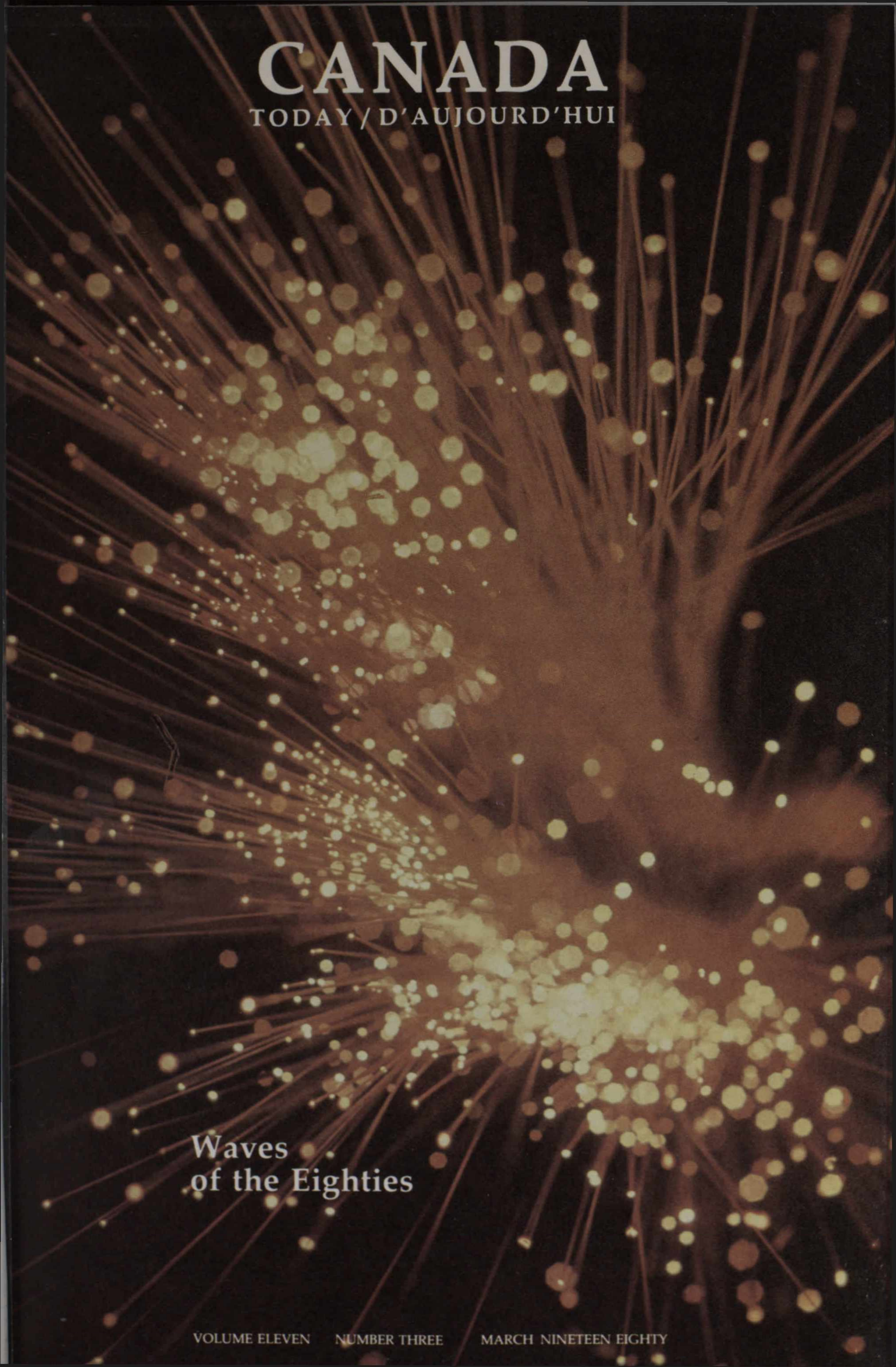
CANADA
TODAY/D'AUJOURD'HUI



Waves
of the Eighties

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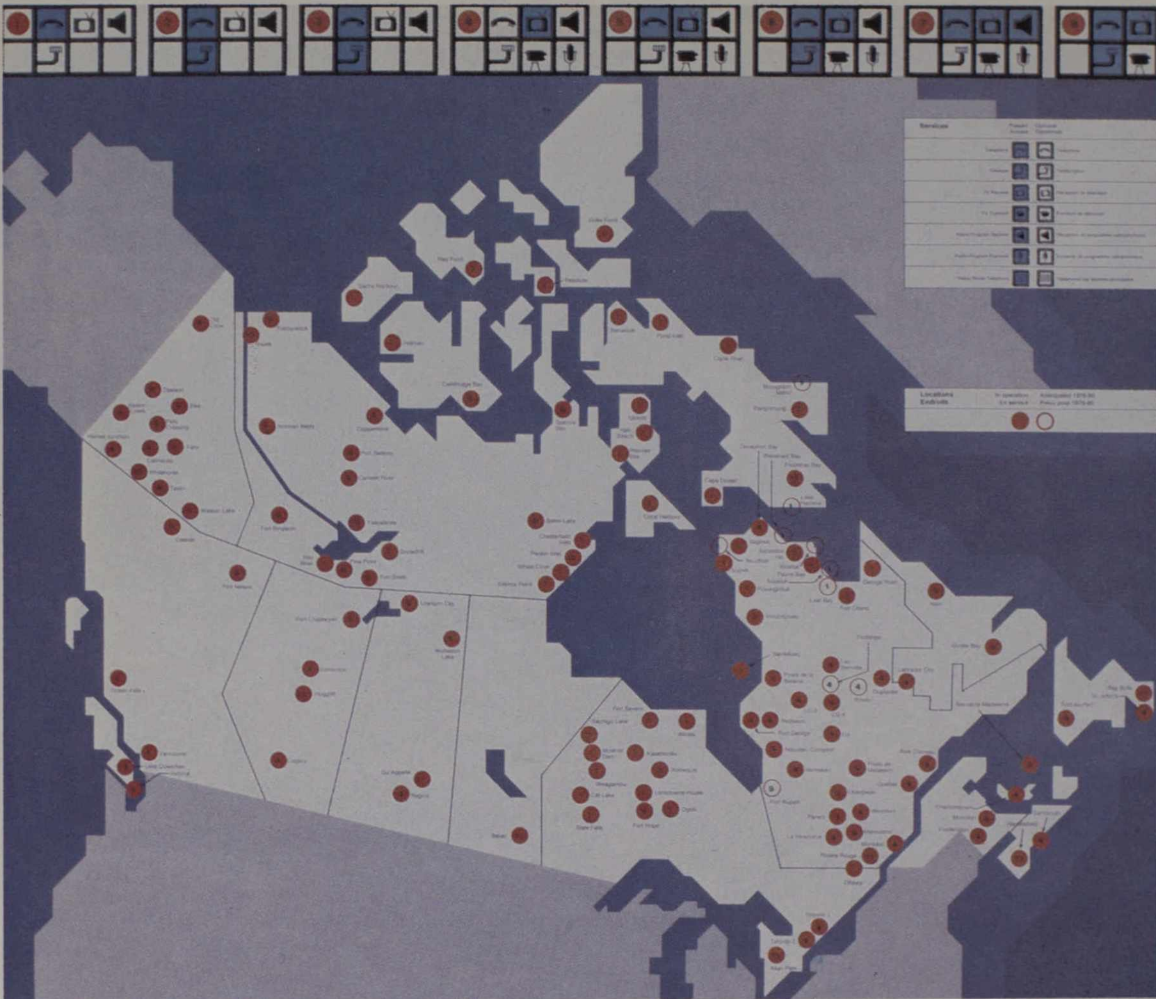
PHOTOS: COVER, NORTHERN TELECOM; PAGE TWO, TELESAT CANADA



Telecommunications

Canada is a huge land and its relatively few and scattered people feel a need to keep in touch. For more than a century, scientists have been finding sophisticated ways to do so and the country is now tied together by telephones, coaxial cables, complementary microwave networks and satellite earth stations.

In this issue of CANADA TODAY/D'AUJOURD'HUI we talk about that system and some new technologies, including **Telidon**, a dazzling method of visual communications based on digital coding. We also talk about the extraordinary effects these technologies will almost certainly have on familiar institutions.

Fibre optics are the light waves of the future. The cover picture shows a mélange of them all aglow. See story on page 6. On the right is one of the great dishes which catch messages relayed from satellites.

A Glossary

SWITCHING: Switching is essential to swift, cheap, mass telecommunications. It permits a telephone subscriber in Canada, for example, to place a call to any one of 300 million other subscribers around the world. In most cases the call is still routed manually (switched) through appropriate cities, but this method is being replaced by crossbar or electronic systems that do the job automatically and almost instantly. A call from Hamilton, Ontario, to Vancouver, British Columbia, for example, can be routed through Toronto or Montreal or Regina. The automatic equipment chooses the route most immediately available, making decisions in billionths of a second. The old systems were laid out mechanically; the new ones can be arranged and re-arranged by tapping out instructions on a teletypewriter. The ease and speed of modern switching make possible commercial data transfer operations across the continent.

DATA: Data means information. Businesses, industries, governments, schools and other enterprises exchange masses of information with extraordinary speed (as much as 50,000 bits of information a minute) through electronic systems. The heart of the system is a computer, or bank, where the information is stored, most often in digital codings. The codes use the familiar numbers but the data can be of many kinds: daily printouts of bank accounts; university registrations and schedules; the recorded heartbeats of a hospital patient; personnel records, payroll procedures, inventories, manufacturing orders.

