DIRECT–TO–HOME SATELLITE BROADCASTING FOR CANADA

Government of Canada
Department of Communications

Gouvernement du Canada
Ministère des Communications

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JUNE 1983

The world's first 12 GHz DBS receiver in a home was installed in September 1979 at the residence of the King family in MacDiarmid, Ontario. Television signals were received from Anik B, during DOC's direct-to-home television delivery pilot project. The TVOntario regular program schedule was broadcast, making TVOntario the world's first broadcaster to deliver its programming direct-to-home via 12 GHz satellite.

Foreword

Direct broadcasting by satellite (DBS) is rapidly becoming an important new application of communications satellites throughout the world.

DBS technology was successfully pioneered in Canada in 1976 on the experimental satellite Hermes. Extended field trials followed using the Anik B satellite. This has encouraged the use of Anik C for DBS services on a commercial basis.

In April 1981, the need to determine the place for DBS in improving television service to approximately six and a half million Canadians in rural and remote areas of the country led the Department of Communications to undertake a two-year program of planning studies designed to guide deliberations on the possible implementation of a broadcasting satellite service in Canada.

Most of the studies were carried out by private consultants working under contract to the department. The study program was conducted in close consultation with all sectors of the communications industry (broadcasters, cable operators, carriers and manufacturers) as well as regulators and provincial governments.

Drawing on the various studies, this information paper describes the current broadcasting environment in Canada; identifies critical issues affecting the design of DBS systems and their prospects for viability; points out some of the social, economic and regulatory implications of DBS; and presents some models for the introduction of DBS in Canada.

A long lead time is required to plan, design and implement any satellite system, and once the system is in place, the basic features cannot be altered during the lifetime of the satellite. If DBS is to be introduced in Canada, good planning and careful design will be crucial in accommodating public, commercial, technical and creative concerns.

Through publication of this information paper, the government hopes to stimulate public comment that will assist it in formulating a policy for direct broadcasting by satellite in Canada.

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Introduction

Communications has a unique place in Canada because of the country's vast territory and its widely dispersed population. The Canadian broadcasting system, perhaps the most publicly visible part of the communications sector, has evolved to meet these challenges, as well as those of regionalism, two official languages and the competition of signals broadcast from American sources.

Satellite communications is an ideal technology for overcoming the tyranny of distance and population dispersion. It already plays a major role in Canada. Since 1973, broadcasters have made increasing use of satellites to extend the geographic coverage of television.

The ultimate application of satellites for broadcasting will occur when they are used for direct broadcasting to home receivers. Experiments in direct broadcasting were first carried out in Canada in 1976 with the Hermes satellite.

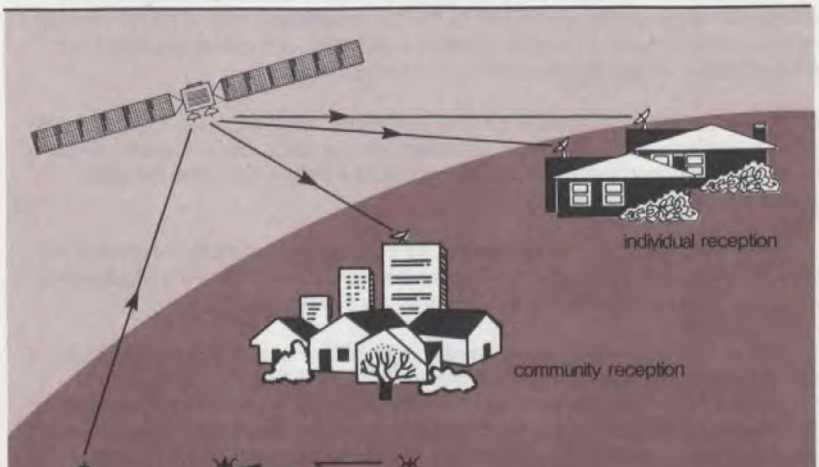
Broadcasters currently using satellite relay of their signals include the Canadian Broadcasting Corporation (CBC); the La SETTE (La Société d'édition et de transcodage t.e. Ltée) network in Quebec; the educational services TVOntario and the Knowledge Network of the West (KNOW); Canadian Satellite Communications Inc. (Cancom), a satellite network offering a package of programming for local distribution by affiliates in remote areas; and all but one of the new pay-TV services.

Despite the increased coverage made possible by this use of satellites to relay TV signals, more than 16 per cent of the Canadian population still has relatively limited access to broadcast services. Between four and five million people in rural and remote areas of Canada are too dispersed to be adequately served by conventional broadcast and cable television systems. They receive between two and three television channels on average (urban Canadians receive on average twelve or more); they must, therefore, be considered underserved by the standard of television service available to the majority of Canadians. Direct broadcasting by satellite (DBS) is an effective way of providing them with the equality of service envisaged in Canada's broadcasting policies.

DBS delivery of television differs from television carried by the Anik satellites in Canada at present because DBS is intended for direct reception. Direct broadcasting satellites are designed to work with receiving stations small enough and simple enough to be affordable by the public. The present Anik satellites transmit signals generally as private communications to earth stations at specified points. The signals are then locally distributed by cable or rebroadcast for reception by whoever tunes in. The earth stations required are larger and more expensive than those required to receive DBS signals. The more powerful of today's satellites, such as Anik C, begin to approach DBS service capability, and there have been proposals to use them to initiate DBS service.

Figure 1

Components of a Direct Broadcasting Satellite system



The key components of a DBS system are a transmitting earth station to send program signals up to the satellite, the satellite itself, and the earth stations in homes or communities that receive the signals broadcast from the satellite. These components, shown in figure 1, are described in detail in chapter 5, as are other technical features of DBS systems.

DBS could provide a diversity of television services in Canada including traditional advertiser-supported programming; pay-services; public interest programming; and specialized native, multicultural, educational, religious, children's and sports programming. Because DBS can address vast areas and numbers of people, new television service concepts could be developed. One new concept is narrowcasting, programming aimed at specialized audiences, for example, to deliver training courses or professional continuing education. If high definition television (HDTV) is introduced, DBS would figure prominently in its delivery.

Other possible services include audio for radio networks, teletext, and facsimile transmission. These services, like television broadcasts, could be delivered by direct-to-home transmission to rural and remote areas of Canada, and either directly or by cable or master antenna television (MATV) for apartment buildings to those living in more accessible areas. (The full range of these DBS service possibilities and their prospects for viability is explored in chapters 5 and 6.)

Made possible by the continuing advances in satellite communications technology, DBS has the potential to change fundamentally broadcasting in Canada. The content of a DBS programming package will depend upon the creative imagination and the entrepreneurial judgements of those seeking to contribute to such a package as well as the regulatory and policy attitudes adopted by government towards the meeting of public service objectives. Certainly the full potential of DBS will be seriously underestimated if it is viewed only as a method of bringing basic TV services to underserved Canadians and as a substitute for the terrestrial distribution systems already in place. As has always been the case, the fundamental nature of broadcasting lies in programming content and diversity. The birth of a new multichannel delivery system, able to deliver programming at a regional or national level, will mean a constant challenge to the creative energies of the Canadian broadcasting system.

It would provide TV broadcasters with an additional mechanism for distributing programs and would enable them to reach wider audiences without using terrestrial distribution systems. In areas served by cable, the cable operators would likely receive and distribute DBS signals, enabling consumers to choose between cable or direct home reception.

DBS studies program

A long lead time is required to plan, design and implement a DBS system, yet in a rapidly changing communications environment it is obviously difficult to foresee the direction and scale of change. Once a system is in place, it is not possible to vary the basic features of the space segment which remains in place for some seven to ten years. Good planning reflected in an appropriate system design is crucial if all interests are to be sensibly accommodated.

The DBS studies program was undertaken by the Department of Communications to address the many variables that need to be taken into account in planning for the possible establishment of a Canadian DBS system. This multi-disciplinary program covered system requirements as well as socio-economic, institutional, policy, regulatory and technical issues. The studies program began in April 1981, and the documents it yielded provide most of the information and comments in this report. It also provided the background for Canada to formulate its requirement for spectrum and orbit positions for direct broadcasting for the 1983 Regional Administrative Radio Conference (RARC 83) which will allocate spectrum for the broadcasting satellite service to the Americas.

The concerns and scope of the study program are illustrated by the following list of some of the questions the program was designed to examine:

- What are the system and technical requirements and options?
- Who will be the end-users of DBS services? How can regional and language requirements be accommodated? How many channels and what beam arrangements would best meet needs?
- Should DBS be supported by advertising, by subscription, by government, or by a combination of these? What are the market prospects for the improved television signals that could be delivered by DBS?
- What new, non-television services (such as radio or teletext) could feasibly be offered by a DBS system?
- Should Anik C, which has characteristics similar to those of Anik B, be used to provide a limited DBS service?
- What impact would DBS have on existing commercial broadcasters, particularly those serving areas with small populations and meeting local needs?
- What regulatory changes would be necessary to accommodate DBS?
- What industrial impact, in terms of both hardware and software, could be expected from the implementation of a DBS system?
- What are the economics of providing television throughout the entire country with a DBS system?
- What institutional arrangements would be most suitable for implementing a DBS service, and how can the satellite and broadcasting industries best be involved?
- What impact can be expected from unavoidable spillover from U.S. DBS signals?

Appendix 1 summarizes all but the most technical of the studies commissioned for the program.

This report provides answers to some of these questions using data gathered during the DBS studies program. It does not, however, attempt to answer other questions which depend on public opinion, commercial development, or new policy directions. Instead, it provides information, describes options, and discusses their implications. It also gives a certain amount of background. The department's intent in consolidating the information and ideas collected in the DBS studies program is to stimulate public discussion which will assist in making decisions regarding the use of direct broadcasting satellite technology in Canada.

2

DBS and Canada's broadcasting policies

Canada's broadcasting policies have been concerned first and foremost with ensuring that Canadians have control over their culture, as an important aspect of Canadian sovereignty. These concerns about cultural sovereignty go back at least as long ago as 1929, when the Royal Commission on Radio Broadcasting (the Aird Commission) recommended that all broadcasting in Canada should be carried out by a publicly owned corporation that would reflect Canadian ideals and culture. The concern for cultural sovereignty also is reflected in a number of recent reviews and studies of Canadian broadcasting and in the Broadcasting Act itself.

With the DBS era at hand, Canada and many other countries now are attempting to decide what policies should govern this new technology. Because broadcast signals may spill over from their country of origin into bordering countries, DBS is of particular concern with regard to cultural sovereignty. In Canada's case there is a strong probability of exposure to DBS television signals spilling over from the United States, which already is the source of so much of the television programming watched by Canadians. The challenge facing the government in this context is to develop policies that will allow DBS to flourish without compromising Canada's cultural sovereignty. The approach taken to DBS should also recognize the potential of this new technology to achieve other objectives of Canada's broadcasting policies.

The Broadcasting Act

Parliament's broadcasting policy for Canada is stated in section 3 of the Broadcasting Act of 1968.[1] The act has its historical roots in the Aird Commission's 1929 report, which put forward the now accepted idea that radio frequencies – the airwaves – are public property and should therefore be subject to government regulation. The Aird Commission did not anticipate DBS. Nor are satellites mentioned in the 1968 Broadcasting Act. But the Broadcasting Act remains the principal policy statement guiding the actions of the CBC, the CRTC, government, and the broadcasting industry in general. The essential elements of its policy are as follows:

- Broadcasting undertakings in Canada, both privately and publicly owned, shall be regulated as component parts of an integrated single system.
- The system shall be effectively owned and controlled by Canadians so as to safeguard and enrich the cultural, political, social and economic fabric of Canada.
- Individual broadcasting licensees are responsible for the programs they broadcast.
- The programming provided by the system is to be varied and comprehensive, and should provide reasonable, balanced opportunity for the expression of differing views on matters of public concern.
- The programming provided by each individual broadcaster should be of high standard, using predominantly Canadian creative and other resources.
- All Canadians are entitled to broadcasting service in both official languages as public funds become available.
- The CBC shall provide a national broadcasting service in English and French that is predominantly Canadian in content and character which should
  - provide a balanced service of information, entertainment and enlightenment for people of different ages, interests and tastes covering the whole range of programming in fair proportion
  - be extended to all parts of Canada as public funds become available
  - serve the special needs of geographic regions and actively contribute to the exchange of cultural and regional information and entertainment
  - contribute to the development of national unity and the expression of Canadian identity.
- The objectives of the CBC shall, in the event of conflict, take precedence over the interests of the private element of the system.
- Facilities should be provided within the system for educational broadcasting.
- The regulation and supervision of the system should be flexible and readily adaptable to scientific and technical advances.

[1] *Statutes of Canada*, 1967-68, c. 25, S.3. This section is reproduced in full in appendix 2.

There are two principal instruments for achieving these statutory objectives: the national broadcasting service provided by the CBC, and the licensing and regulatory process administered by the CRTC.

Recent reviews of broadcasting policy

Broadcasting policy has been examined and re-examined many times since 1929. Four recent studies that dealt with issues of particular relevance to this report are: (1) the 1978 Consultative Committee on the Implications of Telecommunications for Canadian Sovereignty (the Clyne Committee); (2) the 1980 Committee on Extension of Service to Northern and Remote Communities (the Therrien Committee); (3) the 1980 Federal Cultural Policy Review Committee (the Applebaum-Hébert Committee); and (4) the Broadcasting Strategy announced by the Minister of Communications in March 1983.

