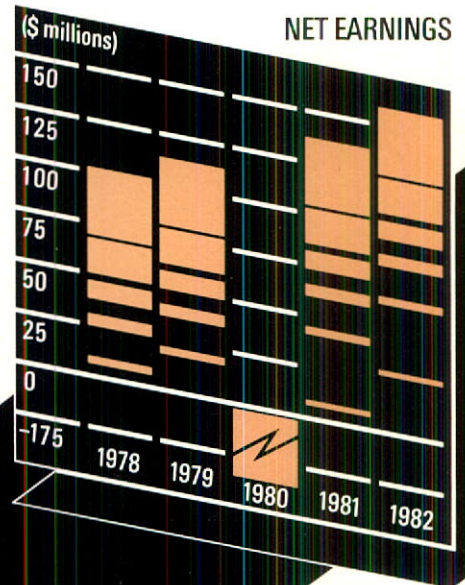
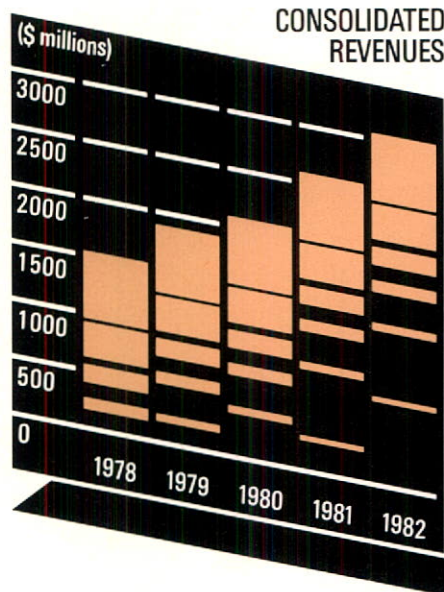
Major contributions to this revenue growth were made by Northern Telecom's fully digital DMS large central switches, and the SL-1 business communications system. DMS revenues in 1982 were \$646 million, a 24 percent increase over 1981. This allowed total central office switching sales to exceed \$900 million, despite a continuing drop in sales of analog systems.

SL-1 revenues in 1982 were \$480 million, a remarkable 51 percent increase over 1981.

U.S. revenues for the corporation rose 40 percent to \$1.5 billion, representing 48 percent of the total. International operations increased 20 percent to \$325 million, about 11 percent of corporate revenues.

Research and development spending, the key investment for Northern Telecom's continued growth, was at a record level of \$241.4 million in 1982. This was a 33 percent increase over the \$181.6 million the year before.

This 1982 R&D investment was eight percent of consolidated revenues, compared to 7.1 percent in 1981. For 1983, the corporation's research spending is targeted at \$285 million.



PROMOTING INTERNATIONAL UNDERSTANDING

NORTHERN TELECOM'S SUPPORT FOR CANADIAN STUDIES WORLDWIDE

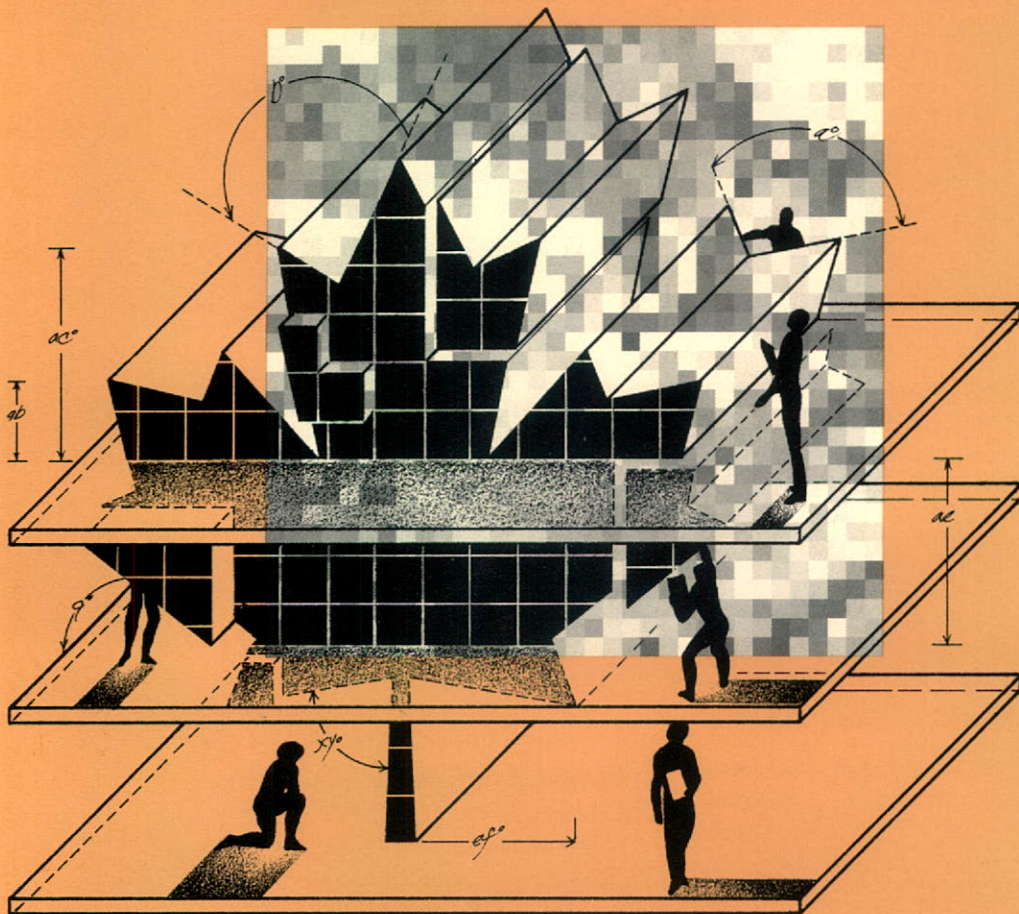
In the fall of 1980, two of Northern Telecom's senior officers launched one of the corporation's most unusual sales campaigns. Instead of selling products and services, they were selling knowledge of Canada.

The salesmen were Walter Light, chairman and chief executive officer, and Roy Cottier, senior vice-president, corporate relations. That November, they embarked on a cross-Canada tour to convince executives of 120 leading companies of the need to establish a business-backed fund to promote Canadian studies in universities across the U.S.

The result of that campaign is a unique cooperative effort providing the largest-ever private contribution to research and teaching on Canada in the U.S. Today, there are new Canada-related courses, seminars, and research projects underway at seven U.S. universities. They are funded by more than C\$220,000 in grants from the Business Fund for Canadian Studies in the U.S.

The proposal to establish the Business Fund, to assist in improving understanding of Canada and Canadians abroad, received the strong backing of Northern Telecom's Board of Directors. With its encouragement, Mr. Light and Mr. Cottier hosted a series of luncheon seminars in Montreal, Toronto, and Calgary to convince other business leaders of the need. Their efforts paid off, as 21 Canadian corporations agreed to support the Fund. The majority committed C\$10,000 annually for an initial three-year period.

Highlighting the Northern Telecom executives' concern had been the steady, and often shrill, deterioration in relations between Canada and the U.S., even though they are each other's largest markets. As late as the fall of 1982, for instance, more than 60 pieces of legislation that could negatively affect Canadian trade were before Congress. To repair that deterioration benefits not only Canada, but the U.S. as well. Ill-will can escalate into retaliatory measures, counter-productive for both sides.



reaching university undergraduates while they are forming their world views. Comprising 10 percent of the population – about 30 million individuals – in the U.S., they are the future thoughtleaders in business, the church, and government.

The Business Fund, says Mr. Light, is an important investment by the corporation and other firms in easing conflicts between the two neighbors and NATO allies. "Greater representation of Canadian studies in the U.S. universities over the past three decades would have eliminated much of the present climate of acrimony and misunderstanding. Those U.S. schools would have produced more graduates in government and business who would have understood Canada better and spoken for us."

Response to the Fund from the American academic community has been enthusiastic. Canadian studies provide a new source of funds for the U.S. universities, allowing them to expand existing programs, increase areas of studies available to students, and, in general, increase their academic knowledge base.

In 1982, U.S. universities submitted some two dozen proposals to the Fund's advisory committee. The committee includes representatives from the Canadian and U.S. academic sectors. All have been extensively involved in, and well recognized for, their contribution to the advancement of Canadian studies.

It is their task to sift through the submissions to ensure they follow the Fund's guidelines and to indicate their interpretations on the merits and pitfalls of programs. These comments are then summarized by Business Fund officer Kristi Vilmansen, Northern Telecom's director, corporate contributions, and submitted to the Fund's board of directors for its ultimate decisions on financial support.

"In our funding guidelines, preference is given to universities that demonstrate an on-going commitment to Canadian studies," says Ms. Vilmansen, "and to new projects that will continue to develop on their own, after the Business Fund's initial sponsorship."

Among the projects currently funded:

■ A series of seminars and a book on Canadian lobbying in Washington, being written by Joseph Sokolsky and Charles Doran, the director of the Center of Canadian Studies at Johns Hopkins University in Washington, D.C. "Canadian studies is a growth industry," says Dr. Doran. He points to intense student and faculty interest in the seminars, which took place last fall, ahead of schedule. The book is due to appear in early summer. "We have policymakers in Canada and in Washington already asking to see it. But," he adds, "I don't think we could have done any of it without the grant."

■ A conference on Canadian and U.S. corporate law hosted by the Canada-U.S. law institute at Cleveland's Case-Western Reserve University. According to Case-Western law professor Ronald Coffey, the conference is a first, bringing together academics, lawyers, and students from both nations. "We'll be looking not only at the similarities and differences in legal principles, but at the different policy questions – such as concepts of economics and wealth distribution – that lie behind these principles," he says.

