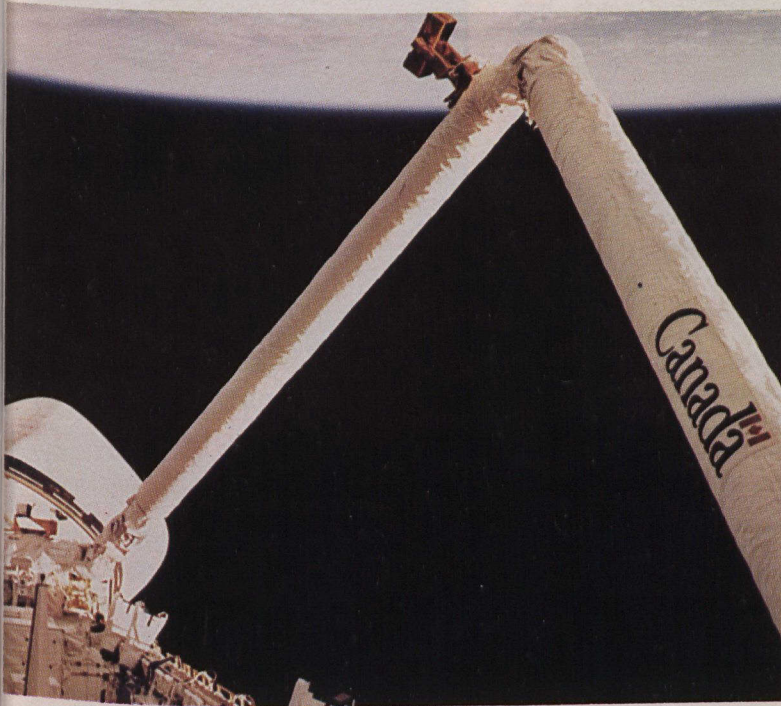


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## Canadian technology ahead of its time

Canadian expertise in science and technology is featured in this special issue of *Canada Weekly* which has been prepared for the Davos Symposium in Switzerland, from January 26 to February 2, 1984. Material has been culled from articles that have appeared in the publication during the past 12 months or so.

The remote manipulator system, Canadarm (left), used aboard the United States space shuttle *Columbia* to lift heavy cargo and satellites in space, is perhaps one of the most remarkable contributions made by Canada to the world of science and technology.

Geneva Telecom 83 — a chance for  
Canada to shine, 1

Canada flies high at Paris International  
Air Show, 4

Seeing-eye computer, 5

Laser used for artificial legs, 5

Preserving the environment, 6

Scanner could replace X-rays, 6

Voice-controlled wheelchair, 6

The OPEN World — a versatile information  
system planned by Northern Telecom, 7

Towards a perfect robot, 7

Canada's computer industry continues  
to grow, 8

Babies' better chance to live, 8

## Geneva Telecom 83 — a chance for Canada to shine

Canadian companies enhanced their reputation as leaders in the communications field at the fourth World Telecommunications Exhibition — Telecom 83 — held in Geneva, Switzerland from October 26 to November 1, 1983. The show, held every four years, is the most prestigious international exhibition in telecommunications and electronics. Canadian capabilities, products and services, which have already earned international recognition for excellence, were exhibited by some 25 companies offering a wide range of goods and services.

Canada, with its 9 970 000 square kilometres and a widely dispersed population, began to develop an efficient communications network early. Alexander Graham Bell invented the telephone in Canada in 1874; two years later the world's first long distance telephone call took place. Today, with a population of almost 25 million, Canada has 14 million telephones in service and the

fourth highest telephone density in the world. The system is now being rapidly converted to the cheaper and more reliable digital mode.

### Canada in space

Telesat Canada was founded in 1969 to establish and operate a commercial system of satellite communications to serve all parts of Canada. *Anik A-1*, the world's first domestic satellite system, was launched in 1972, with similar satellites deployed in 1973, 1975 and 1978. The most recent, *Anik C-3*, was launched in November 1982.

There are now more than 100 Canadian-manufactured satellite earth stations of about 14 types and sizes, ranging from large stations with 30-metre antennas to small transportable stations of 1.2 metres. They provide services such as global television relay with local-area television distribution, telephone, computer-data transfer, and teletype. Telesat Canada





Mitel Corporation products which were displayed at Telecom 83, in Geneva.

also provides consulting services to a number of countries.

Spar Aerospace, the Toronto-based firm that built the highly successful remote manipulator system, *Canadarm*, for the United States space shuttle, recently signed a \$65-million contract to build solar energy panels for the *L-Sat*, a 50-metre new generation commu-

tions satellite being built by three members of the European Space Agency for a 1986 launch.