The Clyne Committee

The task of the 1978 Clyne Committee was to make recommendations on the future of the Canadian telecommunications system in relation to new technologies and the need to meet foreign competition. The committee was asked to pay particular attention to the role of broadcasting in preserving Canada's sovereignty.[2]

The Clyne Committee came to the conclusion that the Canadian broadcasting system was not achieving the broad policy objectives set forth in the Broadcasting Act.

It was the unanimous belief of the committee that the CBC is a critical factor in the development and maintenance of a Canadian identity and in the fostering of a regional and national Canadian culture – the principal defence of the social and cultural sovereignty of the country. The committee further expressed its belief that the Broadcasting Act's mandate for the private sector is inadequate. It went on to recommend that private broadcasters be required by law to provide for a continuing expression of Canadian identity and to contribute actively to the flow of cultural and regional information and entertainment.[3]

Commenting on the failure of TV broadcasters to achieve Canadian content objectives, the committee recognized that foreign programming dominates the schedules of Canadian TV stations, and that the signals of American TV stations are generally available to Canadians.[4] It noted that such excessive exposure to foreign television programming has an attenuating effect on the culture of a country.[5]

The Therrien Committee

The mandate of the Therrien Committee was to report to the CRTC on how the number and variety of television services in northern and remote communities in Canada might best be increased. The committee was asked to deal also with issues related to satellite distribution of programs in its report.[6]

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2 Consultative Committee on the Implications of Telecommunications for Canadian Sovereignty, *Telecommunications and Canada*, Ottawa, Minister of Supply and Services Canada, 1979, Preface.

3 Ibid., chapter 6, Broadcasting.

4 Ibid., p.37.

5 Ibid., p.30.

6 Committee on Extension of Service to Northern and Remote Communities, *The 1980's: A Decade of Diversity – Broadcasting, Satellites and Pay-TV*, Ottawa, Minister of Supply and Services, 1980.

The Therrien Committee concluded that although there have been many achievements in Canadian broadcasting, these achievements have not been complete. Specifically, tens of thousands of Canadians are underserved by broadcasting in comparison with those who live in the southern metropolitan areas. It was a unanimous conclusion of the committee that "immediate action must be taken to meet the needs of the many Canadians who believe that, as regards broadcasting, they are being treated as second-class citizens." This conclusion, reinforced by a recognition that a growing number of individuals and communities in Canada are seeking to satisfy their needs by the unauthorized reception of American satellite TV signals, led the committee to stress that "alternative television programming must be provided from Canadian satellites with no further delay."[7]

The Therrien Committee drew attention

> To the implications of one particular characteristic of satellite carriage of broadcast signals. It is that any satellite signals can be received, broadly speaking, in every part of the country. Any independent station carried by satellite could become, in effect, a new competitor for every broadcaster. And it is on the broadcasting stations (whether or not they are affiliated to one of the national networks) that the system relies, and must continue to rely, for local and regional news, information, and other programming.... The Committee is therefore convinced that any proposal for new satellite services must take into account an assurance that the provision of local and regional programming be maintained and expanded.[8]

On the subject of rapidly changing program delivery technologies, the Therrien Committee pointed out that their impact on the Canadian broadcasting system "did not happen overnight, but there has been a tendency in the past to wait and see what would happen next. Cable television.... might have been better integrated with the broadcasting system had effective planning been undertaken in the first place."[9] It is implied that the committee believed that the same pattern was emerging with the use of satellites for broadcasting. In this regard, the Therrien Committee recommended that all interested parties be consulted prior to developing a firm Canadian position for the 1983 Regional Administrative Radio Conference which is concerned with orbital positions and frequency allocations for DBS.[10]

The Applebaum-Hébert Committee

Set up in 1980 to undertake a comprehensive review of Canadian cultural institutions and cultural policy, the Applebaum-Hébert Committee examined all facets of Canadian cultural endeavor, including broadcasting. The committee noted that the struggle to maintain a vigorous Canadian presence within a broadcasting system that is so plentifully supplied with popular foreign programming is being complicated by rapid technological change. It cited direct broadcasting satellites, home video and new cable services as elements of an emerging new broadcasting environment. The committee pointed out that these changes could usher in a new era of development for Canadian creative talent and for the participation and enjoyment of Canadian audiences. It stated that possibly the most important effect of the new environment will be to give viewers a greatly increased choice of programs and, in some

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7 Ibid., p.1
8 Ibid., p.2
9 Idem.
10 Committee on Extension of Service to Northern and Remote Communities, *The 1980s: A Decade of Diversity – Broadcasting, Satellites and Pay-TV*, Ottawa, Minister of Supply and Services, 1980, p.10.

respects, to transfer control over programming from broadcasters to viewers and listeners.[11]

Concerning satellites and broadcasting, the Applebaum-Hébert Committee said that while this country has been a pioneer in the field,

> Canada now seems to be almost reluctant to build upon and exploit this early lead. We are now preoccupied with controlling entry of foreign satellite signals and programs into Canada, instead of recognizing that this new technology provides unprecedented opportunities for us to increase the distribution of new Canadian programs and services, not only domestically but internationally.[12]

The committee went on to observe that

> when Canada launches Anik C...this country will move to the forefront of new satellite technology, making it possible to offer, among other new services, the economical transmission of broadcasts directly to individual homes.... it is important not to retard such new developments as satellite systems, nor single out any one system as being the "preferred" system of program and service delivery.[13]

Consequently, the Federal Cultural Policy Review Committee recommended that the Canadian government formulate clear and coherent policy for the orderly development of satellite capabilities and put such technologies and the funds they can generate to the service of new Canadian production.[14]

A Broadcasting Strategy for Canada

The government's Broadcasting Strategy for Canada was made public on March 1, 1983. The policies and proposals which constitute this strategy have three fundamental goals: (1) "To maintain the Canadian broadcasting system as an effective vehicle of social and cultural policy in light of a renewed commitment to the spirit of the broadcasting objectives set out in the 1968 Broadcasting Act"; (2) "To make available to all Canadians a solid core of attractive Canadian programming in all program categories, through the development of strong Canadian broadcast and program production industries"; and (3) "To provide a significantly increased choice of programming of all kinds in both official languages in all parts of Canada."[15]

In order to achieve these strategic goals, the Government of Canada adopted four policy initiatives to enable Canadian consumers, broadcasters and other entrepreneurs to take advantage of new technologies. The first initiative is aimed at expanding programming choice through an increased use of cable: "Cable, drawing on satellites and over-the-air broadcasting, represents the most cost-effective means of

[11] *Report of the Federal Cultural Policy Review Committee*, Ottawa, Department of Communications, Government of Canada, 1982, chapter 10, Broadcasting.

[12] Ibid., p.305

[13] Ibid., p.305-6.

[14] Ibid., p.306, Recommendation 81.

[15] Department of Communications, Government of Canada, *Towards a New National Broadcasting Policy*, Ottawa, 1983, p.5.

significantly expanding the viewing choice of most Canadians..." A range of new Canadian programming and non-programming services and foreign television services would be made available over cable on a "tiered" basis.[16]

Secondly, the Government of Canada will establish a special Canadian Broadcast Program Development Fund which will be administered by the Canadian Film Development Corporation to assist private production companies and independent producers in producing attractive, high-quality Canadian programming of international calibre.[17]

Thirdly, so that the Government of Canada will have the ability to adjust broadcasting policy quickly to meet new challenges and opportunities, the government will seek parliamentary approval to give the Governor in Council the power to issue legally binding directives on matters of policy to the CRTC, subject to appropriate safeguards and procedures.[18]

Finally, the Government of Canada intends to abolish satellite dish licensing requirements for individuals and certain commercial establishments to encourage the further development of satellite services to underserved communities.[19]

Eight additional policy proposals were advanced. The federal government will seek public comment on these proposals before they become firm policies which are integral parts of the Broadcasting Strategy. A description of these policy proposals is contained in the Department of Communications publication, *Towards a New National Broadcasting Policy*.

DBS and broadcasting objectives in Canada

DBS can assist measurably in the pursuit of national broadcasting objectives. A Canadian owned and operated DBS would expand programming choice in all parts of Canada. It would make available through individual home receivers additional channels of programming to households beyond the reach of cable or terrestrial broadcasting transmitters, thus helping to equalize the level of services in both official languages throughout the country.

National broadcasting objectives would also be advanced because of the new markets made available to broadcasters. While a large part of the Canadian market is available through cable, the extra market accessible through satellite technology will provide additional revenues which can be applied to strengthen Canadian programming. The ability of DBS to aggregate audiences on a region-wide basis could also give rise to the development of new specialized programming services. Generally, the availability of a new transmission mechanism offering an expanded market should help to stimulate industry initiatives.

In meeting national broadcasting objectives DBS is seen to be complementary to cable. Where it is available, cable represents the most cost-effective means of delivering television to Canadians today. Increasingly, however, programming is being delivered to cable by satellites. A DBS system, therefore, can perform the dual role of broadcasting direct-to-home and delivery of programming for cable distribution. Certainly, cable systems are expected to opt to carry any programming available on a Canadian DBS as a means of expanding their programming choice.

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16 Ibid., p.6
17 Ibid., p.7
18 Ibid., pp.10-11
19 Ibid., p.11

The Broadcasting Strategy renews Canada's commitment to the preservation of cultural sovereignty, to which the potential influence of U.S. DBS services will represent a new challenge. Signals from U.S. DBS systems will spill over into Canada where the majority of the population will be well within receiving range. A Canadian DBS service would provide an alternative to the U.S. DBS and would serve the objectives of preserving national identity and culture.

DBS and broadcasting objectives in other countries

Broadcasting is subject to government policy in most countries, no matter whether service is provided mainly by private broadcasters, by government agencies or in a mixed system.

Plans for private-sector involvement in the development of DBS in the United States are well advanced, and nine applications have been retained by the Federal Communications Commission (FCC) for further consideration. It is not expected that all of the applicants will proceed to operational systems, but the indications are that there will be a number of DBS systems operating in the United States around 1986. At least one American DBS operator may be using Anik C on an interim basis as early as August 1983.

The regulatory philosophy towards broadcasting which has evolved in the United States in recent years has been based on the idea that the public interest is best served when there is a wide range of program sources from which to choose. This notion of competing services and systems continues to influence regulatory approaches towards DBS in the United States.

Not all countries have such a faith in, or an economic capacity for, competing private systems as the sole instrument to achieve national broadcasting goals. Both France and the Federal Republic of Germany are planning the introduction of DBS systems around 1985 consequent to an agreement on technical and industrial co-operation. In both countries the television systems are operated as public services by government agencies without private commercial participation. These countries share the view that the best way to protect their national sovereignty and cultural interests is to enter the DBS era. The French, for example, have been motivated by their desire to (1) improve coverage of the country by the existing television services and make service more reliable; (2) enhance the technological and industrial presence of France in the world market; and (3) provide the technological means to give France an audio-visual presence in Western Europe through unavoidable spillover.

One of the most ambitious DBS proposals, as well as one of the earliest, was the Nordsat project to utilize satellite technology to promote cultural exchange among the countries of Denmark, Finland, Iceland, Norway and Sweden. The 1979 report on Nordsat traversed a whole range of programming, engineering, economic and legal issues. While it did not lead to a positive commitment to proceed with the project (in fact Sweden is now planning the introduction of its own multi-purpose satellite with some limited DBS potential), the report is something of a landmark in the literature; it addresses most of the problems associated with the introduction of DBS. The interesting fact about the Nordsat proposal is that it was driven not by commercial concerns but primarily by cultural considerations, especially from the standpoint of rationalizing the inevitable spillover of programs within Scandinavian national boundaries. The report is evidence of the link many governments perceive between culture and broadcasting.[20]

[20] *Nordic Radio and Television via Satellite, Main Report, 1979.*

The United Kingdom has a broadcasting system which broadly parallels the Canadian system. The system is a mix of services supported by private enterprise and services supported by government. The difference is that the private television sector in the United Kingdom does not own transmitters but rather contracts air-time from the Independent Broadcasting Authority (IBA). The services of the British Broadcasting Corporation (BBC) do not carry commercial advertising.

The decision of the British Government to introduce DBS was announced in March 1982. The system, planned to become operational in 1986, will have a capacity of two satellite services intended for either direct home reception or community reception. Both the new DBS services will be provided by the BBC. One will be an amalgamation of existing BBC-1 and BBC-2 services, and the second will be a new service operated on a subscription basis.

Concurrently with its DBS decision, the British Government also announced a policy of encouraging the development of wideband cable services which would be available to carry the new DBS signal.

Several concerns lie behind the decision to introduce DBS in the United Kingdom.

- A small number of households are unable to receive BBC television and the means of reaching them other than by satellite are prohibitively expensive.
- The potential urban penetration of the new services is recognized, and it is considered wasteful of the resource to provide exactly the same programming as that available terrestrially.
- The new DBS services will increase the range of viewer choice both quantitatively and qualitatively as the challenges of new broadcasting opportunities are taken up by program producers.

This brief overview of DBS planning in other countries establishes the fact that many countries around the globe are looking upon DBS as a way of enhancing their long-term broadcasting goals. Other examples could be added, such as Japan, which will inaugurate operational service in 1984 or Australia, which will introduce both point-to-point and broadcast satellite services in 1985.

Canada's perception of the nexus between control over its broadcasting system and protection of its culture is shared widely among other countries. The extension of service to the underserved, the widening of choice in the broadcasting services available and the meeting of cultural and economic objectives are the concerns held in common by most countries now moving towards the introduction of DBS services.