■ An outreach program conducted by Western Washington University's Canadian-American Studies Center consisting of a series of seminars. It is aimed at providing high-school teachers with an immersion course on Canada. Says program director Robert Monahan, "There's a vast pool of ignorance about Canada in the U.S. Fortunately, there's also been a growing recognition that we should know more, which makes the Business Fund a timely and important initiative."

■ A new program to educate senior journalists about Canada at Chicago's Northwestern University. Coordinator Barry Farrell says the program is designed to help counteract "the remarkably bad reporting about Canada in the American media, which often seems limited to Margaret Trudeau and baby seals." Such a program,

Other nations have long recognized the importance of increasing knowledge of their home countries in the U.S., particularly at the university level, and have spent vast sums to that end. Canadian support for programs to improve knowledge of Canada has been meager. Canadian government (23 percent) and Canadian corporations (6 percent) covered just over one-quarter of the cost of Canadian studies in the U.S. in 1980. The other 71 percent was paid for by the U.S. government, corporations, and foundations.

For Northern Telecom, which operates as a North American corporation in a North American market, the Business Fund was a logical development. "It benefits both Canada and the U.S.," says Mr. Light.

Northern Telecom believed the Business Fund to be the best way of reaching and teaching senior U.S. academics who would be able to speak on Canada's behalf. Through speeches, consultancies, and also memberships on government bodies and committees, U.S. academics help shape the direction of U.S. economic and social philosophy and legislation.

Business Fund programs provide a base for seminal conferences and seminars, which draw Canadian and U.S. government officials, business leaders, and senior academics as participants. The Fund also aims at

which will include visits to major Canadian centers and meetings with business and government figures, is something that cannot be done by government, Dr. Farrell says. "If the Canadian government sponsored the trip, many journalists would probably refuse because they might appear compromised."

However, Northern Telecom's marketing of Canada in the U.S. goes beyond its leading role in the Business Fund. In 1982, the corporation donated US\$8,000 to the Washington-based Association for Canadian Studies in the United States (ACSUS) for a nationwide survey on the status and extent of Canadian studies programs. "This survey will allow us to develop a data bank of who's doing what, and where," says Ellen Babby, ACSUS executive officer. "We can use this

data to encourage the development of Canadian studies, as well as support fund-raising activities."

While the corporation's Canadian studies thrust began in the U.S., Northern Telecom recently initiated two additional projects that added global scope to its pioneering program – grants to Irish universities, and the creation of an international Canadian studies award.

Northern Telecom's decision to provide C\$10,000 grants to each of four universities in the Republic of Ireland was inspired by the formation last summer of the Association for Canadian Studies in Ireland. Each of the association's four participating universities – the National University of Ireland at St. Patrick's College, Maynooth; University College, Cork; Trinity College, Dublin; and University College, Dublin – now include Canadian-related courses or projects in their curricula, and are represented on the association's newly formed governing council.

"Given the success of our plant in Galway – employment there has tripled since 1973 – we have an obvious interest in Ireland," says Mr. Cottier. The interest and the benefits were mutual. "The formation of a Canadian studies association in Ireland was a timely opportunity to provide funds to expand their programs. We'll be watching to see how these programs develop, just as we are monitoring Canadian studies opportunities in other countries, with the idea of continuing our support when conditions are encouraging."

While the Business Fund and the Irish grants do their work in specific locations, Northern Telecom has also introduced a more universal incentive for Canadian studies – the Northern Telecom International Canadian Studies Award. In addition to a



C\$10,000 cash prize, the award includes a gold medal designed by Canadian sculptor Dora de Pedery Hunt, whose internationally recognized work includes the Canadian government medal for Expo '70 in Osaka, Japan. Mrs. Hunt's design for the Northern Telecom award is based on maple leaf "keys" – the tree's distinctive winged seeds – symbolizing Canada and the seeds of knowledge planted by the corporation's program.

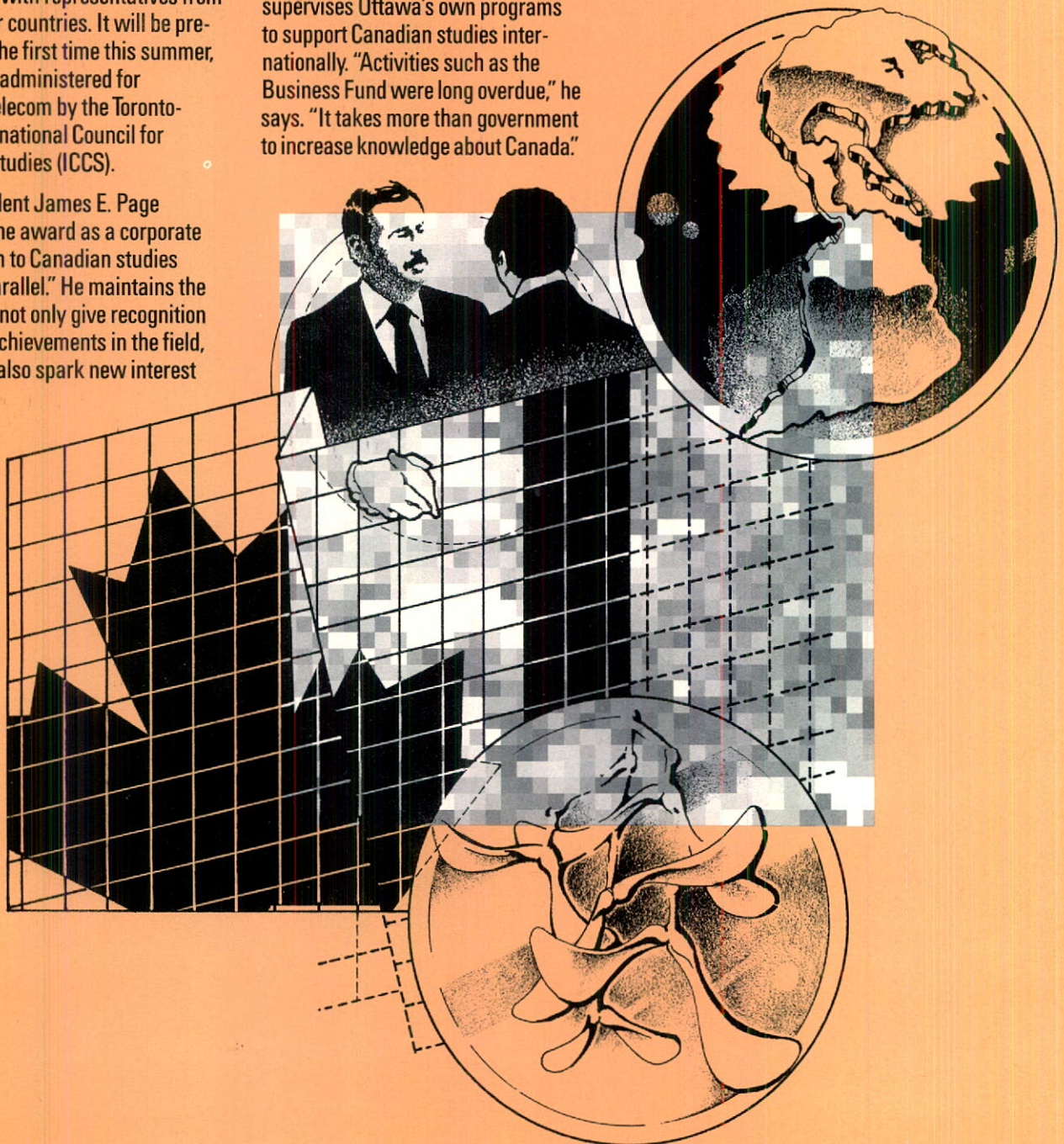
The award will go to a scholar or researcher from any part of the world who has played an exceptional role in the development of Canadian studies. Each year, the winner will be chosen by a five-member adjudication committee, with representatives from at least four countries. It will be presented for the first time this summer, and will be administered for Northern Telecom by the Toronto-based International Council for Canadian Studies (ICCS).

ICCS president James E. Page describes the award as a corporate contribution to Canadian studies "without parallel." He maintains the award will not only give recognition to special achievements in the field, but should also spark new interest

by academics who have bypassed the study of Canada in their work. "Overall," says Mr. Page, "the Northern Telecom Award is an incentive that takes Canadian studies into the front rank of academic endeavors."

Such tributes are gratifying, but the real reward for Northern Telecom will come through the Canadian studies it is supporting. As Mr. Cottier says, "Our goal is to help the world to know and understand Canada better. Why? Because the fruits of international understanding will be shared by all, including Northern Telecom."

It's a view that earns enthusiastic applause from the Canadian government's Dick Seaborn, who supervises Ottawa's own programs to support Canadian studies internationally. "Activities such as the Business Fund were long overdue," he says. "It takes more than government to increase knowledge about Canada."



WHERE THE MONEY WENT

While Northern Telecom generated more than \$3 billion in revenues last year, only a small portion was actually retained for use by the corporation.

One of the largest expenditures was employee compensation – salaries, wages, and benefits – which totaled \$1.22 billion in 1982, a 22.6 percent increase over 1981. This represents 40.4 cents of every dollar of revenue, compared to 38.6 cents for the previous year.

The greatest part of this increase, 78 percent, was in higher salaries and wages, and in improved benefits. The remainder reflects a higher average number of employees over the full year 1981. However, a weak Canadian economy required the corporation

to trim its Canadian work force in the latter part of 1982. This meant that at yearend, worldwide Northern Telecom employment was down to 34,449, compared with 35,444 on December 31, 1981.