TERMINALS: The end of the telecommunications line is the terminal. A telephone is a terminal and so are a TV set, a cathode ray tube, a teleprinter, a radio or any special receiving device.

CARRIERS: The data bank is linked to terminals by a carrier—a telephone, a cable, a microwave network.

TRANSMISSION SPEED: Most transmission speeds vary from less than the equivalent of 100 words a minute to 50,000 a minute or more. The super-high capacity digital pipe used in coaxial cable systems could transmit the entire Bible in a few seconds.

DIGITAL TRANSMISSION: In digital transmission a series of on-and-off pulses are relayed and regenerated at regular intervals along a network. Digital transmission is cheaper, more accurate and more efficient than analogue transmission, which changes the digital signal from the computer bank into a sound signal. The first Canada-wide commercial digital networks became available in 1972.

MICROWAVE SYSTEMS: Canada's microwave system stretches almost 4,000 miles, from coast to coast. Microwave towers, about thirty miles apart, are found atop buildings and mountains, and standing high in fields and forests. The system carries more than 1,200 telegraph data or telephone messages simultaneously on each channel. It also carries television and radio programs.

REPEATERS: At the base of the microwave towers are repeater stations. High frequency electromagnetic signals are received by the antenna at the top of the tower and carried to the base through a delicately machined hollow metal tube called a waveguide. At the bottom, the repeater amplifies and strengthens the signal and sends it back up the tube to be carried to the next tower.

SATELLITES: Canada's communications satellites act as a microwave system with the repeaters in the sky, transmitting messages between strategically located ground stations which are linked to the communication systems.

The switching system developed by Bell Northern Research for Northern Telecom.

PHOTO: NORTHERN TELECOM

Alexander Graham Bell makes a long-distance call.