3

Canadian experience with communications satellites

Canada's experience in space dates back more than 20 years to the launch of the scientific satellite Alouette 1 in 1962. Canada was the third country in the world to enter space, following the Soviet Union and the United States, whose Sputnik and Explorer satellites had been launched in the late 1950s. In the decade that followed, Canada sent three more highly successful satellites into space to study the ionosphere.

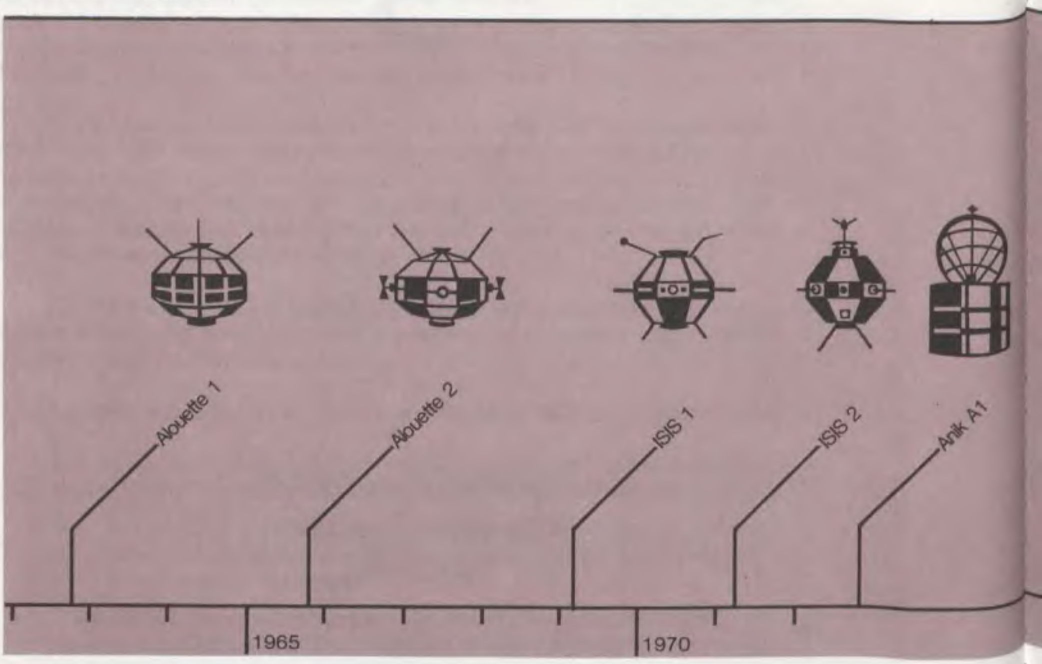
In 1968, Canada changed the emphasis of its space policy from scientific satellites to applications. Geostationary[1] telecommunications satellites were recognized as particularly applicable for extending reliable communication services into the many areas of Canada previously poorly served.

A few years later, the launch of Anik A1 in 1972 made Canada the first country with a domestic commercial geostationary communications satellite system. Six more Anik satellites have been launched since then.

The Anik satellites are owned and operated by Telesat Canada, a corporation created by Act of Parliament in 1969 to provide commercial satellite communications in Canada. Telesat is jointly owned by the Canadian government and Canadian telecommunications carriers. Among the services Telesat provides are transmission of network television, telephone conversations and business communications. Telesat is subject to regulation by the CRTC.

1 The position of a geostationary satellite remains constant in relation to the earth.

Canadian satellites



There are four different series of Anik satellites – A, B, C and D. All share the geostationary orbit but have different operating capabilities. They are designed for a life expectancy in the range of seven to ten years.

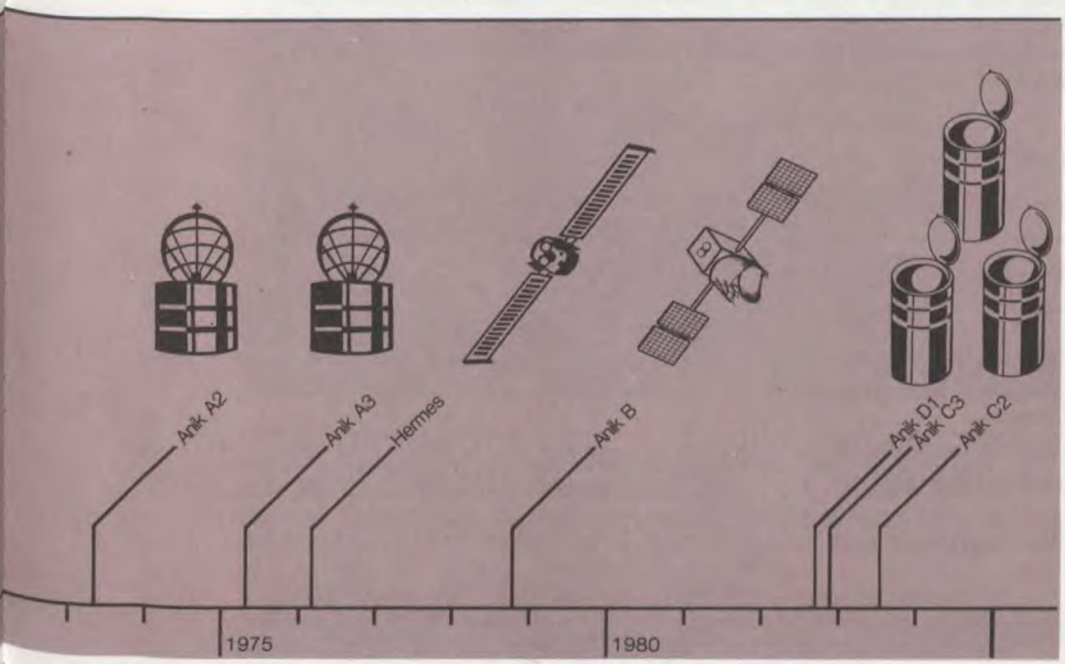
The first two Anik A satellites have been retired from service, while the third remains available as a back-up to other satellites in the system. Each of the Anik A satellites provided all-Canada coverage, operating at microwave frequencies of approximately 6 GHz and 4 GHz.

Among their many uses, the Anik A satellites served for distribution of CBC network television, the televised House of Commons debates and the Cancom signals. These services are now provided by Anik B and Anik D1.

The Anik A, B and D satellites all operate in the 6 and 4 GHz bands.[2] The 6 GHz band is used to transmit signals from earth to the satellite (uplink), while the 4 GHz band is used for space-to-earth transmissions (downlink). Since these bands also serve microwave users on earth, the power of satellite transmissions must be kept within limits specified by international agreement to avoid interference and the earth stations may have to be located away from urban areas where terrestrial microwave usage is most intense. Comparatively large (3 m or larger) parabolic antennas (dish antennas) are required to receive low-power signals transmitted by 6/4 GHz satellites.

2 Anik B, however, is a hybrid satellite and also operates in the 14 and 12 GHz bands.

Figure 2



Telesat's next satellite, Anik B, was preceded by the experimental 14/12 GHz satellite Hermes, which was designed to try out new communications technology. Launched in 1976, Hermes was a co-operative effort of the governments of Canada and the United States. Canada designed and operated the satellite, while the United States provided launch facilities and some technically advanced components; the two countries shared time on the satellite equally for two years. (Since Hermes was not a commercial satellite, Telesat had no formal role in the project.)

Hermes demonstrated the technical feasibility of using higher frequencies of 14/12 GHz and carrying out direct broadcasting by satellite. The advantage of using these higher frequency bands is that by international agreement they are allocated primarily for satellite communications, and consequently interference with terrestrial services is minimal. Higher-power signals can therefore be transmitted from the satellite, and smaller, cheaper dish antennas can be used for reception even in urban areas.

Through a combination of a higher power amplifier and a sharper, higher-gain antenna beam, Hermes transmitted at about two hundred times the power of the Anik A series. Thus it was suitable for direct broadcasting to antennas smaller than 1 m and this was demonstrated in 1976. Later experiments demonstrated that good reception could be achieved with the satellite transmitting at a much lower power than had been generally considered necessary. During these experiments, Hermes' transmitting power was reduced to as much as one tenth of its maximum (about one tenth of the level used for international planning purposes), and dish antennas ranging in size from 0.6 m to 1.6 m were used for reception.

Many social experiments were conducted on Hermes including projects in telemedicine, tele-education and direct broadcasting. During DBS trials, which took place from January to June 1979, several hours of TVOntario programming were transmitted daily to a few isolated schools in Northwestern Ontario, and several hours a day of CBC entertainment programming were transmitted to three communities in Labrador.

The experience Hermes provided in direct broadcasting was the basis of planning for extended field trials with Anik B.

Table 1

Parameters of Hermes, Anik B and Anik C

	Hermes	Anik B		Anik C
Frequency band (GHz)	14/12	6/4	14/12	14/12
Number of radiofrequency channels	2	12	4	16
Channel bandwidth (MHz)	85 MHz	36 MHz	72 MHz	54 MHz
EIRP at beam edge	47 and 57 dBW	36 dBW	47 dBW	47dBW
Downlink beam	2-21/2° steerable spot-beams	All-Canada	4-2° spot-beams	4-1°x2° spot-beams
Design life	2 years	7 years		10 years

Launched in 1978, Anik B is a dual-band satellite operating at both 6/4 GHz and 14/12 GHz. It provides all-Canada coverage in the 6/4 GHz band and has four spot-beams for regional coverage at 14/12 GHz. The 14/12 GHz capacity was added to the satellite at the request of the Department of Communciations to allow further exploration of the most promising applications developed in the Hermes experimental program. The entire 14/12 GHz service on Anik B was leased by the Department of Communications.

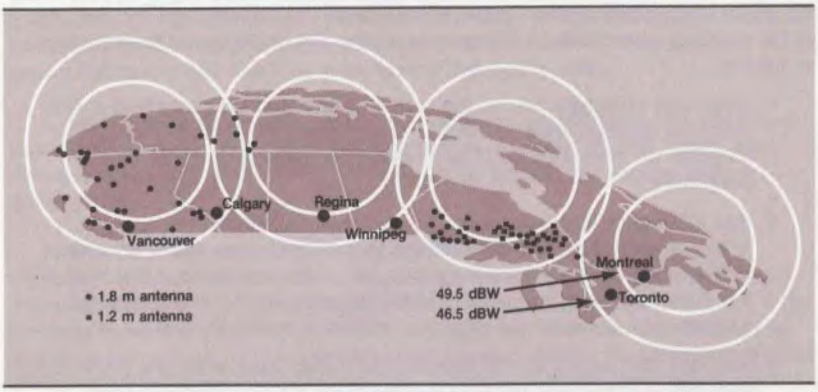
Anik B is often described as a medium-power satellite. Its 12 GHz signal level is only about one-tenth as powerful as that of Hermes, but the experiments on Hermes confirmed the possibility of using such a satellite for extended field trials of television broadcasting direct to small home and community receivers. These trials were conducted in two of Anik B's four beams, as shown in the illustration.

Direct broadcasting to small antennas with a medium power satellite involved a number of compromises. First, picture quality must be set at the minimum acceptable to viewers. A video signal-to-noise ratio of 42 dB was chosen as the minimum quality. Second, signal margin must be minimized. (This is the extra signal allowed for losses due to heavy rain, antenna mispointing or other causes.) With the small antennas used with Anik B, a good quality picture could be expected in clear weather.

Rain could be expected to be the most usual cause of picture degradation. Moderately heavy rain affected the Anik B signal sufficiently to cause "sparklies" to appear on the television picture. For rainfall statistics typical of most of eastern

Figure 3

Location of Anik B field trials



Canada, this occurred for approximately 8 hours per year. Very heavy thunderstorm rain, capable of causing complete signal loss, occurs for about 48 minutes each year. These periods would be comparatively shorter in parts of Canada experiencing less rainfall. Falling snow or fog does not have any appreciable effect.

In September 1979, TVOntario commenced broadcasting 94 hours of programming weekly in the beam covering Northwestern Ontario, using the full power available from one satellite channel. Antennas of 1.2 m in diameter were generally used to receive the signal. In December 1979, the CBC and British Columbia Television Ltd. (BCTV) began broadcasting for 22 hours daily in the western beam, sharing the power of one satellite channel. The reduced power in each signal meant that 1.8 m antennas were required. More than 80 receivers with 1.2 m or 1.8 m antennas were distributed to trial participants in the two beams, as shown in figure 3. Later the Knowledge Network of the West added a third television channel to the western beam, providing an instructional and educational service. Access, Alberta's educational and communications corporation, shared in the use of the third channel.

Receivers were set up in a wide variety of locations, including private homes, mining and logging camps, and small communities with local cable distribution systems or low-power transmitters. Methods of antenna installation also varied widely. Some antennas were firmly attached to buildings, while others were simply placed on the ground and stabilized with materials on hand. This variety in the location of receivers and the quality of antenna installation is typical of what could be expected in an operational system.

Programs to evaluate performances were carried out by both the Department of Communications and the participating broadcasters. The evaluations involved technical and subjective dimensions and were designed to provide information on the public acceptability of the service, as well as on the performance and reliability of the terminals when used by the general public. The findings may be summarized as follows:

- Given their prototype nature, the receivers operated satisfactorily in a wide variety of environmental conditions. Comprehensive technical testing after one year on more than 25 units revealed no appreciable deterioration in performance.
- Size of antenna was not a serious factor in any installation. However, the 1.8 m antenna did require special transportation to some areas, and the installation had to be reinforced against wind. With less than half the area of the 1.8 m dish, a 1.2 m antenna could be more simply mounted on the average roof, generally not requiring reinforcing against the wind.
- Although the margins for the reception of signals were small, the tendency was always to expand the reception area beyond that planned by the designers, rather than to contract it. In these fringe areas the margins were even less, but trial participants accepted this situation for the sake of having the service.
- No user complained about or even noted specifically the degradation or failure of reception during rainfall. It is expected that DBS users would readily accept occasional signal deterioration.
- The satellite signals were at least as good and usually better than any other broadcast signals available at the selected locations.