Average earnings per employee were up 12.9 percent over 1981. Employee benefits were equal to 30.6 percent of the average salary or wage. This reflects benefit improvements in health care and retirement provisions.

The corporation's largest expenditure was \$1.28 billion, which purchased the materials, goods, and outside services necessary to run the business and manufacture products. This item – 42.3 cents of every revenue dollar – covers production machinery, laboratory and office equipment, buildings, and raw materials. Through these purchases, Northern Telecom supported many thousands of jobs in supplier companies in many countries.

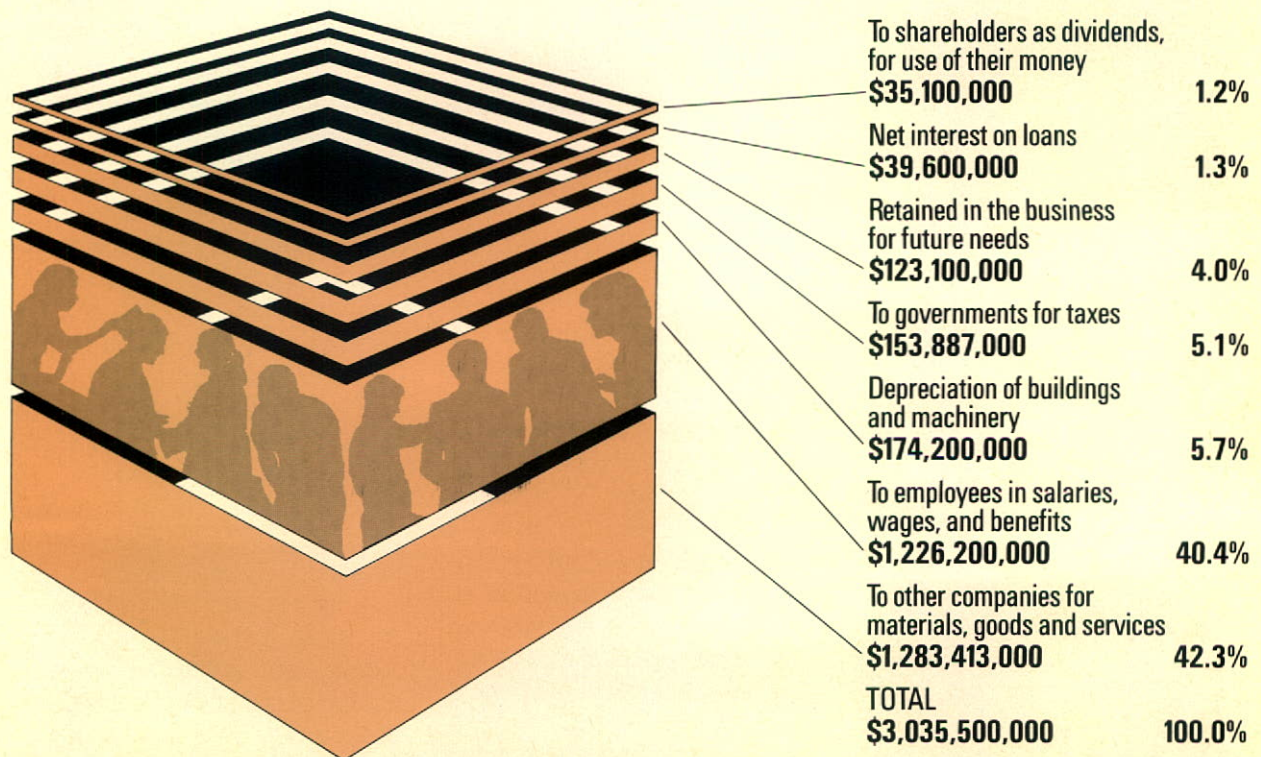
Another major cost for the corporation, \$174 million, was depreciation, the amount by which equipment and buildings are estimated to have lost value over the year through wear and obsolescence.

Taxes paid by the corporation to federal, provincial, state, and local governments totaled \$153.8 million, an increase of \$22 million over 1981.

In 1982, Northern Telecom reduced the interest it paid on loans by \$24.6 million over the previous year. This was due to a lower average level of borrowing and the significant decline in interest rates. The drop in borrowing reflects the corporation's improved cash flow – the result of increased earnings. Total interest payments on loans last year was \$39.6 million.

The corporation paid \$35.1 million – just one penny of each dollar of revenue – in dividends to shareholders, those who put up the capital to run Northern Telecom.

The remaining \$123 million was money retained by the corporation to help finance its future development. This represents four cents of every dollar, the same level as 1981.



THE CHANGING ROLE OF THE ENGINEER

THE FUTURE DEPENDS ON THEIR SKILLS

A photograph taken 20 years ago at the Research and Development Division of Northern Electric Co. Ltd. shows a rack of large black voltmeters and ohm meters. These simple measuring devices were the basic tools of the trade for many of the 400 engineers working for what later became the nucleus of Bell-Northern Research (BNR). It was an era when telephone switching was electro-mechanical, computation was by slide rule, and a dictionary defined an engineer as "a designer and builder of engines."

Today, nearly 4,000 engineers work for BNR and Northern Telecom. For many, their most important tool is the computer. The "engines" they design and build include software programs and microchips that have helped create a global technological revolution in information transmission and handling.

Engineering is at the heart of this revolution. Working together with computer scientists and other technical specialists, Northern Telecom engineers are a vital part of the team that has transformed the corporation into North America's second-largest telecommunications equipment manufacturer and a world leader in research. "The future prosperity of this corporation depends very much on the capability of our engineers," says Walter Light, chairman and chief executive officer. "That's one reason we must all be concerned about the quality of engineering education. It must provide graduates with the ability to develop and use the sophisticated technologies that will generate the competitive products

that will, in turn, create the job opportunities and maintain our present technological leadership."

The complexity and sophistication of modern telecommunications technology is reflected in the role of Northern Telecom engineers. Some design video-display terminals, while others design their packaging. There are engineers who experiment with computerized robots and those who investigate fiber optics, while others create the software programs that direct telephone call-forwarding and voice-message systems, or work on microchip quality control. From the design of a 100,000-line central office switch to the installation and testing of a customer's equipment, it is engineers who operate at the cutting edge of Northern Telecom activities.

However, engineers are not limited to technical functions. From the legal division's patents section to the international sales force, from the human resources department to the executive office, engineers are involved in every aspect of the corporation.

Most of the corporation's senior executives have engineering degrees, including Mr. Light; Ed Fitzgerald, president, Northern Telecom; Basil Beneteau, vice-chairman, Northern Telecom; David Vice, president, Northern Telecom Canada; Des Hudson, president, Northern Telecom Inc.; Bill Simpson, president, Northern Telecom International; and John Roth, president, Bell-Northern Research. As Northern Telecom managers, they are still practicing engineers. "Engineering," says Walter Bengel, executive vice-president for marketing and technology, "comprises all the aspects of management of a large technological enterprise."

This range of endeavor hardly fits the traditional image of the hard hat engineer on the construction site, or with soldering gun in hand. That image, however, is as out-of-date as the idea that engineering is a males-only occupation. More than twelve percent of all engineering students in the U.S. are women, eight percent in Canada. As society's technological needs and capabilities expand, so must the nature and role of the engineer, says Mr. Fitzgerald.

"Engineering is a set of skills, not a job description," he explains. "An engineer is trained to apply scientific principles and technological know-how to achieve certain tasks. The task for Northern Telecom is to create communications systems that will succeed in the international marketplace. Anything involved in this task – and that includes marketing and finance, as well as every aspect of

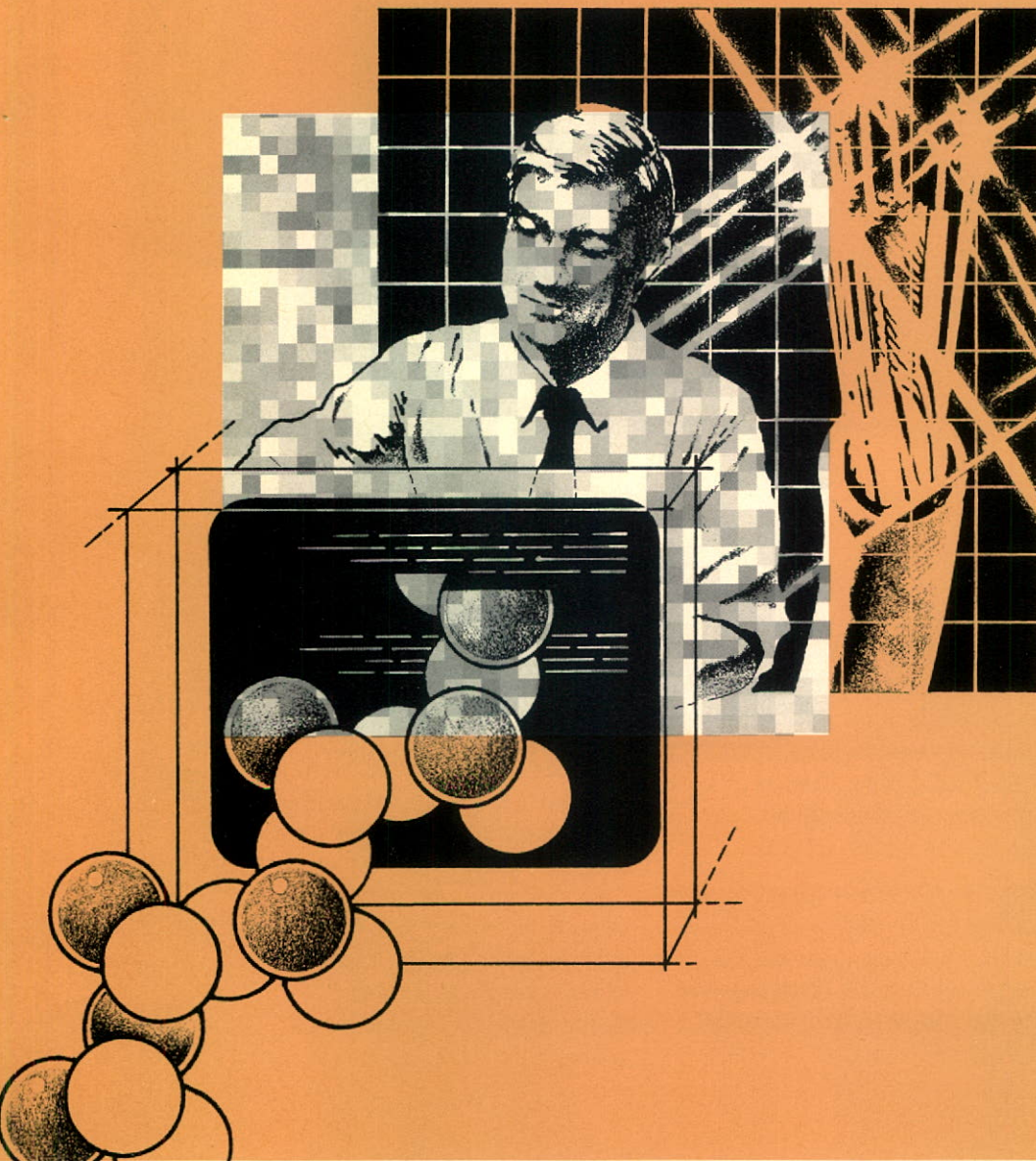
design and manufacturing – must touch upon and include engineers."