The company is also providing two communications satellites for a Brazilian domestic satellite system. This \$150-million contract includes the ground control stations.

#### Digital excellence

In the early 1970s, Northern Telecom, in co-operation with Bell Northern Research and Bell Canada, began developing digital switching and transmission systems. Northern Telecom was the first in the world to produce a complete family of fully digital switching and transmission systems.

The digital model is reshaping the whole telecommunications industry. Canadian digital PABX equipment has won wide acceptance in international markets and two Canadian manufacturers, Northern Telecom and Mitel, are among the world leaders in this product.

#### The electronic office

Like other western countries Canada is in the midst of an information revolution. In 1980, the federal government initiated field trials of integrated electronic office systems within its departments. The aim was also to develop services for national and international markets. About \$12 million has been budgeted for the project which will run until 1985 and create

some 5 000 work stations for professional and executive employees across Canada.

#### World's first teletext

In February 1983, Teleglobe Canada, a Crown company responsible for Canada's external communications services, announced it had inaugurated the world's first overseas teletext service, which makes it possible to transmit a business letter from Canada to West Germany or Sweden in ten seconds. Teletext uses computer terminals and transmits data in digital form.

#### Fibre optics

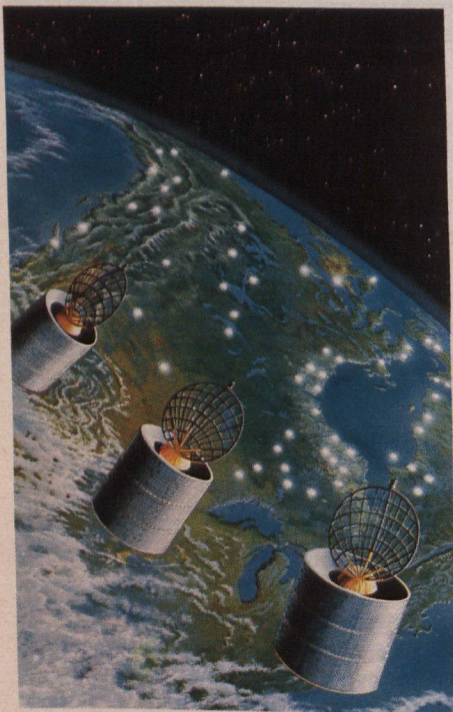
Fibre optics technology (optical fibres that carry light instead of electricity) has been used in Canada since 1976. In Elie,



Northern Telecom's DMS-100 (digital multiplex system) switching machine at Telecom 83. It has a capacity of up to 100 000 lines and can relate to Integrated Business Networks, integrated voice and data terminals, Autovon military network, Maintenance and Administration Positions (MAP) and Traffic Operator Position Systems (TOPS).

Manitoba, some 150 households were connected by fibre optics in the first field trial of fibre optics systems in a rural community.

Three years ago, the Saskatchewan Telephone Company began to install a 3 400-kilometre fibre optics broadband network linking a number of communities in the province. This digital system is the world's longest commercial fibre optics network and provides full



Artist's impression of Canada's Anik communications satellites.



*The Aurora 400 mobile telephone from Novatel Communications.*

voice and data services, as well as cable television signals to 52 communities.

**Data networks**

Canada also initiated the first dedicated coaxial data network, a 12-tube cable linking Toronto, Ottawa and Montreal. The country has had its own national digital-based data networks since 1973 when Dataroute was introduced into the Trans-Canada Telephone System. Introduction of the Info switch and Datapac followed in 1977. These systems link

into United States systems and are part of an integrated network for voice data and visual services.

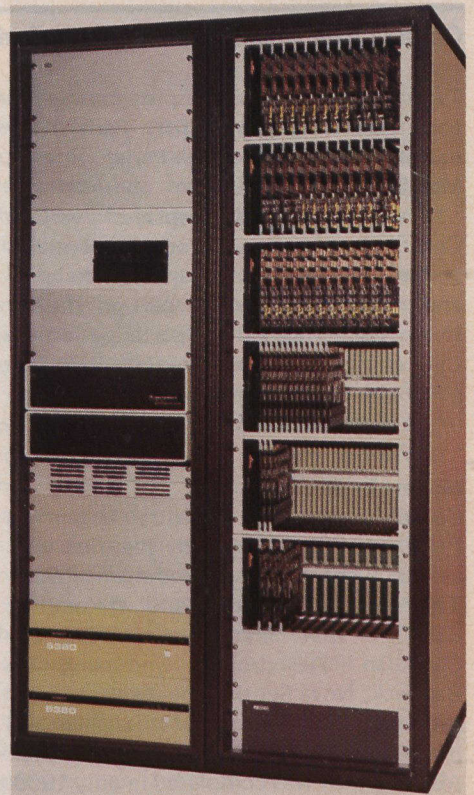
**Videotex-Telidon**

In 1978 Canada's Department of Communications announced the development of Telidon, an advanced videotex terminal capable of producing images with a much higher resolution than other available equipment. It has also shown flexibility and compatibility of data bases with different terminals and has a designed capacity for future expansion.