In September 1982, the government's lease of Anik B's 14/12 GHz television capacity came to an end, and the DBS field trials were concluded. Both TVOntario and the Knowledge Network of the West continued to use Anik B on a commercial basis for distribution of their services until early 1983 when they switched to Anik C.

Today Anik B provides message service and national transmission of CBC network television using its 6/4 GHz channels.

The two most recent series of Telesat's satellites are Anik C and Anik D. The two satellites in the Anik D series are designed to operate in the 6/4 GHz band. Their mission is to continue and expand the national services originally provided by the Anik A series. The first of the Anik D satellites was launched in August 1982, and the second is scheduled to go up in 1984. In addition to message services, Anik D1 is carrying the CBC's Parliamentary Network in English and French, and several Cancom channels.

Three satellites have been constructed for the 14/12 GHz Anik C series. The third one built, Anik C3, was the first to be placed in orbit. It was launched from the U.S. space shuttle Columbia during its first commercial flight in November 1982, the second satellite to be launched in this way and the first Canadian one. (Previous Canadian satellites were launched by rocket.) Anik C2 was launched in June 1983 and a final Anik C is to be launched in spring 1984.

Pay-TV services are using Anik C3 to distribute programming to cable operations across Canada. Anik C3 also carries signals of La SETTE, TVOntario, the Knowledge Network of the West, and the Atlantic Satellite Network as well as message services.

Anik C3 is the world's first commercial satellite with direct broadcasting capability. While it is not a direct broadcasting satellite as such, it is capable of providing acceptable direct home reception similar to that experienced with Anik B if the receiving antenna is about 1.2 m in diameter and if only one television program per channel is transmitted. Under international agreement, satellite broadcasting services are permitted in the band used by the Anik C series, providing transmission power limitations are respected.

The existence of the Anik C series of satellites permits the introduction in Canada of an interim direct-to-home broadcasting satellite service until satellites specifically designed for this purpose are available. However, a technical capability is not sufficient by itself. Also necessary is an attractive array of TV channels. Any DBS service introduced on Anik C can be expected to result in the development of a television programming package which can be transferred to a higher powered DBS system in the future.

4

Present broadcasting services and future needs

Radio and television broadcasting services are available to most Canadians, as indicated indirectly by statistics on ownership of receivers. In 1981, more than 98 per cent of Canadian households owned radio receivers, while more than 97 per cent owned television sets.[1]

The number of radio stations originating programming in 1981 was 587, and there were 117 originating TV stations. The coverage provided by originating stations is greatly increased through rebroadcasting. In 1981, there were 741 rebroadcasting stations for radio and 1,074 for TV.[2]

The Canadian broadcasting system is composed of a variety of radio and television networks, as well as independent stations. Some of the networks are publicly owned, while others are strictly private enterprise. This mixed ownership is a prominent feature of the Canadian broadcasting environment.

Another prime characteristic is the high penetration of cable television. In 1981, 57 per cent of Canadian households subscribed to cable distribution services, and 80 per cent had access to such services. In the same year there were 524 operating cable systems, owned entirely by Canadian enterprise.[3] Cable is a major contributor to the quantity and quality of television services available to Canadians.

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1 Statistics Canada, *Household Facilities and Equipment 1981*, Catalogue 64-202.
2 Canadian Radio-television Commission, *Annual Report 1980-81*, p. 38.
3 Statistics Canada, *Cable Television 1981*, Catalogue 56-205, p.11.

Broadcasting and cable television are important industries in economic terms. Combined operating revenues in 1981 totalled $1,607 million, while after-tax profits were $104 million and capital assets were valued at $1,038 million. The average weekly number of employees was 34,517 in 1981; annual salaries and related benefits amounted to $870 million. Further details are given in table 2.

Table 2

Broadcasting and cable industry economic statistics, 1981 (in millions of dollars)

	Broadcasting	Cable distribution	Total
Operating revenue	$1,206*	$401	$1,607
Capital assets	649	389	1,038
Total assets	1,635	767	2,402
Net profits	166	36	202
Profits after taxes	86	18	104
Salaries	762	108	870
Employees †	28,792	5,725	34,517

* Does not include the $586 million parliamentary appropriation to the CBC.
† Average number of weekly employees.

Note: Figures for broadcasting do not include pay-TV and non-commercial broadcasting. For cable distribution, only systems with more than 1,000 subscribers are included.

Source: Statistics Canada, *Radio and television broadcasting 1981*, Catalogue 56-204; and *Cable television 1981*, Catalogue 56-205.

Pay-television is a newcomer to the Canadian broadcasting scene. In March 1982, the CRTC licensed five organizations to establish pay-TV networks: two national services – Lively Arts Market Builders (LAMB) and First Choice Canadian Communications Corporation, the latter to provide separate services in English and French; three regional English-language services – Superchannel (Ontario), Superchannel (Alberta), and Star Channel Services Ltd. (Atlantic Provinces); and one multilingual service, World View Television Ltd. (British Columbia). In November 1982, a fourth regional service was licensed to serve Quebec, Eastern Ontario and New Brunswick in the French language – La télévision de l'est du Canada (TVEC). Early in 1983, Aim Satellite Broadcasting, an English language regional service, was licensed for British Columbia and the Yukon.

Existing and planned Canadian services are summarized in table 3.

Table 3

Television services in Canada, 1982-1983

National	Regional	Number of principal stations	Number of channels
Public networks			
CBC (E)		44	
(F)		18	
	Access (E)	1	
	TVOntario (B)	12	
	Radio-Québec (F)	8	
Private networks			
CTV (E)		26	
	TVA (F)	6	
	Global (E)	6	
Independent stations			
		19	
Pay-TV			
First Choice (E)			1
Premier Choix (F)			1
LAMB (B)			1
	Superchannel (Ontario) (E)		1
	Superchannel (Alberta) (E)		1
	Star Channel (Atlantic) (E)		1
	TVEC (F)		1
	World View (British Columbia) (M)		1
	Aim (British Columbia) (E)		1
Satellite service			
Canadian Satellite Communications Inc.*			8
House of Commons (E)			1
House of Commons (F)			1
	Knowledge Network of the West (E)		1
	La SETTE (F)		1
	Atlantic Satellite Network (E)		1

(E) English
(F) French
(B) bilingual
(M) multilingual

* Four American channels, the "3 + 1 package", will be added in the second half of 1983.

Note: Figures exclude low-power relay transmitters.

The Canadian Broadcasting Corporation

The CBC is the heart of the Canadian broadcasting system. It is the major source of Canadian television content in English and French, maintaining Canadian content levels in its TV programming in the range of 70 per cent. In categories such as drama, documentaries and music, the CBC is the only broadcaster offering a significant amount of Canadian programming. The CBC has provided television service for more than 30 years.

Spanning six time-zones over Canada's 8 000 km coast-to-coast breadth, the CBC's distribution system is one of the largest in the world. Through the use of satellite transmission and more than 85 000 km of cables and microwave links, the CBC has achieved combined national coverage for its English and French television networks of 99.1 per cent of the Canadian population.

CBC television facilities include national and regional production centres, 31 broadcasting stations and 552 repeaters. The CBC's own facilities are complemented by 32 affiliated private stations and 264 affiliated repeaters. Table 4 gives a detailed breakdown of the CBC's television broadcasting system. The affiliated stations carry packages of CBC programming specified in their agreements with the CBC. All affiliated stations take the CBC's national news and current affairs programming but are responsible for locally oriented productions.

Table 4

CBC television broadcasting system, 1982

	English network	French network	Native language	Total
CBC stations	20	11		31
CBC repeaters	407	145		552
Affiliated stations	26	6		32
Affiliated repeaters	210	48	6	264
Total	663	210	6	879

Source: *CRTC Annual Report 1981-82,* pp. 56, 58, 59.

Some private stations are affiliated with both the CBC and a private network. The so-called "twin-stick" operation is a unique feature of Canadian television broadcasting. In sparsely populated and marginally profitable areas, private broadcasters have been able to achieve sufficient economies to provide service only by becoming affiliates of the CBC English network and CTV or of the CBC French network and TVA, transmitting the signals of two networks.

The CBC is a major instrument for implementing the national broadcasting policy outlined in the Broadcasting Act. Consequently, parliamentary appropriations provide much of the funding necessary for its operation. These appropriations were close to $600 million in the 1981/82 fiscal year. The corporation's financial statement reproduced in summary in table 5 indicates the extent of government support for its operations.

Unlike its national counterparts in the United Kingdom, Australia or France, the CBC relies on commercial revenue from advertising on its TV services to supplement the funds it receives from Parliament. As a result, it faces the challenge of managing the divergent requirements of public service and commercialism.

Private broadcasters

The private TV broadcasting sector in Canada is made up of both networks and independent stations.

The largest component is the English-language CTV network, a co-operative undertaking of its 26 affiliated stations. Two hundred and twenty-five rebroadcast transmitters are also affiliated with CTV. CTV affiliates, like those of the CBC, all take national news and current affairs and are responsible for local programming. Most CTV affiliates take other programs from the network such as sports; films; variety, quiz and talk shows; and children's programs. The CTV stations also broadcast a considerable amount of American programming which is popular with viewers. CTV covers all major metropolitan centres and neighboring areas.

Table 5

Summary of CBC income and expense for the year ended March 31, 1982 (in millions of dollars)

Expense	
National broadcasting service, program and distribution costs	711.1
Radio Canada International broadcasting service	12.6
Total broadcasting services	723.7
Corporate engineering service	7.6
Corporate management service	29.0
Commissions and selling expense	32.3
	792.6
Income	
Advertising	131.5
Miscellaneous	12.2
Excess of expense over income	**648.9**
Deduct: Expense not requiring an outlay of cash	45.9
	603.0
Parliamentary appropriations – current	598.5
Unexpended (overexpended) parliamentary appropriations – current	(4.5)

Source: *CBC Annual Report 1981-1982*, p.68.

The French-language TVA network consists of six affiliated stations and seven rebroadcasting stations in Quebec, plus one rebroadcasting station in New Brunswick. TVA provides French-language programming originating in Montreal to about 99 per cent of the Quebec population. News, sports, public affairs, films, variety shows, children's programs and soap operas constitute its programming fare. Affiliated stations produce local news and community interest programs. TVA is very popular in French Canada, consistently ranking first in viewer ratings, especially for talk shows, soap operas and variety shows. In its 20 years of existence, TVA has succeeded in gaining an important part of the French-language television market in Canada. It is continuing to develop, with present efforts aimed at decentralizing some production.

The Global Television Network is a private corporation operating a system of five repeater stations in eastern and western Ontario that carry programming from its sole originating station, located in Toronto. Some of Global's news and public affairs programs are also carried by four private stations in western Canada. Global's broadcasts reach some 6 million people, about 25 per cent of the Canadian population. Its programming is dominated by foreign, mostly U.S., production; its only original productions are news and public affairs programs.

Within the private sector, there are also 19 independent stations located in metropolitan areas where the market is sufficient to sustain them. Some have gained a substantial audience share. These stations produce or purchase their own programs. Most offer programming aimed at the general public, similar to that of the CBC and the private networks. Several, however, offer multilingual programming directed to ethnic groups.

Educational television

There are three educational television networks in Canada. Among the characteristics they have in common are special provincial mandates, provincial government financing and non-profit operation. The educational networks have been in existence for periods of two to eleven years and are in various stages of development.

The Knowledge Network of the West (KNOW) is the youngest of the Canadian educational broadcasters. KNOW distributes its programming by satellite to cable systems in more than 120 communities in British Columbia and several communities in the Yukon and the Northwest Territories. Instructional and educational programming is offered, permitting students of all ages to enrol in courses up to the community-college level. KNOW broadcasts for 14 hours daily; original productions account for about 15 hours a week of programming.

TVOntario, operated by the Ontario Educational Communications Authority, is a television network which covers 85 per cent of the population of the province. Service from the originating station in Toronto is provided to rebroadcasting stations throughout Ontario by both terrestrial and satellite links. Significant expansion is in progress to extend service to smaller communities.

Sixteen hours a day of programming is broadcast, for all levels of audience from nursery to university age. A general-interest component is aimed at a wide public and comprises documentaries, round-table discussions, movie classics, music and commentary. French-language broadcasting is scheduled for schools in the mornings and for more general audiences on Sundays from noon to midnight. Financing is provided by the Ontario Ministries of Education and Culture, with some revenue being derived from the national and international sale of programming. Some revenues recently have been obtained from voluntary public subscriptions.

Radio-Québec operates a French-language educational network. Its eight rebroadcasting stations carry network programs from the originating station in Montreal as well as some regionally originated programs. The educational and cultural fare is designed for school use in the mornings, and for general audiences in the afternoon and evening. Films, round-table discussions, documentaries, public affairs programs, talk shows and music make up the schedule. Radio-Québec covers 83 per cent of the population of the province, and extension of its network of transmitters will probably be completed by 1985. This will be accomplished by using satellite distribution, with provision for regional input at local stations.

Access Alberta, the educational communications service of the province of Alberta, does not operate its own network but carries out radio and television broadcasting by purchasing two hours of time a day from 30 private stations throughout the province. The broadcasts are aimed primarily at children of elementary school age.