According to Dr. Don Chisholm, Northern Telecom's executive vice-president, technology and innovation, there is an important, although subtle, difference between pure scientific research and the work of Northern Telecom's engineering innovators. "Pure research is scientific investigation carried out to satisfy intellectual curiosity about the workings of the world. Engineering development can be exactly the same work, but with a different intent behind it." That intent is to meet the practical needs of customers and the corporation.

That kind of practical scientific development is taking place at facilities stretching from Ottawa to California's famous Silicon Valley, where BNR has its Mountain View labs. There, Dave Twyver's work is extending the corporation's technological leadership in PBX business communications systems. He is a researcher with little time for ivory towers. "Our towers are made of cement blocks – the challenge of the real world."

Mr. Twyver and his group of engineers are adapting Northern Telecom's SL-1 digital communications system for the corporation's OPEN World, an integrated system that will allow a wide range of makes and types of office information products to work together in one network. "There's no question that what we're doing with the SL-1 is driven by our knowledge of where the market is going, and more particularly, what our users will need to do with such a product five years from now."

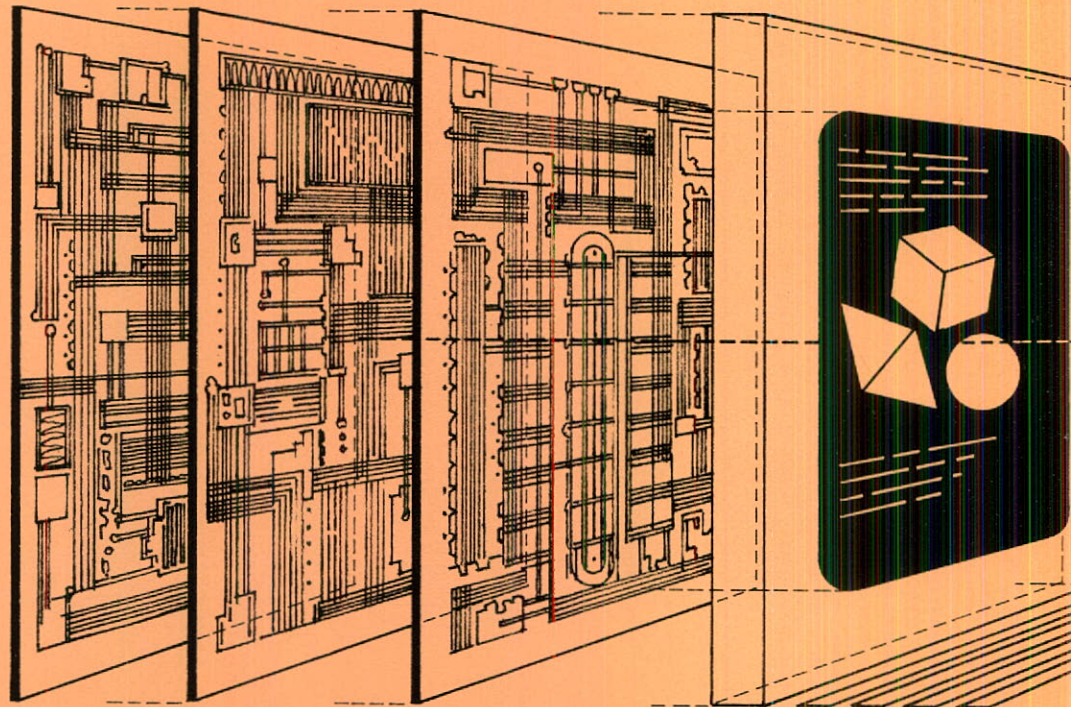
While Mr. Twyver's engineers design the changes necessary to the SL-1 for OPEN World applications, network engineers employed by the corporation's Integrated Office Systems division spend a significant amount of time visiting potential customers to evaluate their networks and determine what design work will be needed to meet the client's needs. They are not salesmen, but engineers with a marketing function.



Comments John Rankin, vice-president, human resources, "For a long time I've noted how often engineers make outstanding managers. I'm sure some of it goes back to their training in concrete problem-solving. However, I believe it goes beyond that. I believe the heavy workload and pressured academic environment provides engineers an early preparation for the uncertainties and competing priorities that a successful manager must handle."

Explains Ed Mattiuz, group vice-president Integrated Office Systems in Richardson, Texas, "The difference is that sales basically relate to the completion of a transaction, while marketing is developmental." Each customer can have different requirements for a system, and it requires an engineer's knowledge to develop the exact system the corporation will propose. And after Mr. Mattiuz's engineers leave the customer's office and make their proposal, they will then follow through and design the networks and software applications that the customer selects.

This involvement in marketing is a logical role for engineers in a high-technology organization. Equally logical is the presence of engineers in senior management functions. "It is a tradition in Northern Telecom to have engineers in our management," says Mr. Vice. "Typically, a new graduate will come into the company and spend a few years doing engineering work, be it in design or manufacturing or cost-improvement. Then, if the interest and aptitude is there, this engineer will move on to a management assignment, where a technological background is tremendously important in dealing with product and manufacturing decisions."

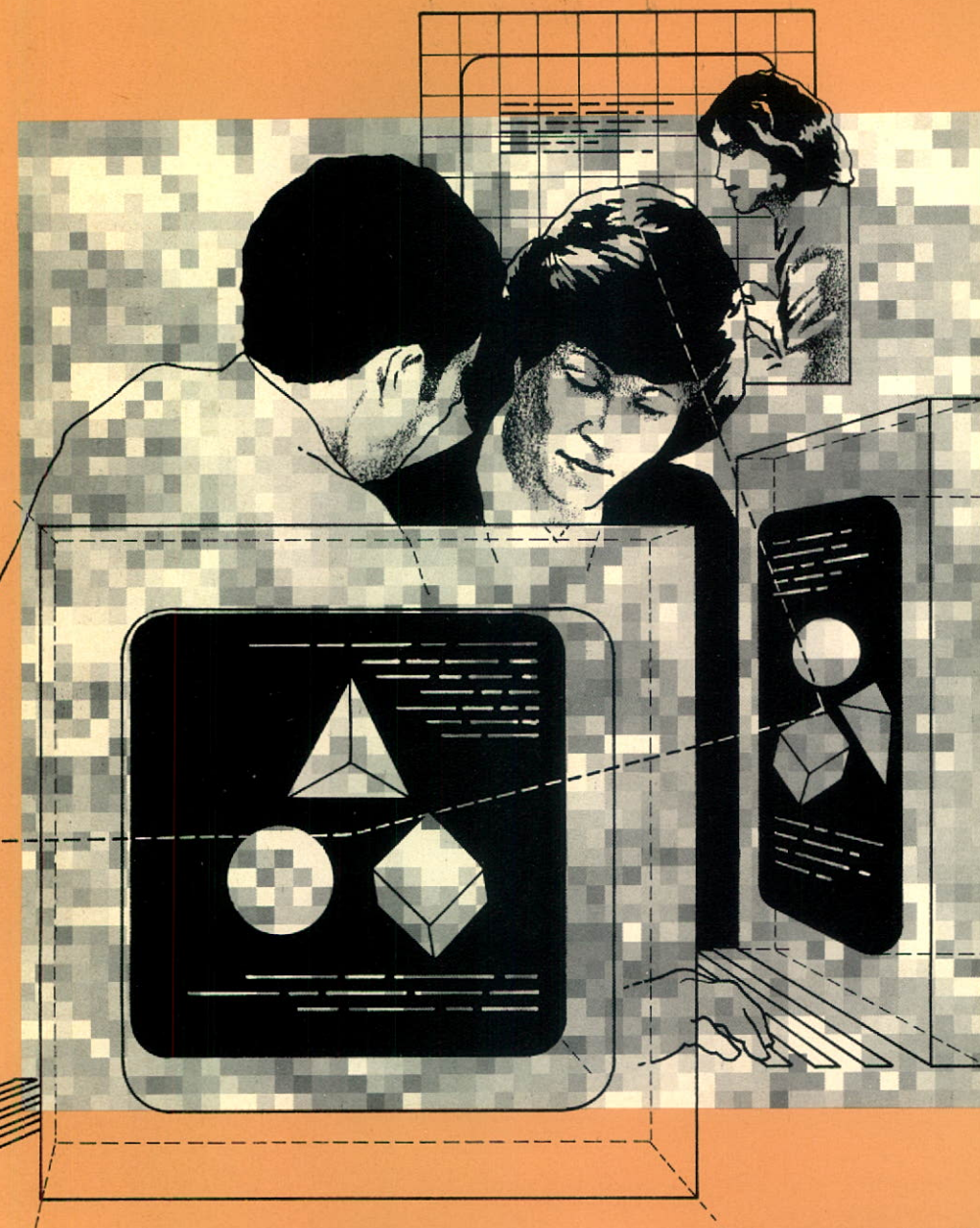


A technological capability is only one of the skills needed by senior executives, however. More and more, engineers are broadening their horizons with formal business studies. It is estimated that engineers now represent the single largest group – generally a quarter and sometimes as high as 50 percent – of all part-time Masters of Business Administration students in North America. At Northern Telecom today, some 40 out of 565 senior managers with engineering degrees also possess an M.B.A.