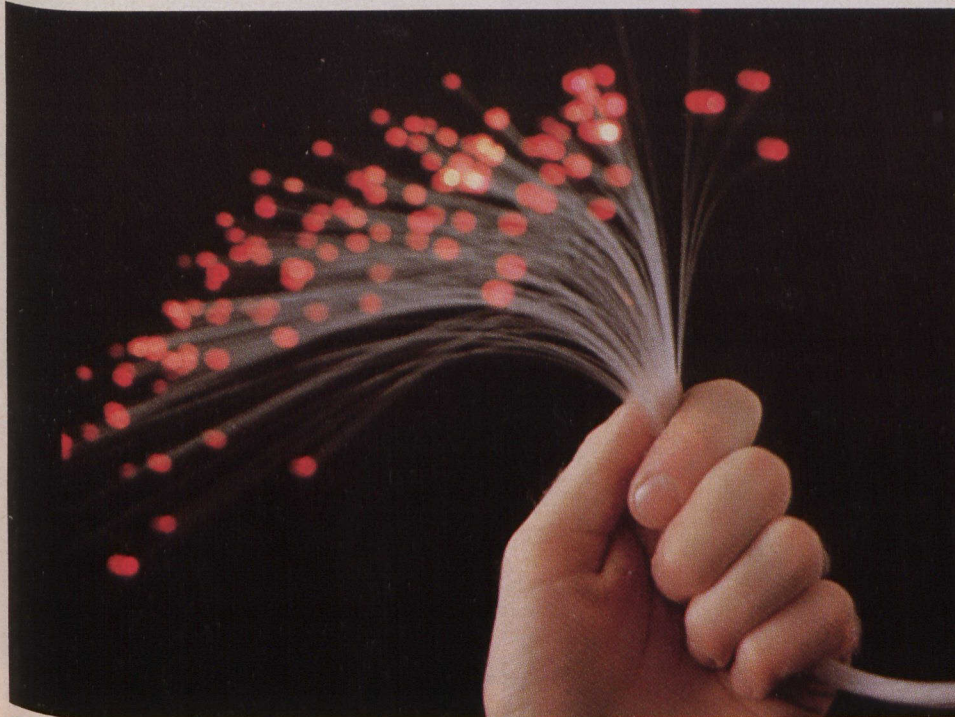
Like other videotex systems, Telidon has a slightly modified television set or display monitor, an interface decoder device, a telecommunications system and a central micro computer which can exploit recent advances in computer graphics and telecom data technologies fully.

**Consulting services**

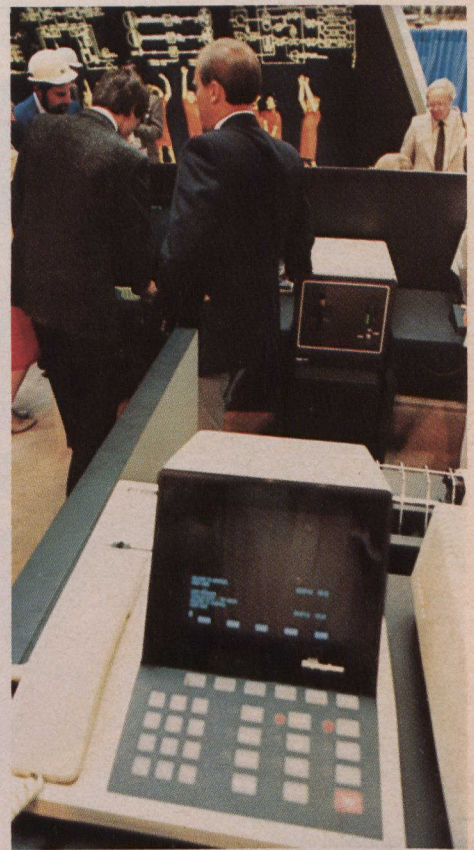
Canadian telecommunications consultants are respected throughout the world. The largest Canadian consultant in this field, Bell Canada International, has provided international services and gained renown for its expertise during more than five years of work in Saudi Arabia. Canadian experts offer a complete range of services: from consulting to managing turnkey operations or from initial basic assessment of an organization's needs to managing systems installations and training of local staff.