A Concise History of Canadian Telecommunications

Canada has a long and progressive history of information exchange. In 1846 its first commercial telegraph was strung between Toronto and Niagara, and in 1874 Alexander Graham Bell, at home in Brantford, Ontario, on a visit from Boston, sketched his first diagram of a telephone. Since then things have been moving along:

1876: Bell made the first long-distance call, from Brantford to Paris, Ontario.

1878: The first telephone exchange in Canada was opened in Hamilton, Ontario. In time there would be 2,000 telephone companies in Canada (and there are still 300). The provinces of Manitoba, Alberta and Saskatchewan went into the business themselves in 1899, 1908 and 1909.

1886: Canadian Pacific set up a telegraph department which would grow in time to CP Telecommunications. Telegraph lines paralleled the tracks and there was a telegrapher at every station.

1901: Guglielmo Marconi received a radio signal from England at St. John's, Newfoundland.

1923: Canadian National Railways established the first coast-to-coast radio network.

1927: Telephone service between Canada and Europe, via New York, was inaugurated, followed by a ship-to-shore service.

1952: Public television service in Canada began.

1956: Canadian Pacific and Canadian National introduced a switched data service called Telex, making it possible for businessmen to send masses of information back and forth across the country quickly. The Trans-Canada Telephone System in-

PHOTO: NASA

troduced DATAROUTE, the first digital data network in the country. It was followed by DATAPAC, a packet-switching network.

1974: The two railroads jointly followed suit with INFODAT. In 1977, they inaugurated INFOSWITCH, a cross-country, data circuit-switching network.

1978: The Department of Communications announced the development of **Telidon**, an advanced interactive television service, permitting exchanges of information between home TV sets.

Satellites

Canada is a pioneer in communications satellites.

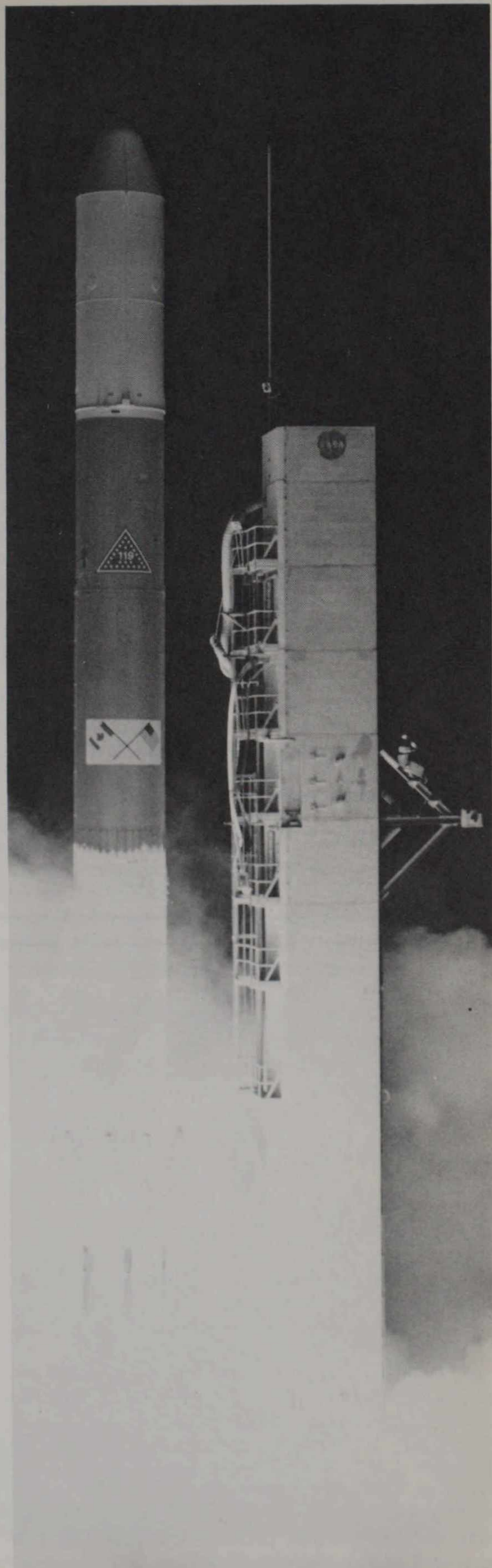
Telesat Canada, jointly owned by Canadian telecommunications carriers and the federal government, was incorporated by Parliament in 1969 to establish a commercial system of satellite communications serving all points in the country.

ANIK-A, the world's first domestic synchronous communications satellite system, with three units, was launched in 1972. (Anik means brother in the Inuit language.) **ANIK-B**, a single satellite, was launched in 1978 and **ANIK-C**, a series of three, will go up in the early 1980s.

Canada has no launching facilities, so all its satellites have been launched from American rockets at the Kennedy Space Center. They orbit 22,300 miles above the equator and, since their movements are synchronized with the rotation of the earth, they appear to be stationary.

They relay messages—telephonic, telegraphic and digital data—and radio and television programs between their ground stations that serve the vast, thinly populated areas of the North. Their principal ones, called heavy route stations, are at Allan Park, Ontario, and Lake Cowichan, British Columbia. They have dish antennas nearly 100 feet in diameter. There are also remote earth stations at Frobisher Bay and Resolute Bay. Some stations are mobile.

Satellites have become increasingly sophisticated. **HERMES**, which was the world's most powerful communications satellite, cost $60 million. It was designed by the Department of Communications Research Centre and launched in 1976 by NASA in the United States. The United States also provided its 200-watt travelling wave tube, and the two countries used it on alternate days. It was intended to have only a two-year life but it lasted until December 1979. **HERMES** was the first satellite which could transmit to very small earth stations, some only eighteen inches in diameter. It was used in dozens of experimental programs. In one, medical information, including x-rays and electrocardiograms, was transmitted between London, Ontario, and Moose Factory and Kasechewan in the North. Patients hundreds of miles from hospitals were given complete diagnostic tests.