As the role of the engineer expands beyond the traditional definitions of engineering, so has the category of "engineer" itself begun to blur. Because so much modern engineering is performed at a computer

terminal, the engineer might easily be mistaken for a computer scientist. "If you walked into BNR or into any of our divisions, nobody knows who holds what degrees," says Dr. Chisholm. "If someone acts like an engineer, we use him or her like an engineer."

Another changing aspect of engineering is the growing number of women in the profession, although the total percentage is still relatively small. In 1974, according to U.S. estimates, less than half of one percent of all degreed engineers were women. By 1978, that figure had jumped dramatically, to 1.6 percent. Such figures are reflected in Northern Telecom where, for example, 24 of the 127 engineers specializing in business systems (19 percent) are women.



Even in the corporation's traditional business segments – such as the production of telecommunications cable – women engineers have long been active. Marta Farago has been with Northern Telecom's cable division for 27 years, and since 1972, has been director of cable research and development in Lachine, Quebec. A graduate in chemical engineering of the University of Budapest, she directs a group responsible for cable design, materials, and manufacturing processes. "In our work we need the entire range of engineering skills – chemical, mechanical, electrical," she says. "And every cable must be designed specifically for a particular application. That's what keeps our work constantly challenging."

One of the things that attracts young engineers to Northern Telecom is the promise of new technologies. As Mr. Vice says, "We have, among graduating engineers, a very fine reputation for job content in electrical/electronic engineering." This "job content" is the prospect of working with state-of-the-art semiconductor and software applications. "These opportunities," says Mr. Vice, "are not really that widespread in the industry as yet."

Because of the changing technology, challenging job content can be found even in design areas that might seem well established, almost traditional. Such is the case for Mark Purol, who works in Ann Arbor, Michigan, for Display Engineering, building the cathode ray terminal (CRT) displays for data terminals. "Anytime," he says, "anyone wants to put data on a TV screen, that screen is designed here in Ann Arbor."

Mr. Purol has been with BNR for about a year. Before that, he worked as a TV designer for a major American manufacturer of television receivers. He is responsible for displays for integrated voice-and-data terminals that will succeed the present Display-phone. Designing an ordinary TV monitor would be old hat for Mr. Purol; but as he says, "We now can do some nifty tricks, which should give us a significant market advantage."

Some of those "tricks" adopt new technology and adapt it to old designs. Computers will still need picture tubes, he says. "We have to do the scanning, the high voltage, and the power supply. And the prospects are unlimited."

At the heart of this crisis is the fact that most engineering schools have been unable to match the growth in student enrollments with necessary increases in faculty and equipment. According to Dr. Gordon Slemon, dean of engineering at the University of Toronto, the ratio of students to staff at many institutions is about 20-to-1. "Yet the level that is best would be a ratio of between 8-to-1 and 12-to-1 at the undergraduate level, and six students to every faculty member at the graduate level."

A crisis situation also exists for many American engineering schools, says John Geils, director of the Project on Engineering College Faculty Shortage, which is sponsored by the American Association of Engineering Societies.

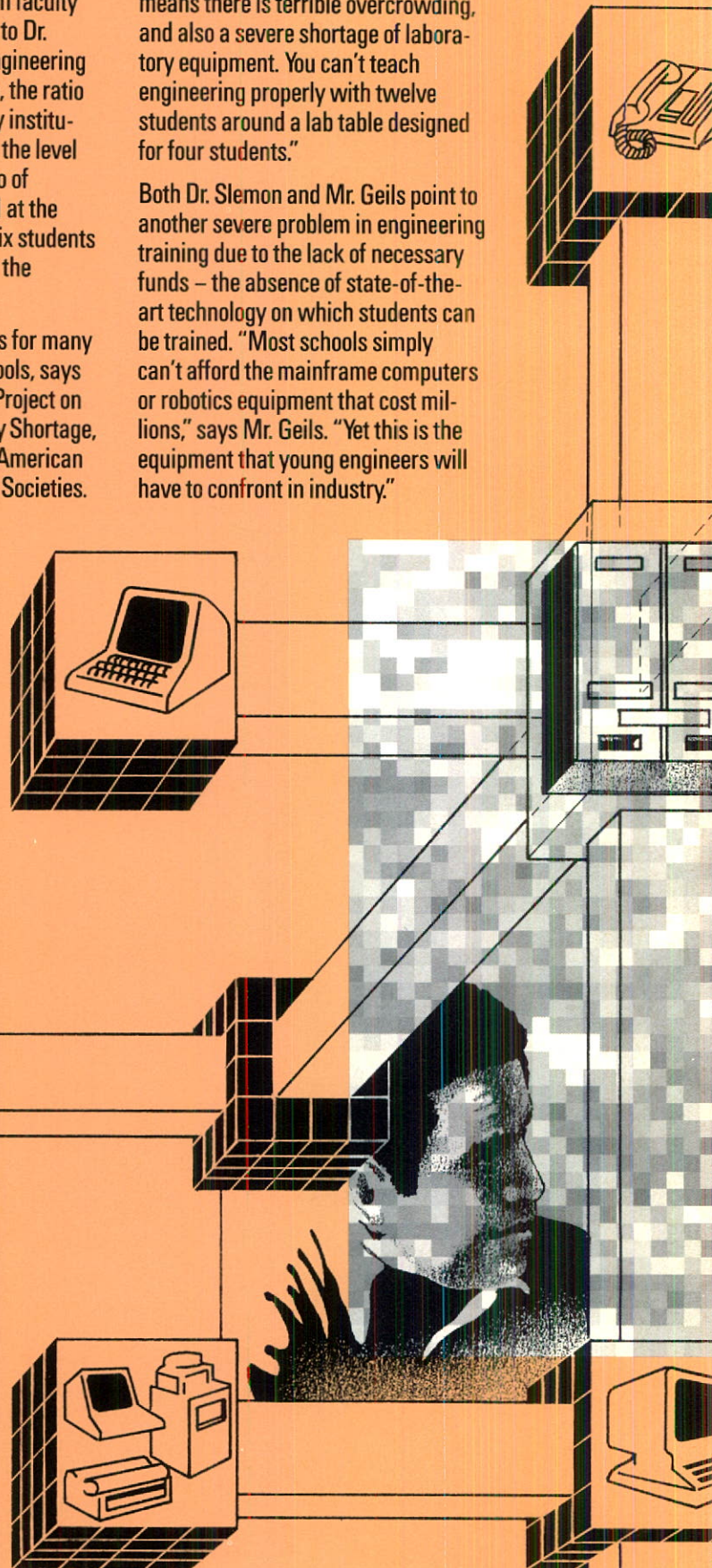
Between 1973 and 1981, says Mr. Geils, engineering student enrollment grew 111 percent, while faculty increased only 11 percent. "This means there is terrible overcrowding, and also a severe shortage of laboratory equipment. You can't teach engineering properly with twelve students around a lab table designed for four students."

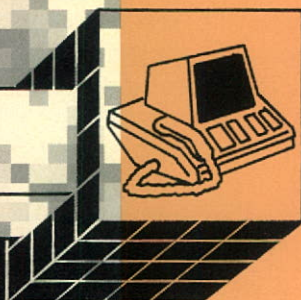
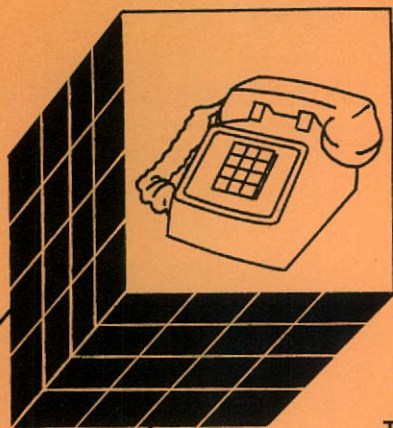
Both Dr. Slemon and Mr. Geils point to another severe problem in engineering training due to the lack of necessary funds – the absence of state-of-the-art technology on which students can be trained. "Most schools simply can't afford the mainframe computers or robotics equipment that cost millions," says Mr. Geils. "Yet this is the equipment that young engineers will have to confront in industry."

The nice thing about television is that it uses every type of technology, so I get my feet wet in digital and anything new on the horizon, even fiber optics."