*Glenayre's large capacity radio paging terminal, with voice message handling, PCM message switching, digital/display paging, and networking (X. 25).*



*Fibre optics involves the transmission of information and voice communication through glass fibres by means of light pulses. A hair-thin fibre can carry several thousand one-way voice circuits simultaneously.*



*Northern Telecom's displayphone, the world's first commercial combined business telephone and data terminal.*

## Canada flies high at Paris International Air Show

Thirty-one Canadian aerospace companies took part in the thirty-fifth Paris International Air Show in Paris, France, May 26 to June 5, 1983.

The participants displayed various Canadian aerospace products, systems and services and some Canadian-designed and -built aircraft took part in the air show itself. Canadian participation in the exhibition was a joint industry-government effort representing an investment of more than \$2 million.

### Modest beginnings

Canada's aerospace industry began on February 23, 1909, with the first successful flight in Canada of the *Silver Dart*. This led to the creation of one of Canada's first aircraft companies, the Canadian Aerodrome Company, in Baddeck, Nova Scotia. The company later produced the first aircraft designed and manufactured in Canada, the *Baddeck No. 1*, which was completed in July 1909.

From this modest start, through two world wars, Canada built the aerospace expertise which served as a base for the continuing growth of this new industry.

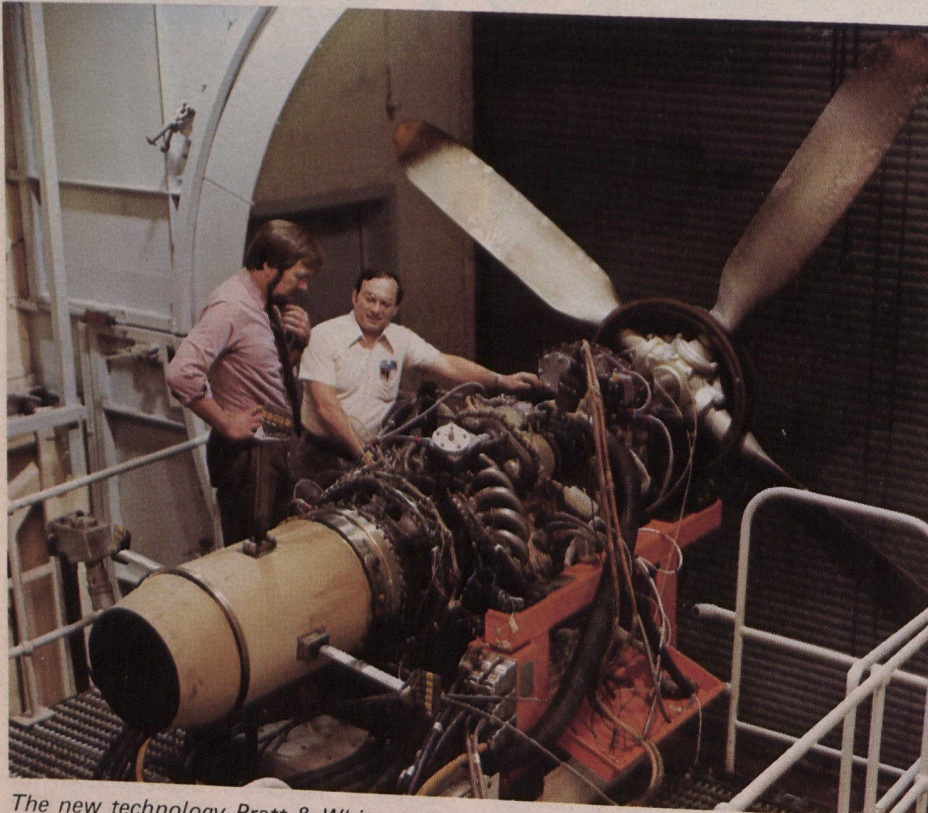
By the end of the Second World War, close to 17 000 aircraft of nearly two dozen different types, from elementary



*The Garrett Manufacturing Limited personal locator beacon/transceiver provides an emergency homing signal as well as two-way voice communication with search aircraft.*

trainers to fighters and heavy bombers, had been manufactured in Canada.

Today Canada's aerospace industry is composed of more than 125 companies which supply the world aerospace in-



*The new technology Pratt & Whitney Canada PW 100 turboprop engine series has been selected to power four new-generation regional transport aircraft.*

dustry and airlines with state-of-the-art and, in some cases, unique aircraft, aero-engines, components, systems and services which have gained an international reputation for high quality and reliability.

### Rapid growth

In the past six years, industry sales have increased by more than 300 per cent, from \$906 million in 1976 to a record \$3 billion in 1982. Industry forecasts indicate sales will more than double again by 1986, reaching an estimated \$7 billion.