Cable TV

Seventy-four per cent of Canada's 7.2 million television households can have cable television and more than half do.

There are over 450 cable companies of which Rogers Telecommunications Ltd.—Canadian Cablesystems Ltd. (675,038 subscribers) and Maclean-Hunter Cable TV (273,747), both of Toronto; Premier Cablevision, of Vancouver (446,122); and Cablevision Nationale of Montreal (234,643), are the largest.

The companies are required to provide community channels and some cover town meetings, high school football games and other local activities. Typically, they spend between five and ten per cent of their gross incomes on such coverage, and in 1978 the industry spent some $16.3 million.

In Quebec a new cable television network—La télévision française au Québec—was inaugurated last September. It broadcasts the best of the three French networks as well as fifty hours of original programs repeated twice each week to 550,000 cable subscribers in twenty-three Quebec regions.

The cable companies are currently not allowed to offer pay-TV services, but the Canadian Radio-television and Telecommunications Commission is considering ways in which a pay-TV system could be developed.

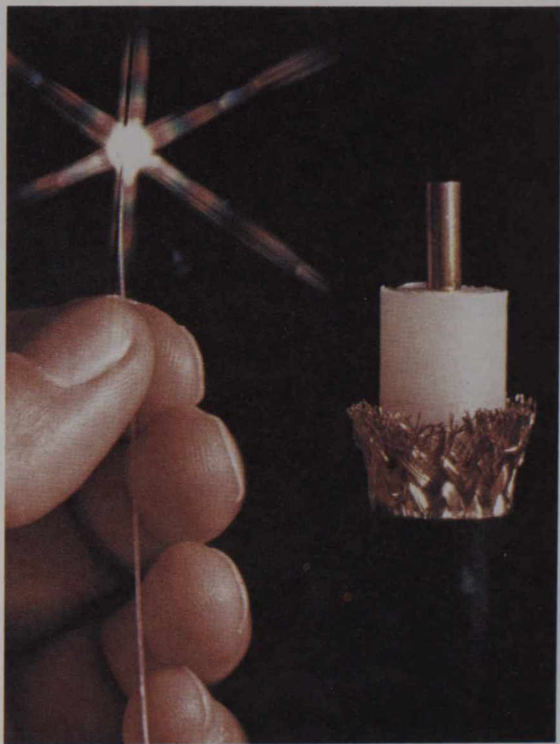
The Clyne Report

The Consultative Committee on the Implications of Telecommunications for Canadian Sovereignty, chaired by J.V. Clyne, Chancellor of the University of British Columbia, was convoked in 1978 and filed a report last year.

It recommended (among other things) that:

- The Canadian Broadcasting Corporation's services be recognized as the main national instruments for the preservation of Canadian social and cultural sovereignty.
- Private broadcasters be required to provide continuing expression of Canadian identity.
- The Canadian Radio-television and Telecommunications Commission regulate rates for TV cable companies and cable companies be allowed to provide non-broadcast services.
- Pay-television be introduced in Canada with the payments per-program, not per-channel.
- The CRTC be authorized to issue broadcasting licenses to independent corporations established by provincial governments.
- The CRTC introduce a point system for measuring Canadian broadcasting content in terms of quality, quantity and timing.
- A portion of the revenues from cable TV subscriptions be used to produce Canadian TV programs.
- When a Canadian broadcaster buys exclusive rights to a program originating in the United States, cable companies be required to respect those rights. (Two members of the committee dissented on this point.)
- The suggestion that Canadian cable companies delete all commercials from programs originating in the United States be rejected on the grounds that it would be unethical.
- Canadian satellites be used more fully in the distribution of Canadian TV to all parts of the country.
- The federal government promote plans for the manufacture and marketing of the **Telidon** information system.
- The federal and provincial governments and private industry stimulate the creation of Canadian-owned private databanks.
- A national awareness campaign explain the social, economic and cultural implications of the new electronic information society.

Fibre Optics



The fibre at the left can replace the cable at the right. (The fingers' red tinge indicates the intensity of the beam.)

Information can be carried on intense, tightly focused streams of light such as those produced by lasers (the acronym for "Light Amplification by Stimulated Emission of Radiation").

These can be transmitted through the atmosphere through hollow tubes called waveguides (such as those used in microwave towers) but only for short distances and in straight lines.

Fortunately they can also be transmitted consistently, practically and cheaply through hair-thin, solid, flexible fibres of a special uniform, highly transparent glass. This glass, developed in the early 1970s, has a high refraction index at its centre and a lower one at its rim, and the bulk of the light is channeled down the centre. The fibres can carry it around bends and corners without dispersal or absorption.

Here's how the system works:

Electromagnetic signals—telephonic, televisual or whatever—are converted to beams of light by low-power lasers. They then travel along the fibre and, at the end, are converted back by a photosensitive detector. If the transmission covers a long distance, the light is intercepted and reinforced along the way by repeaters. (Far fewer repeaters are needed than in cable or microwave systems.) A single fibre can transmit more than 20,000 crystal-clear telephone conversations simultaneously.

Canadian scientists have made two important contributions to the technology: a technique permitting two-way transmission over a single fibre, and an optical coupler which allows transmission from one fibre to others.

Some experts believe that fibre optics may replace coaxial cable systems as a primary means of transmission and, as production costs come down, it may also replace copper wiring and provide cost-effective alternatives to microwave networks.

A 53-km-long fibre optic cable connecting Calgary and Cheadle, Alberta, began operation this year. It can carry 274 million bits per second—which translates into more than 20,000 simultaneous phone calls—as well as video and data signals.