Cable television distribution

Distribution of television via coaxial cable was first introduced in Canada in 1952 and soon permitted thousands of Canadian households to receive signals of American origin. The cable TV industry in Canada has expanded rapidly; between 1964 and 1981, the number of subscribers increased from 0.2 million to 4.7 million.

Known originally as community-antenna television (CATV), cable TV uses high-quality antennas and associated equipment to pick up signals of originating stations over the air. (TV signals can usually be received off air within a radius of about 100 km of the point of origin.) Signals of more distant stations are brought in by microwave relay. In recent years Canada's Anik satellites have been used to distribute programming packaged for redistribution by cable systems.

Most of the content distributed by cable TV is the broadcast programming of U.S. and Canadian TV stations. In addition, cable operators originate local-interest programming which they transmit on the community channel. Many cable companies offer other services such as pay-TV, televised parliamentary debates, community-billboard information channels, alarm services and teleshopping. All these services are distributed to the homes of subscribers by high-capacity cable that can carry numerous television channels simultaneously.

Since 1968, cable television systems have been regulated by the CRTC as broadcast receiving undertakings. Each company's use of its cable channels must be approved in advance by the CRTC. (See chapter 9 for more about regulation.)

Today, more Canadians receive TV by cable than over the air. As of the beginning of 1982, 56.8 per cent of Canadian householders subscribed to cable; 24 per cent had both cable and converters, allowing them to receive more than the basic 12 channels. As for non-subscribers, 23.6 per cent of Canadian households did not have access to cable service, leaving 19.6 per cent that could subscribe if they wished to.[4]

Penetration rates (percentage of households that subscribe) are not uniform across the country, as indicated in table 6, approaching saturation in British Columbia, and being lowest in Quebec and the Atlantic regions. The table also shows that small cable systems, those with less than 1,000 subscribers, have only 1 per cent of the subscribers, while representing about one fifth of the total number of systems. Small systems are typically located in towns and villages where population density becomes a significant factor in economic feasibility. The statistics illustrate that cable has been much more successful in larger urban areas where the density of households is high enough for cable to be economical.

Satellite services

Delivery of television programming to cable systems has been one of the most popular applications of Canadian and U.S. satellites. In the United States there has been a virtual explosion in the number of television channels available to cable systems across the country, with the number of services now surpassing 50. Similar extensive use of satellites has been made in Canada, although the number of channels available to cable systems is considerably smaller because of the much smaller Canadian market.

La SETTE, a consortium of 26 cable operators in Quebec, delivers a selection of recorded television programs from the three national television networks in France. La SETTE programming is distributed on 53 cable systems throughout Quebec to some 800,000 subscribers. Six hours of programming are supplied each evening, repeated in the afternoon of the following day. The programs are delivered across Quebec, except for the Montreal metropolitan area, via Anik C (14/12 GHz) directly to cable head-ends. Negotiations are underway to extend La SETTE service to New Brunswick and Ontario. Programs are acquired and paid for by the Quebec and French governments. Technical and distribution costs are recovered by a universal charge of $.50 a household a month paid by cable distributors to the consortium.

Mostly cultural in nature, La SETTE's programming consists of talk and variety shows, films, children's programs and some sports events. There are no public affairs or news shows, since the programs are distributed to Canadian audiences three weeks after being aired in France. La SETTE began service in September 1980.

Pay-TV was inaugurated in Canada in February 1983. Eight of the nine licensed pay-TV services (all but the multilingual channel) are transmitted via Anik C to cable operators across the country. In addition, Northstar Home Theatre Inc. has announced plans to offer the pay-TV carried on Anik C through individual home satellite receivers to householders without access to cable.

[4] Statistics Canada, *Cable Television in 1981*, Catalogue 56-205.

Table 6

Cable distribution statistics, August 1981

Region	Pacific*	Prairies	Ontario	Quebec	Atlantic	Canada
Number of systems	79	82	140	173	50	524
Number of subscribers	811,373	742,599	1,922,311	952,322	272,038	4,700,643
Number of households † in region	1,015,760	1,448,935	2,969,785	2,172,850	674,130	8,281,460
Percentage of households subscribing	79.9	51.0	64.7	43.8	40.4	56.8
Number of households in licensed areas ‡	914,538	1,056,254	2,477,086	1,769,054	368,116	6,585,048
Percentage penetration of households in licensed areas ‡	88.0	69.8	77.3	52.4	73.0	70.6
Number of reporting units with less than 1,000 subscribers	20	14	15	60	7	116
Number of subscribers to systems of less than 1,000	6,698	5,444	6,446	25,794	3,251	46,633

* Included: British Columbia, Yukon and the Northwest Territories
† As of May 1981
‡ Areas with more than 1,000 subscribers included in a cable licence

Sources: Statistics Canada, *Cable Television, 1981*, Catalogue 56-205.
1981 Census Data.

The five regional pay-TV services and one national service offer general entertainment programming that includes a large proportion of recently released films, variety shows and sports. Lively Arts Market Builders deviates from this formula by offering more culturally oriented programming, including film classics and live productions from Canadian performing arts centres. Since pay-TV is still in its infancy, it is too early to evaluate the cultural and economic impact of this type of service. However, because of the Canadian content requirements set by the CRTC condition of licensing, pay-TV is expected to provide substantial funds for Canada's film and television production industry.

Canadian Satellite Communications Inc. (often referred to as Cancom) is a national service using the Anik D satellite to deliver a package of radio and televison program signals to affiliates in isolated communities. By the end of April 1983, about 430 affiliates had been granted licences by the CRTC to distribute the Cancom package in 658 communities. They plan to distribute the received signal via low-power VHF or UHF transmitters or by cable. A large number of these affiliates have not yet begun service.

Cancom was licensed by the CRTC in April 1981 to provide broadcasting services to remote regions of Canada and to towns and villages in Canada that receive no more than three channels of television. Cancom carries four TV channels, three in English and one in French. These are the channels broadcast by private stations in Vancouver, Edmonton, Hamilton and Montreal, respectively. Cancom also distributes the signals of nine radio stations from across the country, two of which are in native languages. Cancom's signals are scrambled and can be received only by those equipped with decoding devices supplied by the network.

In March 1983 Cancom was granted permission to carry four additional channels coming from the United States: three commercial networks plus the Public Broadcasting System network – the "3+1 package." Service is scheduled to begin by the fall of 1983. A second French channel is planned, and a bilingual educational channel may be added. The Cancom licence also provides for the distribution of ten hours a week of native language programming.

Content of Canadian television

The objectives set forth in the Broadcasting Act provide a standard for gauging the performance of the Canadian broadcasting system. Under the Broadcasting Act, all broadcasters are required to provide programming of high standard, using predominantly Canadian creative and other resources. The Canadian broadcasting system is seen as a means of safeguarding, enriching and strengthening the cultural, political, social and economic fabric in Canada. A few statistics, given in table 7, on the availability and viewing of English- and French-language television in Canada are sufficient to show that these objectives are far from being met.

On English-language television in Canada, 67 per cent of the programs available either over the air or on cable are foreign, and 74 per cent of viewing is devoted to foreign programs. For young people between 12 and 17 years of age, this increases to 84 per cent. The prominence of foreign programming in the prime-time hours from 7 to 11 p.m. is greater yet; in this time period, 76.5 per cent of English-language programs available to Canadian viewers and 81.5 per cent of those actually viewed are foreign.

The overall situation for French-language television is quite different with 64 per cent of French-language programs available being Canadian and 62 per cent of the viewing being devoted to Canadian programs. The figures on viewing of Canadian French-language programs might be even higher except for the fact that French-speaking Canadians, particularly in the Montreal area, generally have a considerable selection of foreign-produced English-language programs available which they watch in significant numbers. Viewing of English-language television is no doubt also increased by the considerable spillover of television signals from the United States.

Table 7

Availability and viewing of programs on English and French television, 1980

	English television	French television
Availability		
Canadian programs	33	64
Foreign programs	67	36
Viewing (two years and up)		
Canadian programs	26	62
Foreign programs	74	38
Viewing (twelve to seventeen years)		
Canadian programs	16	41
Foreign programs	84	59

Note: Availability is shown by percentage of programs. Viewing figures represent percentage of viewing time.

Source: Department of Communications

The seeming failure of Canadian television to meet statutory objectives for programming is largely a function of economic forces which are at variance with Canada's social, cultural and political objectives. Producing, procuring and scheduling domestically produced programs pose both cost and revenue disadvantages to broadcasting and network licensees.

The economics of television program production and distribution are such that the Canadian rights to popular foreign programs can be purchased for about one tenth of what it costs to produce comparable Canadian programs. For example, the cost of producing each hour of a popular TV series like "Dallas" is more than $800,000; Canadian networks are able to acquire the Canadian rights to such a program for about $40,000 an hour.

Because of the mass appeal of foreign programs among Canadian viewers, Canadian broadcasters derive significantly higher advertising revenues from commercial spots on popular U.S. produced drama series than they can from comparable spots on Canadian-produced series. By way of example, based on published 1981-1982 peak-time advertising rates, CTV earned over $50,000 more per hour in advertising revenues for a U.S. show than for a Canadian show.

Faced with these economic facts, it is not surprising that Canadian television networks and stations rely heavily on non-Canadian entertainment programming, particularly during peak viewing hours. This, in turn, has discouraged investment in television program production in Canada. As well, the Canadian market for television programming is limited in comparison with markets such as that in the United States, and it is split along language lines. Accordingly, Canadian producers have to count on international sales to cover the costs of production.

In the face of fundamental economic incentives to do otherwise, the CRTC's Canadian content regulation for television has not been sufficient in itself to encourage a greater diversity and quantity of domestically produced programming. Nevertheless, there have been a number of noteworthy accomplishments by private (as well as public) broadcasters in certain programming categories: news, current affairs, sports and some entertainment. French-language broadcasters, in particular, have achieved a great degree of popularity with domestically produced fare. In 1982, nine out of the ten most popular French-language programs were Canadian produced.

To strengthen the Canadian program production industry, the Broadcasting Strategy of March 1, 1983 established a Canadian Broadcast Program Development Fund to be administered by the Canadian Film Development Corporation (CFDC). In its first year of operation, commencing on July 1, 1983, the fund will have a budget of $35 milion which will rise to $60 million (constant 1983 dollars), by its fifth year of operation. The money in this fund may be applied by the CFDC to cover up to one third of the costs of Canadian drama, variety and children's programming produced by private Canadian program producers for exhibition by the CBC and by private broadcasters in Canada.

The 1980s will see profound changes in the television broadcasting environment. There will be an explosion in the use of new technologies to deliver programs. This will be dominated by expansion in the capacity of cable television and by the emergence of satellites, satellite networks, DBS home receivers, videodiscs, pay-television and videotex. This expansion of the delivery system will greatly increase viewer choice. During this decade, we can expect a move towards user-pay and convenience television (in the form of videodiscs and videocassettes) and a gradual move away from conventional television services; a great increase in specialized programming; and the possibility of a substantial increase in the Americanization of the Canadian broadcasting system because most of the new program services will originate in the United States.

Native broadcasting

According to the 1981 Census, the total native population of Canada amounts to 491,460 – 292,700 status Indians, 98,260 Métis, 75,110 non-status Indians and 25,390 Inuit. Native associations feel this is a very conservative estimate. Other estimates would suggest that the total native population of Canada is between 750,000 and 1,000,000.

The native people are spread throughout Canada, with the majority living in rural and remote areas. They speak a total of 51 different aboriginal languages. Linguistic groups vary in size from more than 30,000 Cree-speakers to a mere handful of Han-speakers.[5]

The technical characteristics of a Canadian DBS system could make it well suited to serving native audiences. Through coverage of rural and remote areas, it could provide service to many native homes not reached by terrestrial broadcasting. Indeed, DBS broadcasters might find that if their service was directed toward rural and remote areas, they would have a far greater proportion of native people in their potential audience than do urban-based broadcasting undertakings.

Since southern television programming was first introduced in northern Canada, native groups have continually expressed their concerns about its negative impact on their cultures and languages. This is not to say that native people do not enjoy non-native programs but their social, cultural and linguistic systems are affected, particularly among the younger generation, by the lack of programming reflecting northern native society. Native groups have asked for assistance to allow them to use television and radio for educational purposes, such as the maintenance of their languages and cultures, and the dissemination of news and information about matters which concern native people.

Some special-interest programming is already available to native people on radio and television, particularly in the North.

The five regional radio production centres operated by the CBC Northern Service in the Northwest Territories and the Yukon provide a considerable amount of regional programming with varying amounts of programming in native languages. The Northern Quebec Service operating out of Montreal produces 22 hours a week of radio programs in Inuktitut and 22 hours a week in Cree. It also provides access to its shortwave and satellite transmission services for an Attikamek-Montagnais Council daily radio program. For Northern Ontario, Manitoba and Saskatchewan, the CBC has established radio programming centres in Thunder Bay, Thompson and La Ronge. These studios produce public affairs and news programming relevant to the regions they serve but they use native languages to a very limited extent.

The CBC offers a small amount of regional television programming in a few northern areas. The Northern Quebec service produces some Cree and Inuktitut television broadcasts. In the territories, some northern programs are generated by the Yellowknife production centre, using native languages and English. "Taqravut", an annual series of 44 fifteen-minute programs in Inuktitut is produced in Ottawa.

[5] *Canada's First Language*, M.K. Foster, Language and Society, No.7, 1982, p. 7, Commissioner of Official Languages, Ottawa.