Employment in the industry now exceeds 40 000 people and the industry estimates that employment will increase over the next few years to more than 51 000 in 1986.

Over the past five years, approximately 80 per cent of the industry's total sales have been in the highly-competitive export market. In 1982, export sales by the Canadian aerospace industry amounted to more than \$2.4 billion.

Since 1947, nearly 4 000 Canadian STOL (short, take-off and landing) transport aircraft, utility amphibians and business jets have been produced and sold to more than 100 countries. These aircraft include the de Havilland *Beaver*, *Twin Otter*, *Buffalo*, *Caribou* and *DASH 7*, and Canadair's *CL-215* multi-purpose amphibian aircraft and the *Challenger*.

In the same period, some 3 700 military aircraft such as the *F-86 Sabre*, *CF-104 Starfighter* and *CF-5 Freedom Fighter* have been produced under licence in Canada. One of the outstandingly successful military aircraft designed and produced in Canada in the 1950s was the Avro *CF-100 Canuck*. About 800 *CF-100s* were manufactured for use by the Canadian and Belgian Air Forces.

Canada, which ranks fifth in free world aerospace industries, after the US, Britain, France and West Germany, manufactures special and diversified products at the forefront of technology.

### Strong research base

Proportionate to its size and number of employees, the industry is one of Canada's two largest investors in research and development, investing an average of 10 per cent of its revenues.

Some of the new initiatives currently under development in the industry include:

- the Pratt & Whitney Canada *PW100*, an advanced-technology, fuel-efficient turboprop engine;
- the de Havilland *DASH 8*, Canada's newest airplane;
- the Litton Systems Canada new genera-



The de Havilland DASH 8 is Canada's latest transport plane.

tion inertial navigation systems based on a ring laser gyroscope;  
 — Garrett Manufacturing's peripheral vision horizon device; and

— Canadair's continued development of the CL-289 and CL-227 unmanned airborne surveillance and target acquisition systems.



The Canadair Limited CL-227 remotely piloted surveillance vehicle. The upper portion houses the power plant and the lower portion the command, control equipment and payload. The CL-227 is capable of taking off and landing vertically, horizontal flight and hovering.

### Seeing-eye computer

A University of British Columbia (UBC) team has set up a new laboratory centre for computational vision. It is designed to use computers to duplicate and extend the human brain's ability to interpret visual data.

The group, headed by Dr. Alan Mackworth, brings together experts from many disciplines, including computer science, forestry, astronomy and pathology.

Helped by a grant of \$400 000 to start the project from the Natural Sciences and Engineering Research Council (NSERC), the group has already installed new hardware and is now working on software — the formal procedures computers follow to do their work.

One new program, MAPSEE, helps the computer system to recognize map features such as rivers, bridges, shorelines, and roads.

According to Dr. Mackworth, the best way for machines to do this often makes good human sense as well — showing how closely computers may approximate the way our own brains solve problems. Thus MAPSEE "knows" that although both roads and rivers appear as lines, roads pass over rivers at bridges; rivers must connect shorelines to lakes; and roads exist in networks connecting towns.

### Laser used for artificial legs

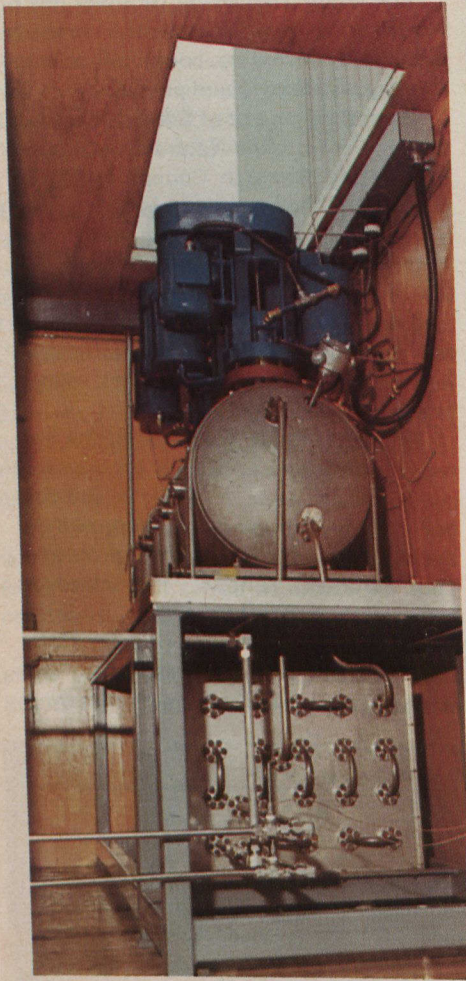
A laser device that can scan a three-dimensional object and create a computer model of it is proving useful for making artificial legs and is drawing interest from companies that make engineering models and shoes.