The world's first fibre optic cable TV super trunk system is in use in London, Ontario. The 7.8-km cable, less than half an inch thick, contains eight optical fibres and can transmit fifteen TV channels.

The Canadian Department of Communications and the Canadian Telecommunications Carriers Association are conducting a $6 million rural test of fibre optics technology in Elie, Manitoba, a town 50 km west of Winnipeg.

A variety of services—telephone, multi-channel TV, FM radio and others—are being delivered to 150 homes through the glass strands. Each subscriber will eventually have a TV data channel as well.

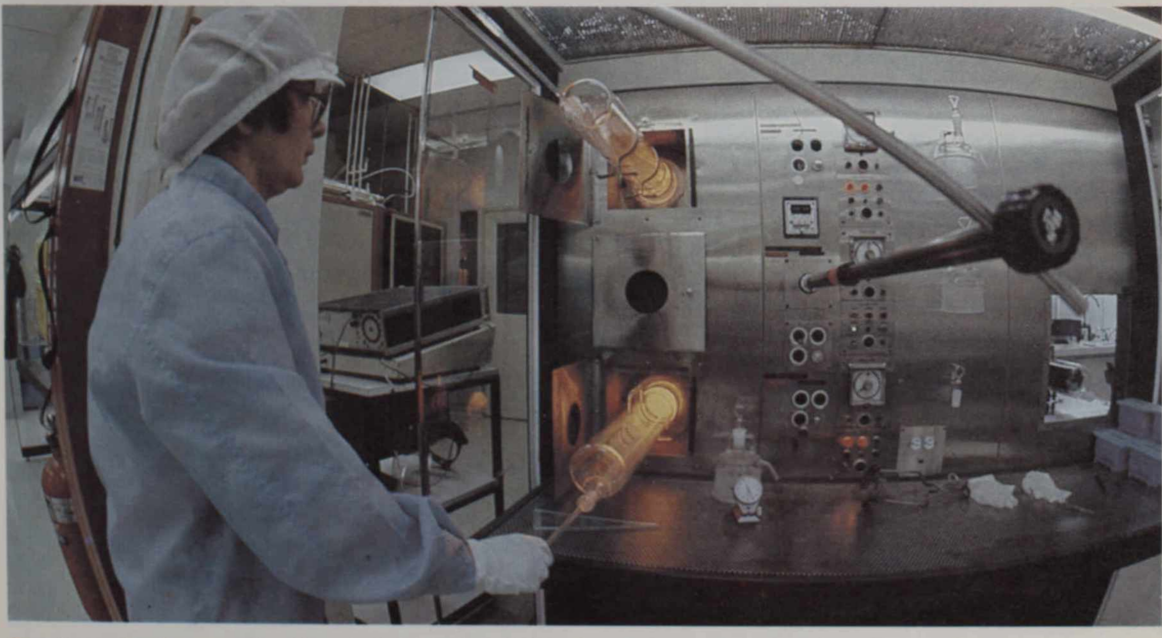
Electronic Telephones

Canada, at the moment, has the world's most sophisticated electronic phones. They are, however, still in limited supply.

They are cheaper to produce and to maintain than traditional ones, and the voices heard over them have the high fidelity of a TV-record player console.

Traditional phones are still modeled on Alexander Graham Bell's original design: As the phone is lifted a pressure switch activates the system. When someone talks into the mouthpiece, sound waves vibrate a diaphragm which operates a microphone. The waves are changed to electrical pulses by a transducer and carried over the wire to the other end where another transducer converts them back to sound.

The electronic phone designed by Bell Northern Research and manufactured by Northern Telecom has an integrated circuitry of "chips". It has fewer parts and uses less energy. The bell ring of the traditional phone is replaced by an alternating pattern of two electronic tones that can be adjusted for both pitch and volume. Memory banks may be attached for frequently called numbers, that may then be dialed by pushing one designated button among the sixteen. (The extra six will be used in a variety of ways—in time, perhaps, subscribers will be able to call home and turn on the oven by pushing a button.)



The silicon chips being produced here by Bell Northern for Northern Telecom are the basic ingredients in the new phone system.

Bell Canada is now conducting a pilot program. When consumer preferences are discernible, other services such as an attachable pocket calculator that can determine instantly the costs of long-distance calls may be included. It is assumed that the electronic phone will replace the traditional one in the next few years.

Telidon

We live in a time in which institutions are changing rapidly.

Right now the shapes and functions of universities, libraries, television stations and office buildings are being challenged by "interactive visual communication," a new technology that sends written texts and graphic images between TV screens and computers.

The Canadian system called **Telidon,** the most sophisticated in the world, is being tested in Ontario this year by the Department of Communications and TV Ontario. Fifty-five user terminals will be placed in schools, libraries and a few private homes throughout the province. In the 1980s teachers and students will be able to use their separate screens as a common blackboard on which one may write a sentence, draw a diagram or jot down a formula that others may change or rub out. Soon, possibly in a decade, subscribers will be able to take out entertainment—classic old movies, stage plays, concerts—from the data bank for display on their home sets.

Interactive Visual Communication

How It Works:
All cameras are light sensors. Most focus on a well-lighted scene or object (a landscape, a face, a rose, a page of a book) and expose light-sensitive film. The film records the varying intensities of reflected light, the shadows and highlights, reproducing the image. But film is not necessary—pictures can be taken, stored and transmitted from place to place by measuring the light intensities and assigning numbers to each variation. Satellites, for example, take precise pictures of the earth's surface by measuring the differences in the sunlight reflected. Snow reflects more light than a plowed field; green foliage reflects more than barren rock. Each difference is recorded by sensors and converted to numbers. These are transmitted to earth stations, where they are converted back to the reflected intensities, producing facsimile pictures.