The total effort amounts to an average of 45 minutes of original northern programming per week. With the exception of Quebec, no special northern television programming is available on the CBC network serving the northern portions of any of the provinces.

Department of Communications programs using Hermes and Anik B satellites enabled native groups to conduct radio and television experiments and pilot projects. These field trials contributed to the creation of the Inuit Broadcasting Corporation to which the CRTC granted a network licence in 1981. Today, the Inuit Broadcasting Corporation and Taqramiut Nipingat Incorporated, the Northern Quebec Inuit Communications Society, produce five hours of television programming a week in Inuktitut at production centres in Frobisher Bay and Baker Lake (N.W.T.), and Salluit (Quebec). Portable cameras are also used in Eskimo Point and Igloolik. The Inuit Broadcasting Corporation leases a video uplink facility from Telesat Canada in Frobisher Bay and the CBC makes available its satellite channels and 32 relay transmitters in the Northwest Territories, Arctic Quebec, and Labrador to broadcast the programming.

Northern distribution of native programming is available through Cancom. Cancom is also required, as a condition of its licence, to provide one video and two audio uplinks in northern locations and to distribute up to ten hours a week of native-produced television programming plus two channels of native radio programming. However, to date the lack of adequate financial resources for program production has prevented native groups from taking advantage of the Cancom option.

Consultations with numerous native organizations, primarily northern ones, indicate that these groups are very interested in improving local and regional broadcasting services. The Northern Broadcasting Policy will enable all northern native groups to further improve native broadcasting. The policy establishes principles which will offer native groups the opportunity to use northern broadcasting systems to help preserve their cultures and languages and provides $39 million over four years to native communications societies for northern native program production. When the Northern Native Broadcast Access Program is implemented, northern native organizations will require distribution systems which can be dedicated to native narrowcasting applications.

A Canadian DBS system could be fairly well suited to meet native programming requirements. An antenna pattern would provide four to six spot-beams. Native programming could, therefore, be broadcast in each region, according to need. This would suit the regional nature of native programming better than the existing Anik D services. However, the social and economic aspects of putting native programming on a direct broadcasting satellite may not be so straight forward. Native programming is essentially narrowcasting, because it is aimed specifically at one segment of the population. In native communities, it is possible to use local transmitters to broadcast programs of interest, but on a DBS service directed to an entire region, it would be necessary to dedicate channels specially for native programming, or to fit native programming in a channel distributing other narrowcasting services.

Many native people have indicated that they would like private and public broadcasters to produce native programming as part of their regular schedules. While broadcasters have not indicated much interest in this to date, DBS would also be well suited for delivering such services.

As with all other broadcasting undertakings, consultation with native groups will be imperative to the planning of a Canadian DBS system to ensure that their broadcasting and cultural requirements are taken into account.

Federal-provincial co-operation

There has been a long history of consultation and co-operation between the federal government and the provinces with respect to the development and application of satellite telecommunications. All experiments and pilot projects conducted under the Hermes and Anik B communications programs were implemented in co-operation with provincial organizations. The educational television services of the Knowledge Network of the West and TVOntario now carried on Anik C are excellent examples of satellite broadcasting applications which have evolved through such co-operation.

As a result of the Anik B pilot projects and federal-provincial briefings and consultations, the provinces have become very aware of the potential uses of satellite telecommunications including broadcasting. In the case of DBS, they are interested in the contribution it could make to achieving some of their key objectives such as the extension of services, and in the improved service it could mean for their populations.

The DBS Studies Program was also conducted in close consultation with the provinces, through numerous meetings and briefings as well as through discussions in the consultative committees which bring federal and provincial government officials together regularly at a regional or provincial level in the Atlantic region, the Prairies and British Columbia. As a result of these consultations, the federal government is aware of provincial needs in the development of satellite telecommunications. Similarly, the provinces are aware of the potential of DBS for the extension of services, particularly the extension of educational broadcasting services.

The technical characteristics of a Canadian DBS system would be attractive for educational broadcasting applications. Each beam in a system with four or six spot-beams would cover a region of Canada and would approximate time-zone boundaries. Uplinks would be available on provincial and regional bases. Low-cost receivers owned by individual households would make it possible for provincial educational broadcasting authorities to fulfill their mandates for total coverage. Provinces could either transmit their educational television services separately or enter into arrangements to share hardware and software to provide regional or national educational services.

Requirements for television service

Television is available via cable distribution systems in virtually every city and town in Canada with more than 1,000 households, and even in some smaller communities where housing density is high enough to make cable systems economical. Distant Canadian and American TV stations typically make up the complement of channels available and, in larger systems, from 20 to 30 channels are offered. In contrast, householders in non-cabled areas must receive television over the air, and the number of channels they can receive depends upon their proximity to metropolitan centres or to repeaters. Nevertheless, regardless of where they live, all but about 1 per cent of Canadians can receive a CBC station.

Most of Canada's non-cabled householders are to be found in rural and remote areas and in small towns where population densities are insufficient for cable to be economical. The 1976 Census indicated that 6,287,079 Canadians lived in these areas. Figure 4 shows their distribution according to population density. As cable service is extended, it can be expected to penetrate towns with population densities of more than 500 per square mile – 10.9 per cent of the rural group – but it is doubtful that it can be commercially provided in areas with lower population densities.

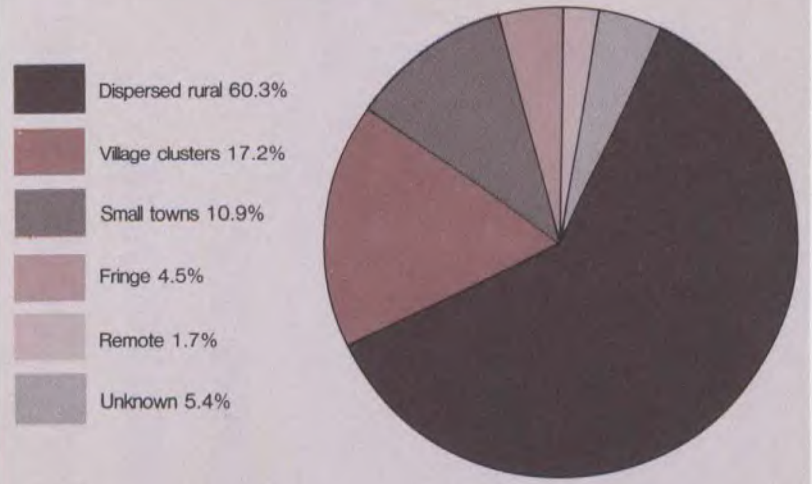
There is great disparity between the television service available to rural dwellers and that enjoyed by urban residents. On average, rural Canadians receive between two and three channels, from all sources, while urban Canadians receive more than twelve. Two hundred and sixty thousand Canadians receive no television at all. More channels are expected to become available to rural Canadians in the next few years through the services of Cancom, as shown in figure 5.

Television service in rural and remote areas by province and territory is shown in figure 6.[6] Only Ontario and Quebec have substantial populations receiving more than four channels. Appendix 3 contains more detail on rural television service, including availability of Canadian English, Canadian French, and American television. Finally, figure 7 shows the distribution of the rural and remote population receiving three channels or less of television from all sources. Compared to the majority of their fellow citizens, this group can be considered underserved. From the figure, it can be seen that 90 per cent – all but those in small towns and in larger village clusters – are too dispersed to be served with cable distribution systems in the foreseeable future. The only way they are likely to have service improved is through direct broadcasting by satellite.

[6] *Statistics of Television Broadcasting Coverage in Rural and Remote Canada*, The Telecommunications Research Group, Simon Fraser University, 1981.

Figure 4

Distribution of Canada's rural and remote population

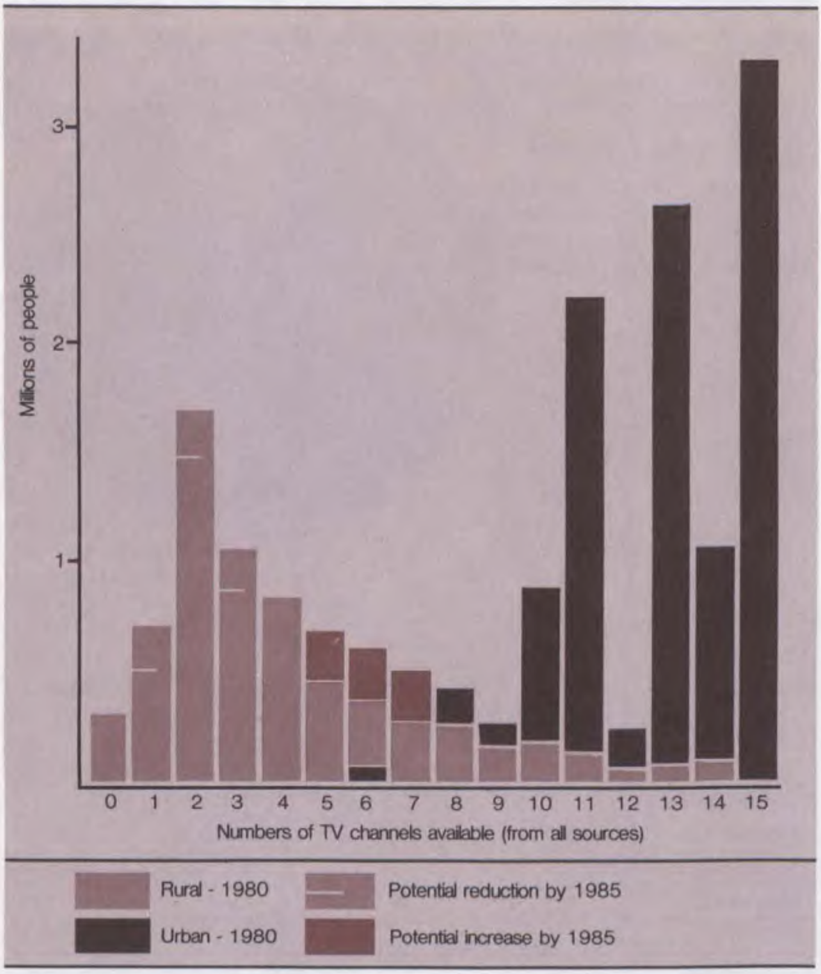


Category	Population density per square mile	Population*	Households
Remote	< 0.8	107,356	28,766
Dispersed rural	≥ 0.8, <100	3,790,185	1,029,489
Village clusters	≥100, <500	1,084,054	304,997
Towns of less than 2,500	>500	685,568	206,644
Rural fringe of cities		280,883	85,899
Unknown		339,033	98,123
Total		6,287,079	1,753,918

* 1976 Census

Figure 5

Availability of television in Canada



Availability of television in rural and remote Canada by province – 1980

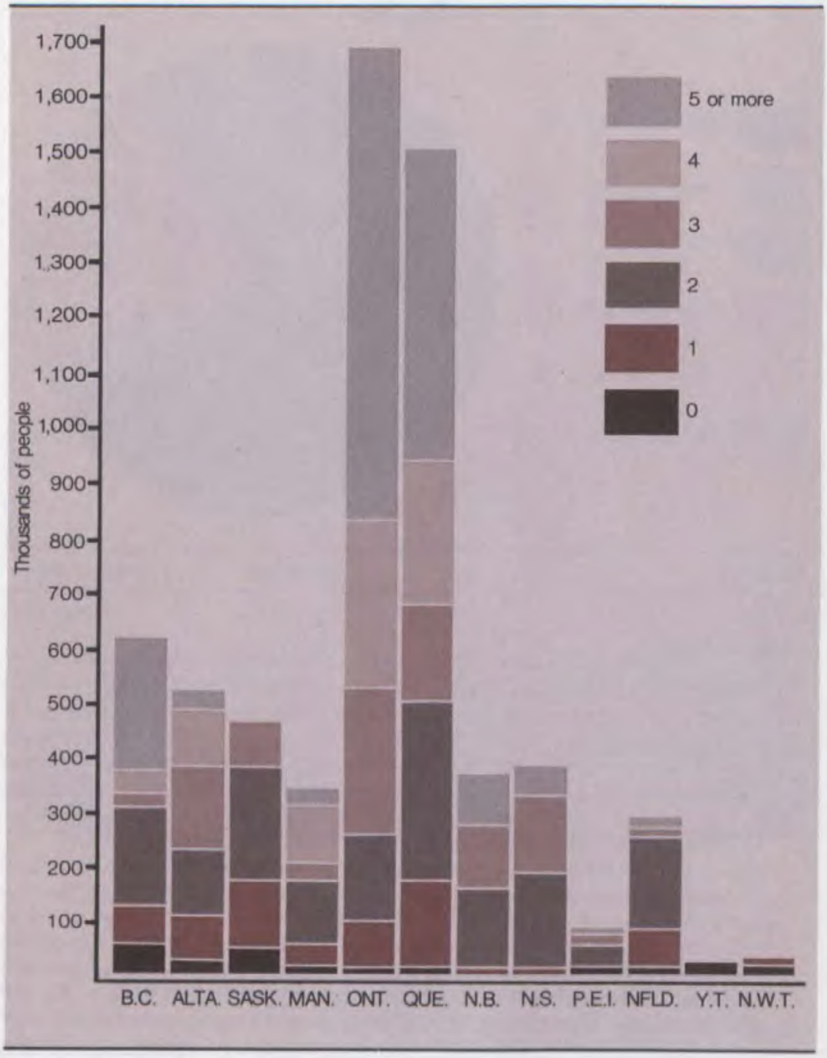
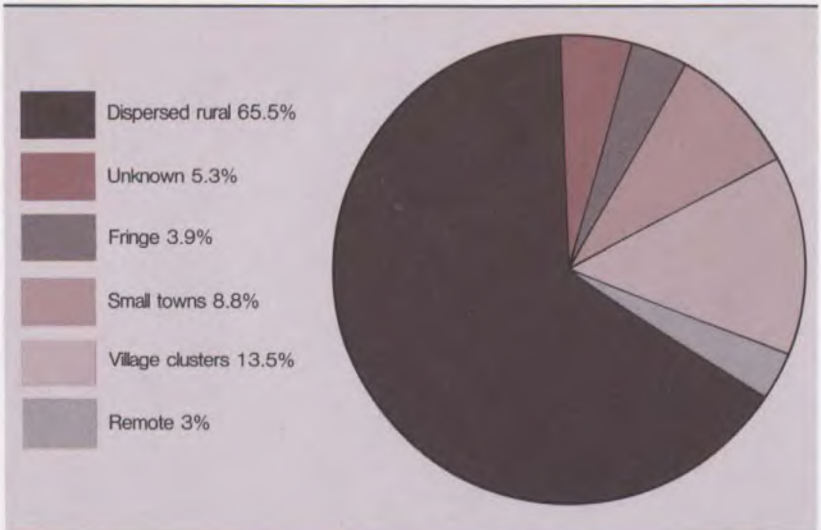