The shape sensor was developed at Toronto's West Park Hospital to study shapes of casts for making prosthetic devices. A low-power helium laser beam scans a vertical line as the body part or object is rotated past it. Three-dimensional measurements of up to 17 280 points are taken with an accuracy of within one millimetre in any dimension. A computer collects the readings and displays a cross-section of the object anywhere along its length on the computer's terminal.

The information can be fed to a numerically controlled model-shaping machine to create a plaster mold. A process that once took days of careful carving and measuring can be completed in a few hours.

## Preserving the environment

A new process for toxic organic waste disposal with energy-producing potential has been developed by the Ontario Research Foundation (ORF) and is now being marketed under licence by WetCom Engineering Limited of Scarborough.



Toxic organic waste-disposal unit.

In the Wetox process, the liquid waste is pumped through a heat exchanger and then into a reactor where it is mixed with compressed air. The oxygen in the air reacts with the organic matter to produce mainly carbon dioxide and water. The heat produced helps keep the liquid material in the reactor at the required high temperature.

The entire process is co-ordinated by a microprocessor. The processor monitors and controls the process at all times, and can signal when there is a problem.

After carbon filtering, the remaining material is neutral enough to pass through a normal sewage treatment plant. To any company which generates liquid organic waste as a result of its production process, the financial and environmental

advantages are obvious.

A mobile plant for the Wetox process was developed by ORF after study of a prototype built by an American firm for the Skylab project. The Ontario government helped with funding, both for initial research and for the pilot project.

First commercial application of the process is at Uniroyal Chemicals in Elmira which, with financial help from the federal government, is just finishing building a \$1.3-million Wetox plant to get rid of residues from production of chemicals.

"One of the big benefits of Wetox is that we will be able to destroy, on-site, strong wastes previously shipped off-site," said project manager Louis Klink. He estimates that there will be a \$200 000 annual saving in transportation costs.

WetCom is currently handling requests for demonstrations of the process from the United States, the Netherlands and England.

## Scanner could replace X-rays

A \$1-million machine that uses magnetism to scan a patient's body without emitting harmful radiation may revolutionize diagnostic medicine, some medical researchers say.

The machine, known as nuclear magnetic resonance (NMR), can take repeated scans over a short period to monitor the effects of medicine on the body's organs, study ways to reduce the severity of strokes, find aneurysms in the brain, or chart the damage caused by multiple sclerosis.

The NMR scanning technique allows doctors to check tumor response to treatment on a continuing basis without exposing the patient to the radiation emitted by X-rays. Instead, NMR uses radio frequencies and a magnetic field, neither of which appear to harm body tissues.

The method also takes images of areas of the body that do not show up well with X-rays such as the back part of the brain — which is covered by bone — and the spinal cord. Furthermore, it shows not only structure, but function of soft tissues, revealing abnormalities that do not affect the size or shape of an organ. Even an image of the bone marrow can be made with the magnetic effect.

One of the first machines in existence is installed at the University of British Columbia in Vancouver; others will be installed in Alberta, Quebec and Ontario.

## Voice-controlled wheelchair

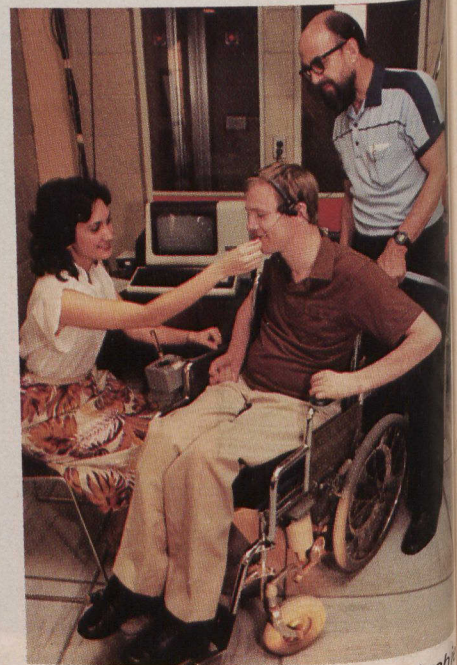
A new wheelchair operated by the sound of the voice could offer new mobility and independence to quadraplegics who cannot manage the stick controls on standard electric wheelchairs.

A standard electric model coupled with a computer, the wheelchair is controlled solely by voice commands and requires no body movement whatsoever.

The voice-operated wheelchair was developed by Haleh Vafaie, a fourth-year student in the systems and computer engineering department at Carleton University, Ottawa.