What It Does:
An interactive visual communication system connects a bank of information to a home or office television set. A special device is plugged into an electrical outlet and connected to the set. It converts digital lists from the data bank and displays them as texts or pictures on the screen. A small keypad (or a similar device) wired to the set allows the subscriber to call for the particular information he wants.

Prestel and Antiope:
The first system, **Prestel**, was developed in Great Britain and the second, **Antiope,** in France. They were designed when memory storage was still very expensive. Each divides the display area into a grid of mosaics (forty squares by twenty-four for texts; eighty by seventy-two for graphics). Since the picture detail is limited by the number of squares, these systems do not permit fine reproduction of graphic variation—a straight line appears as a series of steps and a curve as a series of right angles.

Prestel first offered an information retrieval service to 1,500 subscribers in 1979. Its data bank has some 300,000 pages of information on such subjects as agriculture, child care, dental care, marriage guidance, motorcycle racing, insurance, housing vacancies and theatre listings. The system is run by the British Post Office (which also runs the phone system). Subscribers call the data bank by phone and select the information wanted by punching a keypad. They pay an average of about ten cents for each page displayed. The page appears on the screen as information and is received line-by-line.

Similar but lesser services are offered by the British Broadcasting System and the Independent Broadcasting Authority. They broadcast on fixed schedules and viewers must wait for particular information to come up.

The Telidon System

Canada's **Telidon** differs from **Prestel** and **Antiope** in the complexity of its digital codings, a difference that is important. The Canadian system has a basic advantage: the ability to put a great many more details into its display coding or, to use the jargon of the trade, into its Picture Description Instruc-

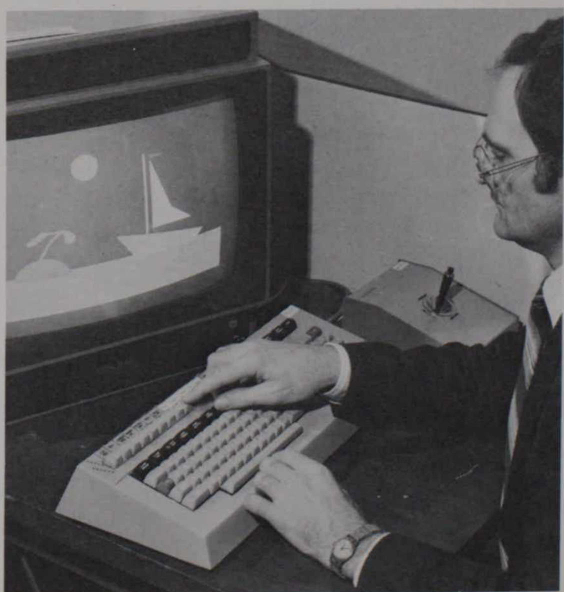


PHOTO: DEPARTMENT OF COMMUNICATIONS

tions. The PDI displays, designed by Herb Bown and Doug O'Brien of the Department of Communications Research Centre, do not use mosaic squares but are composed of points, arcs, lines and polygons, giving fine resolution to texts and basic graphics. The pictures appear all at once. When the composition is too complex to be replicated by combinations of geometric shapes, it is done by slow scanning tv techniques, which take longer but which produce precise reproductions of paintings and photographs.

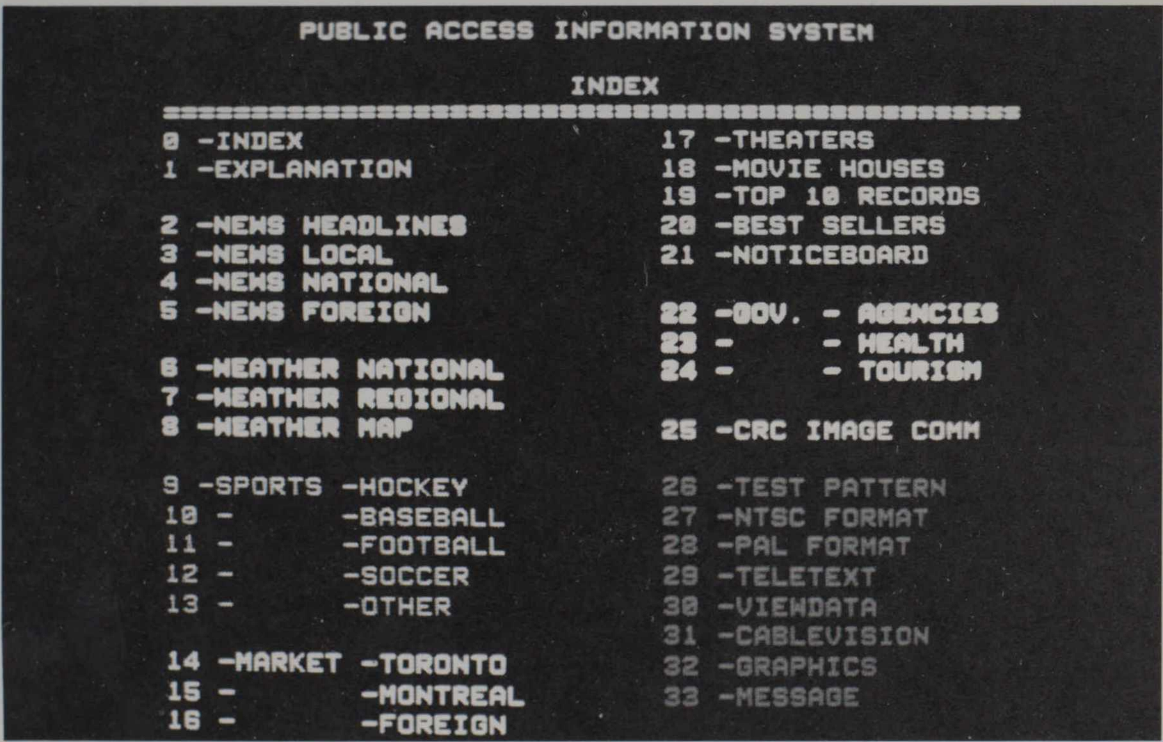
John Madden, former director general of special research projects at the Department of Communications, says **Telidon** has the edge over **Prestel** and **Antiope** in several ways:

*It can reproduce maps, charts, cartoons and engineering drawings clearly and accurately, with flowing lines.