Figure 7

Distribution of rural and remote population receiving three or less channels of television



Category	Population	Households
Remote	106,590	28,561
Dispersed rural	2,354,426	639,615
Village clusters	485,459	136,595
Small towns	316,460	94,017
Rural fringe of cities	138,865	42,479
Unknown	190,292	55,077
Total	3,592,092	996,344

5

DBS system models

The earliest satellites operated within a few hundred kilometres of the earth's surface. In order to remain in orbit at this low altitude, satellites have to be given sufficient velocity to counteract the effects of the earth's gravitational field. Low-orbit satellites pass quickly over the horizon; consequently, they have to be tracked continuously by stations wishing to use them for communications, and a series of satellites is needed for uninterrupted operation.

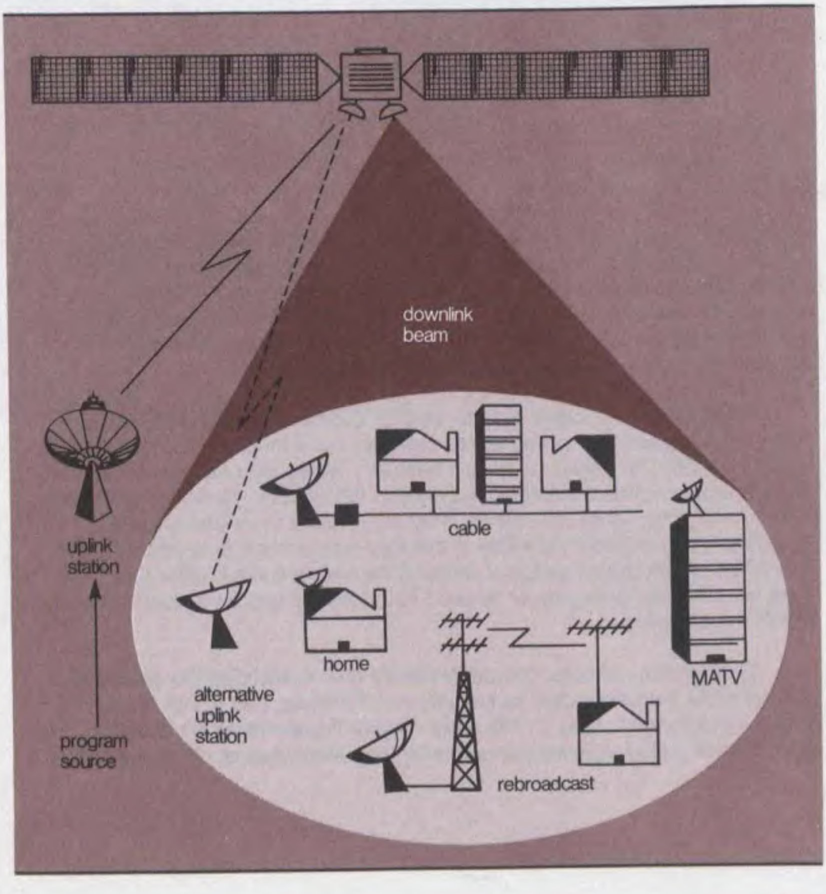
While low-orbit satellites are still used for specialized applications, nearly all modern communications spacecraft are launched into a much higher circular orbit – about 36 000 km above the earth's surface – where they have an orbital period of 24 hours and circle the earth directly above the equator. Because their position relative to the earth does not change, they are referred to as geostationary. The advantage of geostationary satellites is that they do not need to be tracked, and they afford continuous coverage of areas of the earth's surface within their view. They can therefore conveniently be used both for point-to-point telecommunications and for broadcasting.

Unfortunately, because the geostationary orbit is limited to the equatorial plane and has a unique radius, its capacity is not limitless; only a finite number of satellites can co-exist within it. The exact number is constrained principally by considerations of mutual radio-frequency interference rather than of physical proximity.

The suitability of geostationary satellites for telecommunications, particularly intercontinental services, has been established for many years, although their application to broadcasting has only recently become a realistic proposition. The change has been brought about by many advances in technology, the most important of which are the development of high-powered travelling wave tube amplifiers (TWTAs), solar arrays to provide the necessary power and antennas providing narrow beams; and favorable experience with super high frequency (SHF) transmission. At the same time, more efficient receivers and lower-cost components have become available for the use of individuals and the operators of small earth stations. Finally, frequency bands dedicated to satellite communications – not required to share the spectrum with terrestrial services – have become available by international agreement. In the light of these changes, many countries are now planning to use satellites for direct broadcasting.

Figure 8

General features of a DBS system



Basic elements of a DBS system

The basic elements of a satellite broadcasting system are shown in figure 8. The following features should be noted:

- The uplink is independent of the downlink (broadcast beam). The uplink transmissions may, or may not, originate in the area covered by the downlink beam.
- The receiving antenna must be aligned with the desired satellite. In most cases it requires realignment to receive signals from another satellite.
- The broadcast signals can be received directly by home viewers or can be received by cable operators or rebroadcasters who distribute the signals to the home viewer. In the latter cases, the distributor can control who receives what programs through scrambling of the signals. The distributor can also control when programs are shown by taping them for later delivery.
- A given channel (frequency) can be used in the planned coverage area only once. However, since the beams do not have a sharp cut-off at the boundaries of the coverage areas, and since satellites cannot be held either absolutely stationary or in a completely steady attitude, signals spill over into adjacent areas. This spillover imposes some limitations on frequency re-use. It may also cause political problems when international or other political frontiers are involved. One solution available to system planners is to use opposite forms of polarization on signals transmitted to adjacent areas. However, a low-cost receiving antenna cannot normally receive both of these forms at the same time.
- The transmitting power of the satellite is concentrated into beams covering particular service areas. Hence, if a service area is enlarged, either a higher power from the satellite or greater sensitivity in the receiving station is required to maintain the same quality of service. (The signal-to-noise ratio of the received signal, which is a good measure of its quality, can be controlled to a certain extent at the receiving station by a suitable choice of equipment. With high-performance receiving equipment that is properly sited, even home viewers can receive DBS signals of excellent technical quality.)
- Today's communications satellites receive their power from on-board solar cells. This reliance on solar power is likely to continue for at least the next two decades. When satellites are shadowed by the earth (eclipse of the satellite) they have to rely on rechargeable batteries for their power. Direct broadcasting satellites require a large amount of power, and it is not economically feasible to carry enough batteries to permit full operation during periods of eclipse. Geostationary satellites are eclipsed twice each year for a period of about six weeks centred on the spring and fall equinoxes. The length of the eclipse increases each night to a maximum of 72 minutes, then decreases again. The farther west of the coverage area a satellite is located, the later in the evening the eclipse occurs. This makes it possible to avoid problems associated with eclipse by strategic positioning along the geostationary orbit.

Figures 9 to 12 show examples of receiving installations. These consist typically of two parts: an outdoor unit that includes the antenna and support structure, with equipment to amplify the signal and to convert it to a frequency suitable for transmission by cable; and an indoor unit, which demodulates the chosen signal. The units are linked by coaxial cable.

In the case of a receiver intended for home use, the indoor unit contains remodulation equipment to allow the output to be fed directly into a conventional TV set. Channel selection (tuning) is carried out within the indoor unit (which may eventually be housed within the television receiver cabinet). Such receivers would be required in large quantities and have been designed for low-cost mass production.

In the case of receiving equipment used by cable operators and rebroadcasters, the indoor units contain sufficient demodulators to provide simultaneous access to all the DBS channels available from a particular satellite. These signals are then processed as necessary, modulated onto suitable frequencies and distributed via the cable system or transmitted over the air. As far as the user is concerned, DBS channels can be selected in the same way as other channels.

Figure 9

DBS individual home reception

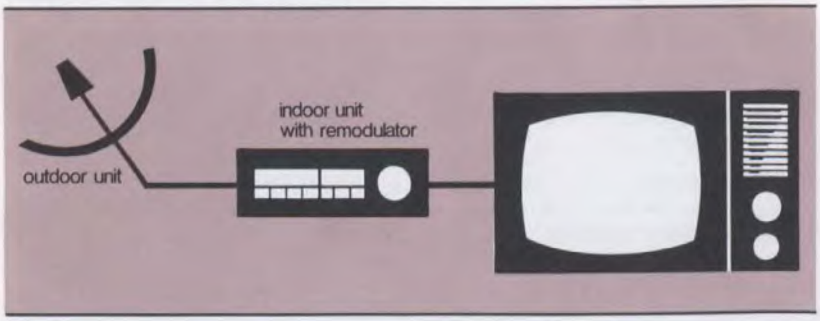
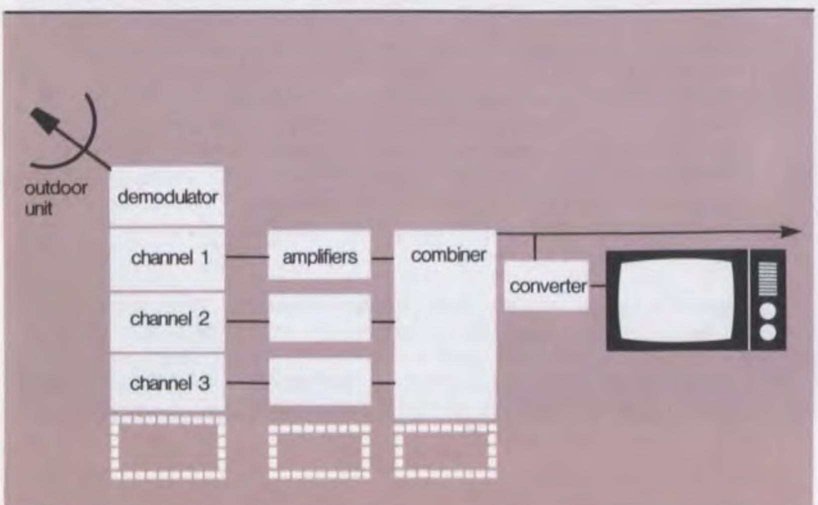
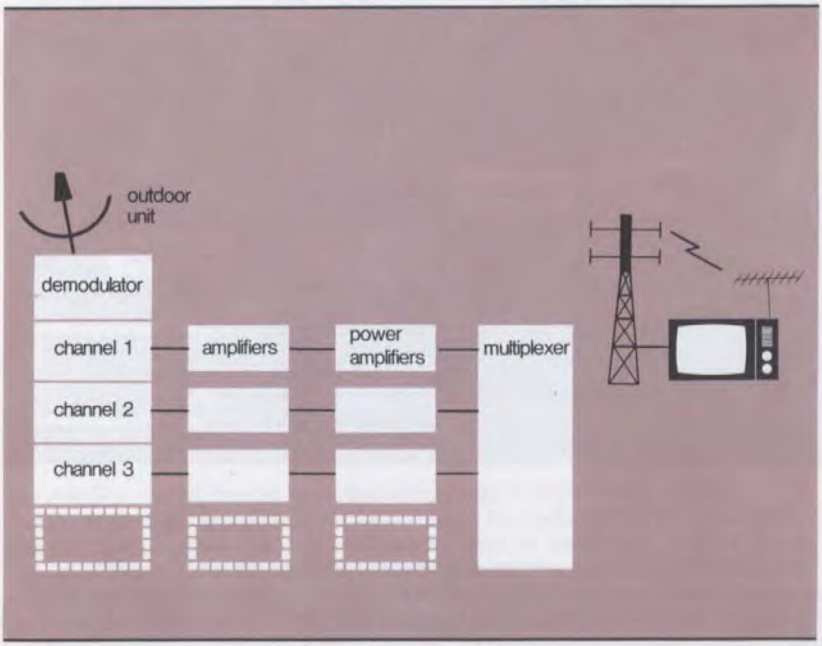


Figure 10

DBS reception via a cable system



DBS reception via a rebroadcasting system



International regulation

Downlinks

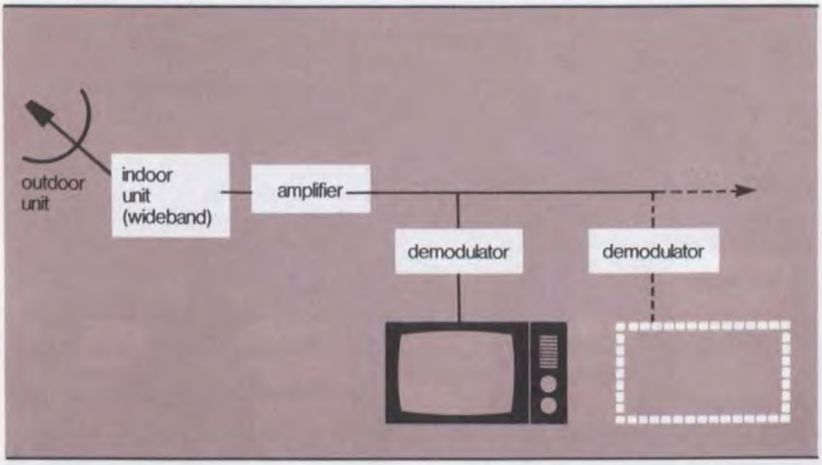
Direct broadcasting satellites operate in frequency bands internationally allocated to the broadcasting satellite service (BSS). In some cases they may also operate in frequency bands allocated to the fixed satellite service (FSS), which provides radio communication between earth stations at specified fixed points.[1]

The International Telecommunication Union (ITU) defines the broadcasting satellite service as a radiocommunications service intended for direct reception by the general public using small antennas (usually 1 m or less in diameter) for individual reception or using moderate size antennas (1-2 m in diameter) for community reception.[2] At WARC 79, a new frequency band, 12.1-12.7 GHz, was allocated to the broadcasting satellite service in Region 2 (North, Central and South America and the Caribbean), with the lower limit to be fixed between 12.1 and 12.3 GHz at RARC 83, the regional conference convened to plan the BSS in this band. It is generally assumed that 12.2 GHz will be set as the lower limit.