The computer can be programmed to recognize any sound in any language. Because it recognizes a sound's frequency, it must be re-programmed for each person's voice.

The voice recognition unit inside the computer is an electronic board about the size of a sheet of letter paper. It has a 100-word vocabulary and is available only in the US. A video terminal was donated by Digital Equipment of Canada Limited in Kanata, near Ottawa, and was booked into the university's computer. The cost so far has been about \$2 000, including about \$1 200 (US) for the voice recognition unit. The wheelchair costs about \$4 000 new. The next step, combining the computer and voice recognition unit onto one prototype electronic board on the back of the wheelchair, is expected to cost \$5 000.



Haleh Vafaie (left) and Professor Archibald Bowen (right) with Bob Brown in voice-controlled wheelchair.

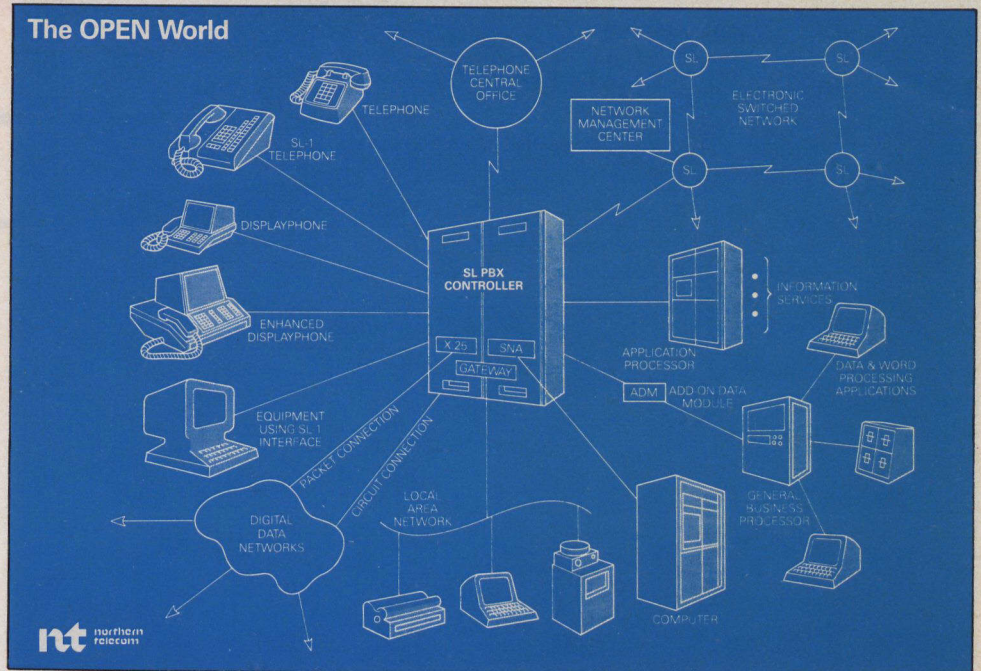
## The OPEN World – a versatile information system planned by Northern Telecom

Northern Telecom Limited has announced a \$1.2-billion five-year research and development program that will allow organizations to manage their information needs – including data processing voice and data communications, word processing and communications, and the exchange of image communications – as one integrated system.

The OPEN World (Open Protocol Enhanced Networks) system, which Telecom is planning, represents a significant departure from traditional approaches to the design of information management systems. It comprises a planning framework to assist users in planning and building their own information management systems, and includes the provision of telecommunications products, services and features for the implementation of such systems.

Northern Telecom is planning for a number of new voice and data terminals, for a series of services and features for information handling, and for enhanced networks based on digital communications technology.

A digital switch, either in a telephone company central office or on a user's premises in the form of a business communications system (or PBX), will be the hub or controller of the system. Northern Telecom is evolving its DMS-100 family of telephone switches and its SL family



The OPEN World integrated information management system being developed by Northern Telecom is depicted, with a variety of systems, equipment, networks and services under the control of an SL PBX controller, on one integrated, evolving system.

of PBXs as OPEN World products to meet these requirements.

Northern Telecom Limited is the largest manufacturer of telecommunications equipment in Canada and the second largest in North America. It is also a significant manufacturer of information-

processing equipment. It employs about 35 000 people throughout the world and has 49 manufacturing plants in Canada, the US, England, Republic of Ireland, Malaysia and Brazil. Its shares are listed on the Montreal, New York, Toronto and Vancouver stock exchanges.

## Towards a perfect robot

The New York Police Department recently received a call about a suspicious-looking briefcase outside a restaurant in Manhattan. It called in its new bomb-disposing robot from Canada, the Remote Mobile Investigations Unit (RMI-3).