*It can be sent over telephone lines, cables, air waves or fibre optics and bounced off satellites. Because its data base is independent of transmission and display, it will not be outmoded by technological change.

*A **Telidon** subscriber can use his terminal as a mini-computer.

Telidon's greatest potential is not in information retrieval, however, but in two-way communication. It can be used for instant exchanges between terminals—subscribers can have a private or public discussion, writing their thoughts or drawing their own supplementary images on the screen as they go along.



The Shape of Things To Come

As Herb Bown, director of data systems research and development at DOC, puts it: "**Telidon** is in its infancy and the emphasis now is solely on information retrieval. It is a message sender. It's going to move on into areas where things have traditionally been done in other ways. The whole concept of interactive visual communications is going to change our way of thinking with respect to electronic mail and message delivery and electronic information interchange. It is not just a question of technology. **Telidon** is going to have economic and social consequences which will decide the shape of things to come."

Libraries: In theory, all the information in the Library of Congress (or the British Museum or the French Bibliothèque Nationale) could be put into data banks and made available to TV watchers at home. It won't be. Bown says: "I think there will always be libraries. Of course, most people who use traditional libraries now will keep on using them but **Telidon** will bring much more information than they're accustomed to getting at home. I think they will find it valuable, particularly in letting them 'walk through' information easily. Primarily, though, the people who can benefit most from this new technology are those who currently don't go to libraries."

Universities: Telidon can put teachers and students in direct two-way contact even when they're far apart. The teacher will be able to visit the work space of each student and can direct him to research and background material that will be immediately available from the data bank. The physical components of universities could change considerably. Students may no longer need to congregate in classrooms, and the need for many other university facilities—dining rooms, dormitories and recreational buildings—may be greatly diminished.

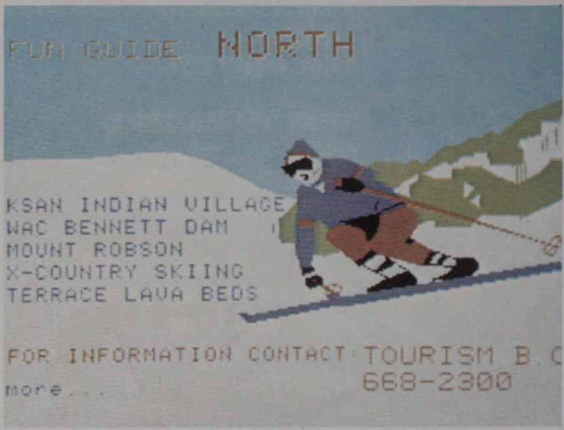
Entertainment: Director Bown believes that it will be possible to transmit live and stored entertainment through the **Telidon** system in the relatively near future. "We're initiating a program of research to expand image coding. Now we can code alphanumerics, geometrics and slow scan images. We want to move into the television area and do coding schemes for moving pictures. That's a good ten years off." When it happens, it may totally change the nature of local television broadcasting.

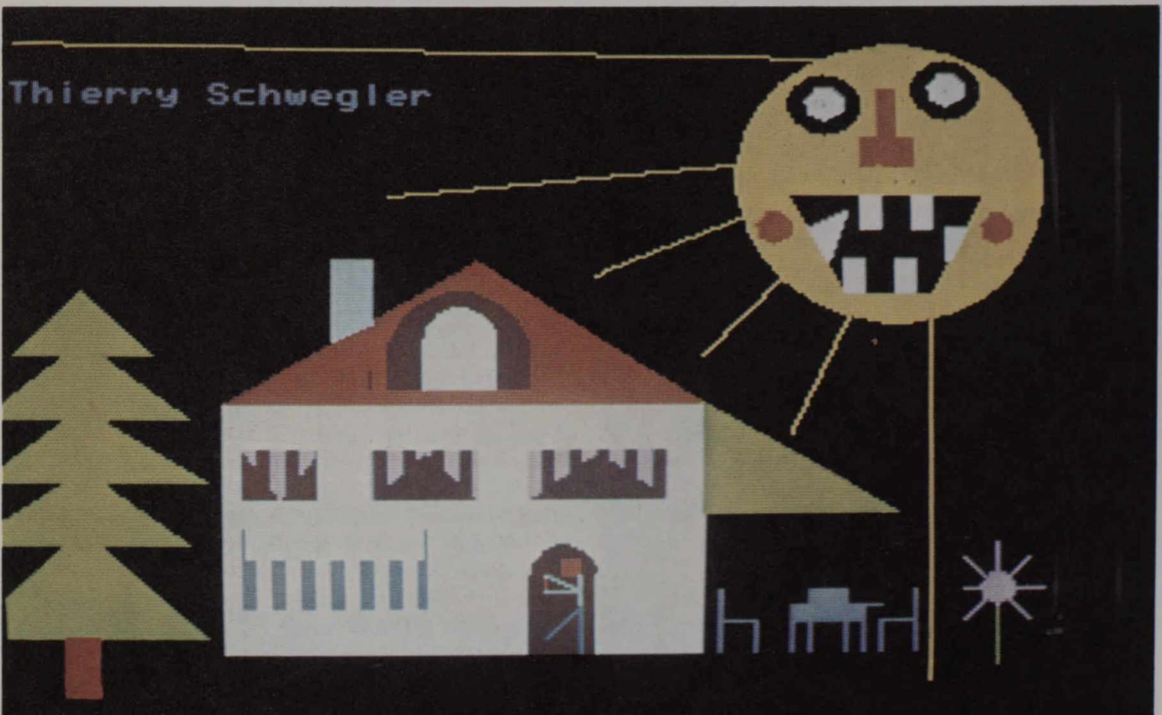
Business and Commerce: As Mr. Bown says: "We now do business by bringing people together. They all come to the same building each day or we fly them around to meet with each other. With **Telidon** we won't have to concentrate so many people in large cities, and the number of times they will have to meet face-to-face will be considerably fewer." Cities could become primarily cultural and recreational centres with shops, theatres, restaurants and museums and no need for massive office skyscrapers.