The broad technological and career prospects offered engineers by Northern Telecom is an important advantage in attracting the quality of graduates needed to maintain the corporation's industry-leading capabilities. While the current recession has sharply reduced the total North American demand for engineers, the competition for electrical engineers and those with computing backgrounds remains strong. A study by the American Electronics Association of 610 companies in 1981 projected that there would be an annual shortfall of 20,000 engineering graduates in electrical and computer-science engineering through 1985, the very areas where Northern Telecom seeks most of its recruits.

While the corporation remains confident it can compete successfully for its share of top graduates, Northern Telecom executives share in the growing concern of industry about the quality of North American engineering education. Says Mr. Light, "There is a crisis developing in the engineering schools that, unless corrected quickly, will seriously handicap our continental ability to achieve economic growth and remain technologically competitive with other nations."





To help solve such problems will require action by both government and industry, says Mr. Light. One step undertaken by Northern Telecom is a special program to assist universities in strengthening their capability in microelectronics and computer-aided design tools. The program will see Northern Telecom fabricate and test integrated circuits designed by students as part of their course requirements. The circuits and test results will then be returned to the universities.

This is one example of how industry can play an important role in developing new generations of engineers equipped for the technological challenges our society faces, says Mr. Light. And the corporation itself is a training ground for engineers to expand their skills, and operate on the leading edge of a technological revolution.

One engineer whose Northern Telecom work has moved far beyond his original training is Dave Cuddy of BNR's Carling facility in Ottawa. He is both a second-generation engineer and Northern Telecom staffer, as his father, Robert Cuddy, is vice-president, manufacturing, for Northern Telecom Canada.

With degrees in electrical engineering from the University of Toronto and the Massachusetts Institute of Technology, Mr. Cuddy is manager of speech and signal processing with BNR's Design Interpretive Division. Much of his work involves voice transmission and digital signal processing. He determines the optimum digital bit rate that can be used to transmit the most acceptable voice quality. It's the sort of question that a

modern electrical engineer with computer training might be expected to handle.

But Mr. Cuddy's job involves much more. Design Interpretive deals with what they call the human interface — designing features and devices that can be easily used by a customer's non-technical employees. For example, Mr. Cuddy is working on a voice-messaging system that effectively puts a combination dictation and voice-answering machine inside every telephone.

The technology involved in such a system includes digital storage on disks, tapes, or optical memory. But, says Mr. Cuddy, it shouldn't be necessary to understand this technology to use the system. All one really needs are understandable, simple commands. "One command might be 'reply' and another 'rewind' and then 'play,'" Mr. Cuddy explains. "The 'rewind' command isn't really rewinding a tape onto a spool, but it fits most people's mental model of an audio cassette recorder. And that's a model most users would understand and feel comfortable with."

To decide what works best, Mr. Cuddy's group brings in people who act as test subjects and who experiment with different sorts of controls. Using behavioral psychology testing methods, Mr. Cuddy can then decide which controls are least prone to user error. This combination of engineering, behavioral psychology, and industrial design is unusual, he admits. "It's not the kind of work I expected to be doing, not based on what I studied in university."

Does Mr. Cuddy still consider his work engineering? He laughs. "I'm an engineer," he says, "and I'm doing it, so it must be engineering."

INTERNATIONAL HORIZONS

THE CORPORATION'S ACHIEVEMENTS IN GLOBAL MARKETS

In the softly lit cabin of a jet high above the Caribbean Sea, Northern Telecom Vice-chairman Basil Beneteau reflects on the corporation's past growth and its future. "Becoming an international marketer and manufacturer has been a necessity, not just a matter of choice," he says. "If we do not compete abroad, we jeopardize our ability to be a world leader in telecommunications technology."

Earlier that day, Mr. Beneteau had presided over the formal opening of a TOPS – traffic operator position system – office in Port-of-Spain, Trinidad. Designed by the corporation's Bell-Northern Research subsidiary, a TOPS frees telephone company operators from dialing and billing for long-distance calls. The TOPS installation is just one facet of a major telecommunications modernization and expansion being undertaken by Trinidad and Tobago. At the heart of the Caribbean nation's new network will be some \$60 million in Northern Telecom products – digital switching systems, transmission equipment, telephone sets, cable, and outside plant equipment.

Such contracts and other international activities are increasingly important to Northern Telecom. In 1982, sales to customers outside North America exceeded \$325 million, a 19 percent gain over the year before. This includes telecommunications products, and European sales of the corporation's distributed data processing (DDP) systems.

Exports by the corporation's Canadian and American operations represent the largest portion of its international sales. For example, the DDP products sold in Europe – more than 4,000 systems have been installed – are

manufactured mainly by Northern Telecom Inc. (NTI) in the U.S. In turn, Northern Telecom Canada (NTC) is a major offshore supplier of the successful SL-1 digital business communications system.

Exports, however, are only one aspect of Northern Telecom's growing offshore presence. It has licensed technology to firms in Sweden, the U.K., Italy, Austria, and Korea, to name a few countries. The corporation is also an international manufacturer.

■ In Brazil, NTI's Cook Electric division has a facility producing outside plant equipment for South America.

■ In Malaysia, the corporation has added a new plant in Kedah, producing electronic components and printed circuit boards, to its existing component facility in Penang.

■ Northern Telecom's plant in Galway, Ireland, last year completed a 25,000-square-foot expansion, an increase of 60 percent. The facility produces telephone apparatus, the SL-1 business communications system, and the SL-10 data packet switching system, for domestic and international markets. Sales have increased 800 percent in the last five years.

Such export and manufacturing activity reflects the rapidly growing world market for telecommunications and information management systems. While North America remains the largest single market for such equipment, it still represents less than half the total global spending on telecommunications, estimated at \$80 billion in 1983. By 1990, this world figure could reach \$150 billion. "The degree to which our corporation will grow and prosper," says Mr. Beneteau, "will depend on our continuing evolution as an international enterprise."

It is an evolution that has already produced dramatic results. In 1970, when the corporation (then called Northern Electric) was a wholly-owned subsidiary of Bell Canada, it was a mainly Canadian enterprise, depending on Canadian customers for over 80 percent of its sales. Revenues were \$562 million, but profitability was only \$4 million.

Today, Northern Telecom is the second largest North American manufacturer of telecommunications equipment, and ranks sixth in the world. Revenues in 1982 passed the \$3 billion mark, and profits were a record \$158 million. Most significantly, while Canadian sales were double those of 1970, much greater growth has come from the corporation's American and international operations. As a result, in 1982, revenues from the U.S. (\$1.46 billion) and offshore were equal to nearly 60 percent of the corporation's total.

"There has been nothing accidental or easy about our growth," says Mr. Beneteau. "Our ability to expand beyond Canada is the result of our willingness to undertake the long-term investment in research and development that has made us an industry leader in telecommunications technology."

Through the 1960s, most Northern Telecom products were based on designs licensed from AT&T subsidiary Western Electric of the

U.S. This was good enough to earn a major share of the Canadian market. But it did not provide the technological lever to turn the corporation into a successful North American competitor able to flourish in the international marketplace.

To obtain that lever, the corporation embarked on a massive research and development program. That activity – which by 1982 totaled over \$1 billion in R&D investment – produced a stream of proprietary products, such as the Contempra telephone, the Pulse business communications system, and the SP-1 switching system, opening up new markets. Then, in 1976, Northern Telecom unveiled Digital World, a program that produced the world's first line of fully digital telecommunications switching and transmission systems.

Digital World became an international success that helped to revolutionize telecommunications. Customers for Northern Telecom's digital products now include all the major telephone companies

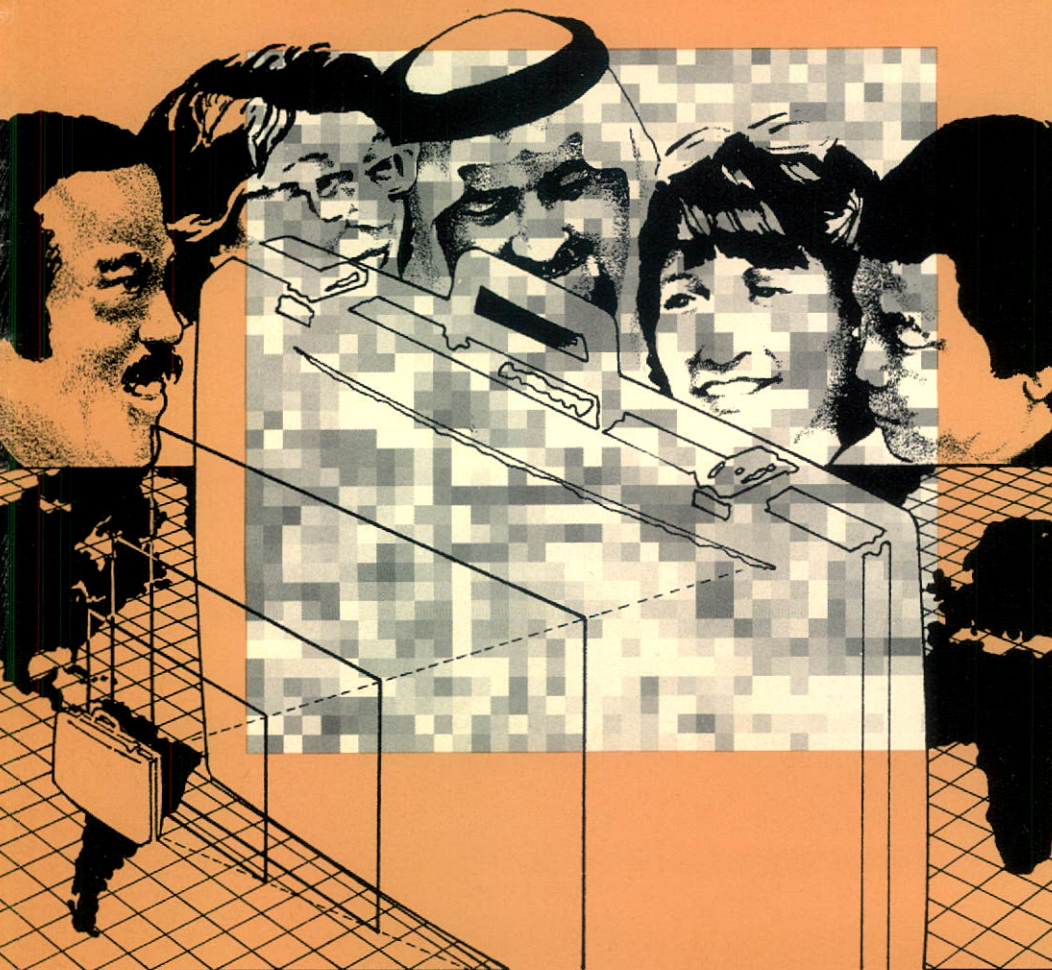
in North America, including AT&T. By yearend 1982, Northern Telecom had in service, or on order, fully digital systems representing the equivalent of more than 10 million telephone lines. No other manufacturer in the world can match this record.