With ease and dexterity, the remote-control device picked up the case and deposited it in an explosion-proof box at the rear of the bomb squad's truck. The case was found to be harmless, but the robot's performance was a confirmed success.

"It's like buying life insurance for bomb squads," says Robert Pederson, president of Pedesco (Canada) Ltd., the robot inventor. His firm has been manufacturing the units at its Scarborough, Ontario location for six years.

With contacts and encouragement supplied by the Ontario Ministry of Industry and Trade field offices in both New York and Willowdale, the company has been



Bomb-disposing robot proves a success.

able to expand its international profile. Approximately 90 RMI-3 models now can be found in the service of law enforcement agencies overseas and through-

out the United States, as well as across Canada.

The robot has won widespread publicity. In New York, the briefcase incident brought news hounds scrambling for details. Major newspapers, including *The New York Times*, and three major television networks covered the event.

The robot most recently demonstrated its strength in Arizona during a hostage-taking incident. Complete with two-way radio and mounted guns, it confronted the criminal and forced his surrender, while the police kept vigil a safe 90 metres away.

The basic robot sells for \$20 000 (US) with extra options available on a made-to-order basis. These include radio control, X-ray vision, blasting water guns used to defuse bombs, and firefighting equipment.

When assembled, the New York Police Department's model cost \$64 000 (US), weighed in at 104.3 kilograms and stood 46 centimetres high when folded.



## Canada's computer industry continues to grow



Telidon — an innovative design in Canadian computer technology.

The Canadian computer industry is a burgeoning sector of the Canadian economy that is moving towards becoming a major force on the world scene — both as user and supplier. In 1982 its revenues totalled some \$4.5 billion in retail computer and office machine sales, representing an annual growth rate of about 20 per cent. In addition it generated \$1.2 billion in revenue from computer services.

The several hundred companies in the computer equipment field supply a variety of products such as microcomputers, large mainframes, peripherals and operating software. The services subsector provides a wide range of systems design services, data processing by service bureaus, on-line data bases, consulting and custom software. There are more than 1 400 companies providing computer services, employing more than 20 000 people. At least 90 per cent are Canadian-owned: it is estimated that Canadians produce 82 per cent of the total service industry revenues. An average growth rate exceeding 20 per cent has been realized in recent years and shows no sign of abatement.

The Canadian market for computing equipment is largely supplied by imports. In 1982 Canada imported computer equipment worth \$3 billion, the bulk of which originates in the US. In a complementary manner, about 90 per cent or \$900-million worth of the output of

domestic production was exported by the industry. Canada is the fifth largest import market and eighth largest exporter of computing equipment.

### Innovative designs

Canadian firms have generally chosen not to compete with multinationals in the production of general purpose computers. They have, instead, concentrated on the design of innovative products with a wide range of applications incorporating the latest advances in microprocessors.

The following Canadian products and services have met with particular international success:

- word processing systems, now sold in more than 80 countries;
- "intelligent" terminals, such as the (computer-aided design/computer-aided manufacturing) special high resolution terminal developed for Telidon;
- data communications products to link computers to data networks, including packet switching;
- CAD/CAM graphics with specialized terminals and software languages;
- custom-built on-line computer systems;
- proprietary software packages;
- desk-top microprocessors for financial management applications in small businesses;
- specialized data bases; and
- microcomputers capable of receiving a wide variety of software services through cable television networks.

## Babies' better chance to live

A team of Winnipeg, Manitoba doctors is earning an international reputation for its success in preventing infant deaths during or just after birth.

Using a unique ultrasound evaluation and amniocentesis screening process pioneered in Manitoba, the doctors have been instrumental in reducing the province's infant mortality rate to 1.3 per cent of babies born — one of the lowest rates in the world. Dr. Frank Manning and his team recently combined skills with Dr. John Bowman, a world leader in treatment and prevention of Rh disease, to successfully complete intrauterine blood transfusions on twins with Rh factor disease.

This procedure was not new to the Winnipeg doctors. Hundreds of patients from across the country and throughout the world have been referred to them. By using sophisticated, high-resolution ultrasound scanning, they are able to monitor the path of the needle through the wall of the uterus and into the abdomen of the fetus. Before ultrasound, the procedure was done "blind" and presented a much greater risk to both mother and fetus.

Dr. Manning and his associates have used the same method to identify and treat fetuses with abdominal and bladder obstructions. On another occasion the screening program discovered two fetuses that had developed fluid in their lungs at the time of delivery, needles were used to remove the fluid and save the lives of the babies.

Provincial medical care officials point to the program as a significant factor in helping to reduce the province's infant death rate to 13.3 per 1 000 births of infants who weigh over 500 grams, a 46 per cent decrease in the death rate since 1977.

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Canada

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