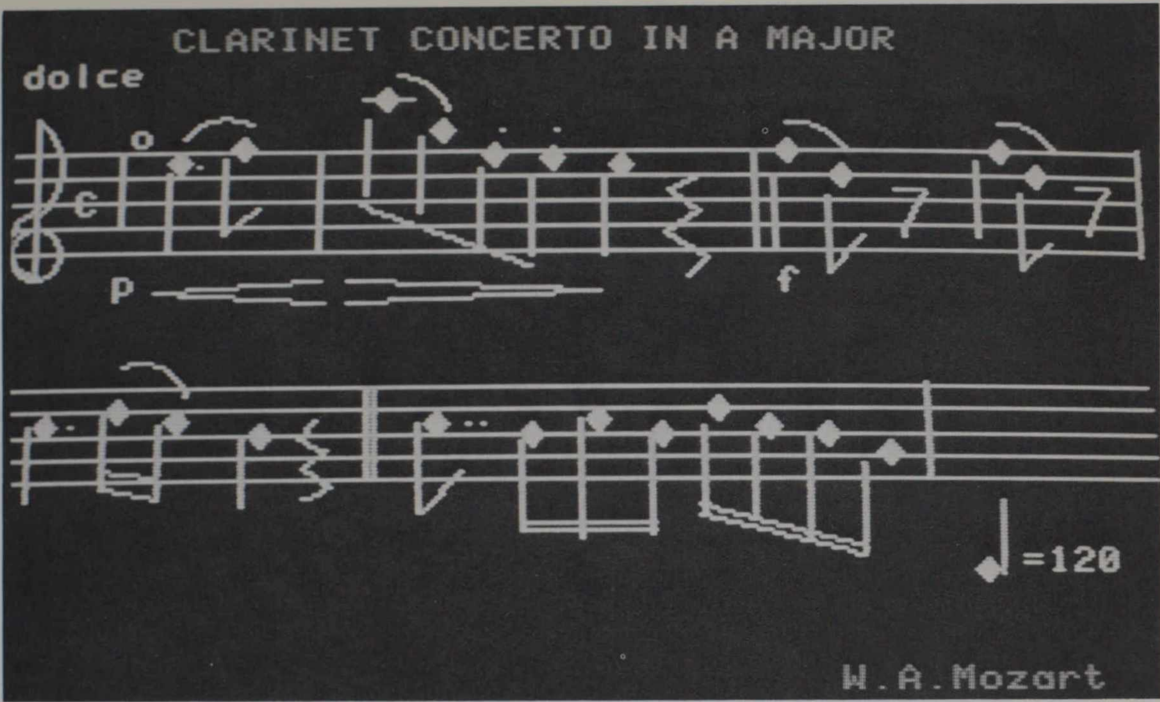
Everyone His Own Publisher: Individuals will be able to build up businesses publishing their own compilations of information. An investment of only $25,000 to $50,000 would be needed. The entrepreneur could establish his own system or rent data bank space from a major system. He could, for example, furnish his own subscribers with weekly reports on legislation, market fluctuations, business trends or anything else.

Testing, Testing

Telidon is one of the services being supplied in the first large-scale rural testing of fibre optic transmission at Elie, Manitoba. The Ontario Educational Telecommunications Authority is also testing the use of **Telidon** as an educational tool. Telecable-Videotron, a cable company, is planning extensive testing of an information retrieval system in Montreal. A number of major Canadian telephone companies are developing field trials for **Telidon** terminals, the largest of which is the 1000-terminal field trial of Bell Canada in Toronto.







Interview With Mr. Bown

Telidon was developed at the Communications Research Centre of the Department of Communications under the direction of Herb Bown. Right, in excerpts from an interview, Mr. Bown describes how it came about.

I've been at the Centre since 1966. From 1966 to 1969 I was working on the satellite program, Alouette II and ISIS A. In 1969 we started a new program in interactive visual communication. The word *Telidon* didn't exist at the time. I can't look back and fix a moment and say that was when we began to build **Telidon.** What we did was set out to define a set of codings for interactive visual communications having two very important characteristics that the Europeans who were already in the field had overlooked. We wanted a set of independent codes that could be delivered over the telephone, over coaxial cable, over satellite channels and by over-the-air broadcasts and that could be received and displayed whether the receiving terminal happened to use a television scan technology or a storage tube or whatever. We wanted a data base that would never have to be changed with changing technologies because data base development is where the most expense will occur. The system announced in August 1978 was only part of the broader system. The first part is information retrieval. The second permits two-way communications between **Telidon** terminals.

We wanted a system that would create a common visual space between individuals the way a telephone creates a common audio space. We wanted to create a common blackboard so that one person could draw a picture on the screen which would appear immediately on the other person's screen, and both people could make changes on it.

Those were the basics. The other things that are going to happen are simply improvements—refinements in the delivery network, having voices accompany the pictures, and things like that.

PHOTO: DEPARTMENT OF COMMUNICATIONS

Telidon *can transmit finely resolved images which are stored in the database as geometric shapes.*

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