While North America is the largest market for Northern Telecom's digital systems, offshore success has also been significant. For example, by the end of 1982, more than 1,150 of the corporation's SL-1 digital private branch exchanges (PBXs) were in service or on order in some 40 nations, representing nearly 20 percent of total system sales. Last year alone, Northern Telecom Canada's plant in Belleville, Ontario, supplied over 400 SL-1s to international customers, or more than 50 percent of the total systems shipped by the plant. New orders for the SL-1 came from Jamaica, Venezuela, Korea, and New Zealand, among others.

However, technological leadership alone does not bring quick and easy international success. While Canada and the United States share an integrated telecommunications system, as well as a common culture, the offshore environment is a patchwork of often-conflicting technical standards and national interests. And Northern Telecom faces aggressive competition from firms with decades of international experience.

"Offshore growth only comes through long-term commitment and patience," says Mr. Beneteau. A single contract can take years to negotiate. Only through investing considerable time and resources has Northern Telecom developed the relationships and reputation now producing sales success.

As part of this international commitment, in 1977, the corporation set up an offshore marketing arm, Northern Telecom International Limited (NTIL), headed by President W.T. "Bill" Simpson. The basis of NTIL's performance, says Mr. Simpson, has been to combine Northern Telecom's innovative products with a marketing strategy based on three words: "selectivity, flexibility, and empathy."



Selectivity, Mr. Simpson explains, means choosing which contracts the corporation will bid for, and the countries where it will aggressively pursue business. Charlie Shiu, NTL's assistant vice-president for business development, estimates that the company may look into as many as 100 opportunities before picking the five or six that it will go after. It costs money to put a bid together – as well as involving millions of dollars in research and development work if the contract, as often happens, calls for a telecommunications system tailored precisely to the customer's needs. "If we are going to invest significant resources to enter a new market, we have to be confident that a real opportunity exists for long-term growth," says Mr. Simpson.

Flexibility – the second NTL byword – means that Northern Telecom recognizes the importance of cooperating with foreign nations and companies to achieve mutual benefits. "Most governments today face severe – and very understandable – pressure from their own industries and workers to fight unemployment and create new economic growth," says Mr. Simpson. "If Northern Telecom is not willing to help create such opportunities, we can find ourselves shut out completely."

As a result, Northern Telecom's international operations take a number of forms, depending on the needs and policies of the local environment. It might decide to set up a wholly-owned subsidiary, as it did in Galway, Ireland. Or, the corporation might enter into a joint venture, sharing its technology and management expertise with a local government or company.

This is the basis of NTL's participation in NETAS – Northern Electric Telekomünikasyon A.S. in Istanbul, Turkey. When the NETAS plant was opened in 1967, NTL was the majority owner, holding 51 percent of the firm. Today, 69 percent of the operation is controlled by Turkish interests, and NETAS has established its own R&D laboratory. In turn, NETAS is a significant market for Northern Telecom products.

Another approach to international growth can be distribution agreements, by which the corporation appoints a foreign company to act as its exclusive agent in a market. Early this year, NTL signed just such a deal with Japanese industrial giant Mitsui, a \$70-billion enterprise, which hopes to market the corporation's SL-1 PBX in Japan.

Finally, there is licensing, one of the most important opportunities for the corporation and a growing aspect of international business. Under such an arrangement, a foreign company can manufacture as well as market Northern Telecom's systems. This allows the foreign company to provide a state-of-the-art, locally – manufactured product in its own market and, at the same time, seek new export opportunities. In return, Northern Telecom receives an initial payment for its technology, plus the prospect of future royalties. Moreover, licensing often leads to increased exports for North America, since many licensees choose to import some parts or subassemblies.

NTL licensees include Olivetti, one of the leading manufacturers of private telephone exchanges and office equipment in Italy, which manufactures SL-1. Under similar arrangements, Northern Telecom has licensed the SL-1 to Televerket, the Swedish telecommunications authority; to General Electric Company of the U.K.; and to Taihan Telecommunications Company Limited, Korea. In Austria, where the government has chosen Northern Telecom's DMS-100 local and DMS-200 toll switching technology to expand its telecommunications network, these systems will be manufactured under license by two leading Austrian firms, Kapsch AG and Schrack Elektronik AG.

Whatever the deal, maintaining good customer relations remains a vital part of the job. For Northern Telecom's senior management, that means playing an active and visible role that shows the corporation's commitment to its products and clients.

"Chairman Walter Light and President Ed Fitzgerald are our most effective salesmen," says Vice-chairman

Beneteau. "As part of the opening of the Trinidad TOPS office, the first call placed was between Mr. Light and Trinidad's minister of public utilities. This was more than a ceremonial gesture because it helps build the type of personal relationships and identification that are crucial to international sales."

Such personal involvement by NTL senior management reflects the third aspect of the corporation's international strategy – empathy. "If you are going to do business in foreign markets, you have to understand the people and their national priorities and concerns," says Mr. Beneteau. "I'll go halfway around the world just for a four-hour meeting. Some people think that's nuts. But it is something that pays off in the long run."

Another form of empathy that aids Northern Telecom is its ability to appreciate the evolving needs of telephone operating companies. This is the result of the corporation's close relationship with Bell Canada, one of the world's most advanced telephone organizations.

"As Bell Canada's principal supplier," says Mr. Beneteau, "Northern Telecom has a special credibility, and a proven sensitivity towards a customer's requirements. And by working with Bell Canada International, we can provide foreign clients with both the engineering support and the operating expertise needed to develop their networks into world-class systems.

"For example, Bell Canada International is an associate of Northern Telecom in the reconstruction of the network of the Trinidad and Tobago Telephone Co. While Northern Telecom has overall responsibility, we are there as a team."

If Northern Telecom has already achieved offshore success, the future appears even brighter. "This corporation has made, and is continuing to make, the investment to provide the industry-leading technology and first-class service our global customers deserve," Mr. Beneteau says. "Such commitment is already paying off and will provide greater returns in coming years."

THE INTELLIGENT UNIVERSE UNFOLDS

USING DIGITAL ART TO EXPLAIN A DIGITAL CORPORATION

It was a moment of decision. The conference table in the Toronto offices of graphic design firm Cabana Séguin was bare, except for two photographic slides. The slides represented six 20-hour-days' work by one of the best computer graphics companies in the United States.

Jeff Roach, Northern Telecom's assistant vice-president, corporate communications, stared at the pictures, then glanced at his director of editorial services, Daniel Mothersill. They agreed. The artwork wasn't good enough.

The set-back was serious. The slides were a trial run to produce computer-generated graphics that would be the heart of, and key to, Northern Telecom's new corporate brochure. These graphics begin as three-dimensional computer images, which are created by complex computer programs that digitally "paint" images on a video screen. These images can then be transferred to film for printing.

Recalls Mr. Mothersill, "The pictures were passable, but they weren't state-

of-the-art. The lines were not smooth, and the colors weren't quite right. They simply weren't top drawer."

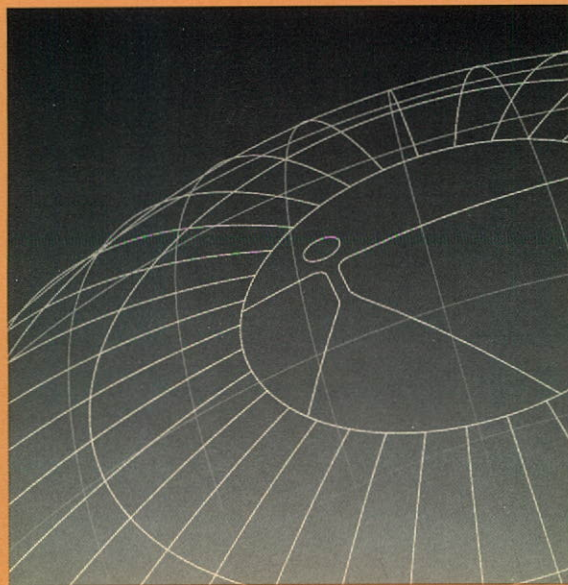
More than any other publication, the corporate brochure represents Northern Telecom to the outside world and symbolizes its quality and character. Second-rate graphics, therefore, were unthinkable.

If the graphics were to mean anything at all, they must demonstrate that change is constant at Northern Telecom.

The corporation is on the leading edge of manufacturing equipment for integrated telecommunications networks throughout the world. An international leader in the development of digital telecommunications, Northern Telecom is helping create a communications revolution.

Even while creating that revolution, Northern Telecom must find means to communicate necessary information about itself. Without a source document, the range, scope, and diversity of the corporation would be unknown to many. The corporation's growth is so rapid that a corporate brochure has a life of three years or less. While an excellent brochure had been produced several years ago, another brochure was now needed.

It would be used as a corporate calling card; a tool for marketing and recruitment; an introduction to digital, software, and semiconductor technologies; a history of the corporation's achievements; an outline of its future plans. It was to illustrate graphically Northern Telecom's international strength: more than 34,000 employees around the world with 49 manufacturing plants in Canada,



the United States, England, Republic of Ireland, Malaysia, and Brazil.

Entitled *The Intelligent Universe Unfolds*, the new brochure was designed to provide this overview. About 150,000 copies were produced in English, French, and Spanish. It will get wide international distribution in the fields of government, business, the telecommunications and computer industries, media, universities, the financial community, and other special audiences in which the corporation has an interest.

The beauty of the concept was its simplicity: to use digital art to explain a digital industry. The artwork was slated to appear on the cover and introduce each of six chapters. The challenge was that it had never been done before. The problem was that no one was sure who – if, indeed, anyone – could do it.

The alternative was to hire a conventional artist who could paint the designs created by art director Keijo Tapanainen. However, these images would lack the precision and the enormous feeling of depth found in the best computer graphics. “Normal illustrations would be faking it,” says Mr. Mothersill. Even so, the trial run had failed, and no one was sure that the idea was achievable. All that remained was a stubbornness to make it happen.

That stubbornness took the Northern Telecom team to an unimpressive gray stone office building in New York’s midtown Manhattan, near the theatre district. It was the home of Digital Effects, Inc., one of the oldest firms, founded in 1978, in the young computer-graphics industry. The company is known for its work on the Disney film *Tron*, and the opening titles of the *NBC Nightly News*.

However, Digital Effects had worked mostly with film and animated digital images. “Printing is something very new to us,” says computer specialist Don Leich. He was responsible for transforming Mr. Tapanainen’s rough pen-and-ink sketches into digital images. It’s a tedious process that requires equal parts of patience, computer expertise, and artistic imagination.

Creating a computer image is like painting by numbers, but without a brush. Mr. Leich used a computer terminal to sketch on the “canvas” of a monochrome TV monitor screen. One of Mr. Tapanainen’s designs, for instance, involved a cluster of globes with maps of the continents and key Northern Telecom locations spotlighted against a background grid. Mr. Leich began by punching up circles, already available in a standard program, on the screen. The continents, being irregular shapes, would have to be programmed separately.

That required a digitizing tablet, a flat, plastic surface on which original artwork was attached and then traced with an electronic pen. With the rough images stored in the computer memory, they were manipulated – enlarged and shrunk, moved about or rotated, even distorted in various ways.

Another program transferred the flat circles into spheres, and yet another was needed to wrap the flat continents around those spheres. Adding the Northern Telecom location symbols took even more programming. Mr. Leich spent 72 hours just to get this far, and he was days away from finishing the picture.

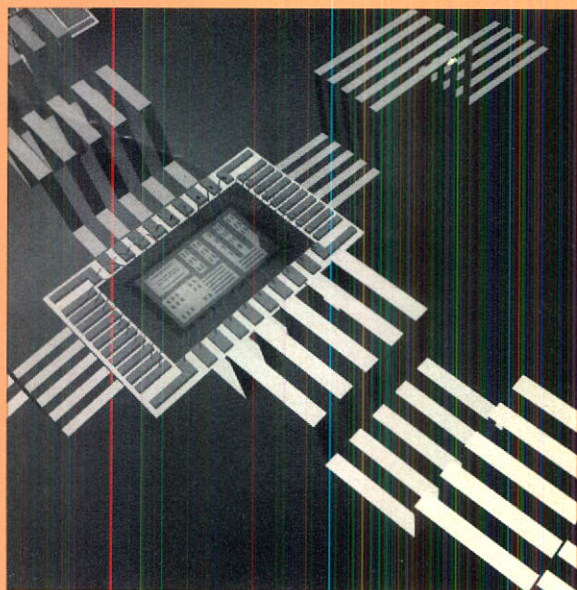
It still had to be colored, and it required lighting. Even computer images cannot be “seen” in darkness, so an imaginary source of light was needed. Mr. Leich chose a point from somewhere within the frame. This represented the source of light, as a kind of imaginary sun shining somewhere out of view. To imitate its effects, the computer used mathematical calculations to simulate the way light falls on an object.

Now he was ready to color it. Mr. Leich ran the image onto the frame buffer, which stores data and displays it on a color video monitor. Picking numbers that stand for varying amounts of red, green, and blue, he altered their values almost infinitely, or more precisely, to any of 16 million shades.

With no room for error, no time for mistakes, and an unequivocal mandate for perfection, the sweat

ran even on the chilliest nights of last December, when everything was assembled at the Toronto printers. Digital Effects had spent nearly 180 hours creating the computer graphics with detail that no human artist could match, while setting a standard that others will be imitating for years. “We were pushing,” recalls Mr. Mothersill, “the printers were pushing, but the question remained – would it work?”

Happily, it did. Northern Telecom produced a publication that has already been hailed as a pacesetter. The opening page of the brochure says it all. “This is the first corporate brochure of its kind to incorporate three-dimensional, computer-generated graphics and represents a major advancement in this emerging art form.”



THE MAKING OF A CORPORATE FILM

NORTHERN TELECOM'S VISUAL PORTFOLIO

At Northern Telecom, filmmaking is part of few people's jobs. But during the shooting of the corporation's recently released film, Towards the Intelligent Universe, more than 400 employees and managers from around the world were recruited to tell the corporation's story.

Northern Telecom people dug the film crew out of snowdrifts in Michigan, demonstrated how the DMS and SL families were designed and assembled, manned word processors and test equipment, and everywhere served as gaffers, prop-persons, and extras. In short, they were the stars.

But even as the film was constructed, it was understood that everything hinged on the employees themselves. "There were risks," says Montreal filmmaker Robert Duncan. "When bringing a film crew into plants, there's always the risk of causing disruptions and shutting down lines. This was minimized by careful advance planning."

There were also unplanned, but inspired, improvisations. In the shipping department at Northern Telecom's fiber optics plant in Saskatoon, the filmmakers confronted Liz Neuert with a problem. The shooting was stalled because they needed a mobile platform that would allow the filming of a panoramic view of the plant. To complicate the matter, they also needed to slowly lower the camera for some factory floor close-ups. "Simple," replied Miss Neuert, who rigged a scissor lift as an improvised crane that descended smoothly from the 18-foot high ceiling. "It was the easiest thing to squeeze into small areas," she says.

Such experiences were repeated dozens of times: in Ann Arbor, Michigan; Aylmer, Quebec; Bramalea, Ottawa, and Toronto, Ontario; Las Vegas, Nevada; New York, New York; Raleigh, North Carolina; Vienna, Austria; and locations in Korea and Qatar.

Ron McMeekin, the manager of administration for the Ann Arbor facility, remembers the storm when the film crew had to be rescued from a blizzard. But he also remembers how employees volunteered to stay after-hours, on their own time, helping to arrange equipment for the shooting, cleaning work areas, and appearing on camera.

The effort was justified. The film itself is a visual portfolio of Northern Telecom's principal products and services. It transports the viewer from the bustling canyons of Wall Street to the Arabian Gulf deserts. It demonstrates how governments, telephone companies, manufacturers, and others in more than 90 countries around the world employ Northern Telecom's equipment. It shows how Northern Telecom's DMS and SL families of digital systems are kept constantly new.

Towards the Intelligent Universe is a major component in Northern Telecom's corporate communications plan. Produced in English, French, and Spanish, it will be distributed worldwide. About 150 prints were made in the initial run, and additional copies and video tape versions are being produced upon request.

Ots predecessor, *The Innovators*, was first shown in 1977, shortly after the Digital World introduction. Since then, it has been seen by about a half-million viewers in English, French, Spanish, German, Japanese, Arabic, Chinese, and Turkish. Like the new film, it was originally produced in three languages for Northern Telecom's primary markets. Additional languages were commissioned as required.

"The film could have a direct effect on the corporation's profit," says Dick Wertheim, assistant vice-president, investor relations, who helped shape the final script. By providing an overview of Northern Telecom's major achievements, its technological supremacy in a number of areas, and the advances the corporation has made in communications, the film encourages individual and institutional analysts and other groups to learn more about Northern Telecom's financial performance and to invest in the corporation. The film will also be shown to shareholders at the annual meeting in Halifax, Nova Scotia.

"It was a cinematographic challenge to turn an international corporation like Northern Telecom into 22 minutes of visually gripping film," says Mr. Duncan. He used animation, specially composed electronic music, and thousands of feet of raw footage to build the story of Northern Telecom's technological leadership.

"To make a film," Mr. Duncan explains, "you have to shoot too much". A sequence might require five to ten minutes of footage at 24-frames per second; while in the final cut, only

a few seconds are needed to make the point. Typically, a good ratio of film shot to film used is 9:1. On average, it's more nearly 12:1. "However, the film that ends up on the cutting room floor is essential to the final product," says Mr. Duncan. "What remains is a distillation; and to produce that, no one's effort is truly wasted."

Screenings are being held throughout the corporation, and Miss Neuert looks forward to seeing it. She wonders how that scissors/crane shot really looks. Mr. McMeekin and the many other employees who participated in the shooting now share a personal interest in how well the corporate film works. "In part," says Mr. Duncan, "the film was made for them."

Did *Towards the Intelligent Universe* please the filmmaker? Mr. Duncan laughs. "I guess you could say so," he says. "After I finished it, I went out and bought some Northern Telecom stock."