1 International Telecommunication Union, *Radio Regulations*, chapter 1, section IIA.

2 Ibid.

DBS reception via a MATV system



The frequency band and the geostationary satellite orbit will be divided among all administrations in Region 2 at RARC 83. These national allocations then will be exploitable, with little need for further co-ordination with other users in the band. Such a plan was established in 1977 for BSS in the rest of the world, and the orbital positions and frequencies were allocated among 149 administrations, giving a minimum of four television channels to each administration.

The international regulations governing the use of the frequency bands allocated to the fixed satellite service are quite different. The FSS is characterized by the "first-come, first-served" principle, whereby any new users must co-ordinate their intended networks with all existing systems which are likely to be affected. Orbital location and type of traffic scheduled are among the technical and operational characteristics which may be disturbed by a new network.[3]

In Region 2, the frequency band 11.7-12.2 GHz (just below the band allocated to the BSS) is allocated to the FSS. However, a footnote in the ITU *Radio Regulations* permits the use of the 11.7-12.2 GHz band in Region 2 by the BSS, provided the maximum effective isotropically radiated power (EIRP) is less than 53 dBW.[4] This allocation by footnote is not specifically planned but subject to co-ordination.

[3] Co-ordination procedures for the FSS may be reassessed at the WARC for the planning of all space communication services in 1985 and 1987.

[4] Footnote 836.

The major differences between the BSS and the FSS are polarization, EIRP and inter-service sharing. The FSS generally uses linear polarization whereas the BSS is expected to use circular polarization. Satellites of the FSS operating in the band 11.7-12.2 GHz have EIRPs in the range of 40-50 dBW, because of interference considerations. On the other hand, EIRP values for broadcasting satellites operating in accordance with the expected 1983 DBS plan will be in the range of 53-63 dBW. The difference in EIRP between the two services (about 10 dBW) can be compensated for by the generally larger diameter of earth-station antennas associated with the FSS.

The complexity of inter-regional and inter-service sharing between the BSS, the FSS and other services in the band 11.7-12.7 GHz is illustrated in table 8, ITU Allocations to Services. A footnote to the ITU table of allocations referring to the BSS in the 12.1-12.7 GHz band provides that the development of the Region 2 plan in 1983 shall not be restricted by existing or projected terrestrial service.[5]

The use of the BSS band is more appropriate for the provision of a broadcasting service to the general public than are the FSS bands, since stations in the BSS service would be protected from interference from other services.

Uplinks

By definition, uplinks (feeder or earth-to-space links) to broadcasting satellites belong to the fixed satellite service. Accordingly, the frequency bands allocated to the FSS in the earth-to-space direction can be used for feeder links to broadcasting satellites. However, the frequency bands 14.5-14.8 GHz and 17.3-18.1 GHz are allocated specifically for feeder links to broadcasting satellites in all three regions of the ITU. RARC 83 will be planning feeder links to the BSS in only part of the 17.3-18.1 GHz band – a part that will be equal in width to the bandwidth allocated at the conference at 12 GHz for the downlink. It is usually accepted that the planned feeder links in Region 2 will be in the band 17.3-17.8 GHz. The use of any other band for feeder links to broadcasting satellites can be achieved on the basis of co-ordination with other services.

In the band 17.3-17.7 GHz, uplink to broadcasting satellites is the only primary allocation and therefore no sharing constraints are placed on its use. However, in the band 17.7-17.8 GHz, the feeder links must share on a primary basis with the fixed service, the fixed satellite service in the space-to-earth direction, and the mobile service. Special consideration is being given to the problems of sharing in that last 100 MHz.

Home and community reception

The signals transmitted from a broadcasting satellite can be received at any point in the coverage area having a clear view of the satellite. This means that direct reception will be possible in most locations, particularly in rural areas.

Exceptions exist in mountainous areas and in cities where tall buildings may obscure the line of sight. Multiple dwellings such as apartment buildings are not well suited to direct reception by individual units because it may be too difficult to find places where individual antennas can be installed and properly pointed at the satellite. In such locations, alternative modes of reception could be used.

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5 Footnote 844.

ITU allocation to services in the Band 11.7-12.75 GHz

<table>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="5">11.7-12.5
FIXED
BROADCASTING
BROADCASTING-
SATELLITE
Mobile except
aeronautical mobile

838 840</td><td>11.7-12.1
FIXED 837
FIXED-SATELLITE
(space-to-Earth)
Mobile except
aeronautical mobile

836 839 840</td><td rowspan="2">11.7-12.2
FIXED
MOBILE except
aeronautical mobile
BROADCASTING
BROADCASTING-
SATELLITE

838 840</td></tr>
<tr><td rowspan="2">12.1-12.3
FIXED 837
FIXED-SATELLITE
(space-to-Earth)
MOBILE except
aeronautical mobile
BROADCASTING
BROADCASTING-
SATELLITE

839 840 841
842 843 844</td></tr>
<tr><td rowspan="2">12.2-12.5
FIXED
MOBILE except
aeronautical mobile
BROADCASTING.

838 840 845</td></tr>
<tr><td rowspan="3">12.3-12.7
FIXED
MOBILE except
aeronautical mobile
BROADCASTING
BROADCASTING-
SATELLITE

839 840 843 844 846</td></tr>
<tr><td rowspan="3">12.5-12.75
FIXED
FIXED-SATELLITE
(space-to-Earth)
MOBILE except
aeronautical mobile
BROADCASTING-
SATELLITE 847

840</td></tr>
<tr><td rowspan="2">12.5-12.75
FIXED-SATELLITE
(space-to-Earth)
(Earth-to-space)

840 848 849 850</td></tr>
<tr><td>12.7-12.75
FIXED
FIXED-SATELLITE
(Earth-to-space)
MOBILE except
aeronautical mobile

840</td></tr>
</table>

Source: Table of Frequency Allocation, DOC, p. 112

A variety of cable operators, broadcasters and common-antenna systems (such as the master antenna television or MATV systems in many apartment buildings) will likely distribute DBS signals. Table 9 compares these modes of DBS reception with direct reception in terms of cost to the user, technical performance and whether it is possible to insert local or regional material.

Table 9

Some comparative characteristics of four modes of DBS reception

	Cost to user	Technical performance	Insertion of local programming	Insertion of regional material
Direct home reception	high	good	not possible	possible
Rebroadcasting systems	usually low	poor to good	possible	possible
Cable systems	moderate	poor to good	possible	possible
MATV systems	moderate	moderate	not permitted	possible

Distributors will usually be in a position to invest in earth stations providing higher quality and reliability than the average individual's equipment, though this quality and reliability will be offset to a degree by the interposing of distribution equipment. If DBS programming can be added onto an existing delivery system at a cost attractive to the consumer in comparison with that of purchasing a home receiver, it will make direct home reception less attractive for the average city viewer. The option of purchasing an earth station may, however, prove attractive to some people for other than economic reasons, such as the freedom to tune in on different broadcasting satellites whose signals might not be available from distribution companies. Where cable systems are not economical to build and where terrestrial broadcasting is limited, individuals can be expected to buy or lease DBS receivers and, where necessary, arrange for their own pay-TV descrambling.

Coverage areas

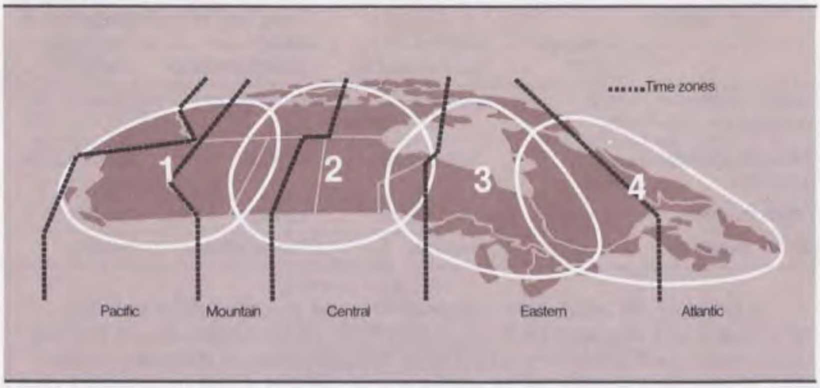
The options for DBS coverage range theoretically from a single all-Canada beam to many small beams, for example one beam for each province. The optimum arrangement will depend on the following factors:

- the need for national programming
- the need for regional programming
- the time differences across the country
- the need to make the most effective use of the radio frequency spectrum and the geostationary orbit, both limited resources
- the cost and complexity of the spacecraft antenna, feed system and electronics
- the market characteristics of each coverage area
- total space-segment costs
- political, geographic and demographic factors.

The best arrangement would appear to be six separate coverage areas, although four could be acceptable in the start-up phase of service. Less than four would render the regions excessively large and would result in some viewers receiving programming an hour earlier or later than they now do; more than six could result in too high a cost per user.

Proposed coverage areas are shown in figures 13 and 14. The boundaries indicated do not represent precise limits but rather provide contours within which reception by a typical, small earth station would give acceptable performance. Farther out from the contour, larger antennas would be needed to meet the same performance standards.

Coverage areas of a four-beam DBS system



The coverage areas identified in figures 13 and 14 are fed by separate beams. These beams do not necessarily originate from one satellite. Each beam can carry a number of television or radio channels up to a maximum which is determined by several technical factors. Using current technology, the limit is about 36 TV channels or their equivalent.

In the technical modelling study carried out for the DBS Studies Program by Spar Aerospace Limited, the results of which are included in the sections of this chapter entitled "System level trade-offs" and "Cost of major elements", a number of beam combinations were analyzed. The final choices cannot be made, however, until RARC 83 has been held.

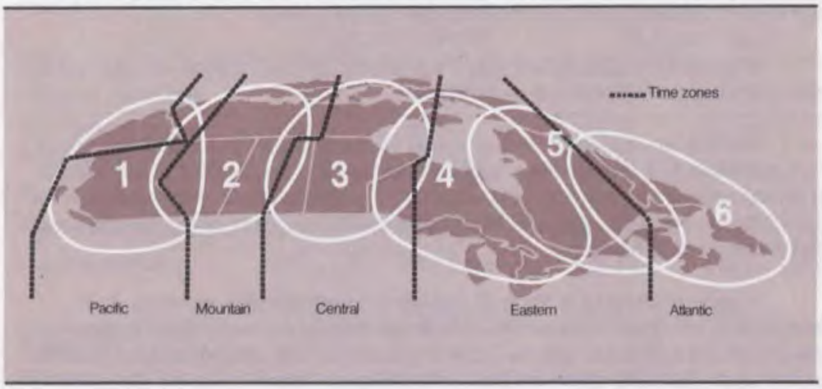
The coverage areas discussed above are those associated with the broadcasting service or downlink. Signals carrying programming must be transmitted from the program source up to the satellite (uplinked) in another frequency band. Since the number of uplink stations will be relatively small, it is feasible to equip them with fairly large antennas and high power transmitters. This would permit the use of a single all-Canada receive capability on each satellite and the origination of signals from different points in the country either simultaneously or at different times. This flexibility would be of great value to program planners and producers, allowing them to deliver both regional and national program material to any coverage area.

System level trade-offs

The technology of TV broadcasting is evolving rapidly, and it is wise to avoid making final decisions on such system parameters as modulation type and bandwidth too early in the planning process. Nevertheless, fairly detailed engineering studies have been carried out by Spar and others to develop models based on current engineering practices, making it possible to examine technical trade-offs, costs and cost sensitivities.

Figure 14

Coverage areas of a six-beam DBS system



The most fundamental trade-off is that between satellite power and earth station sensitivity – in technical terms, between satellite EIRP and earth terminal gain-to-noise temperature ratio (G/T). The higher the effective satellite power, the smaller and cheaper the earth stations can be. Early plans developed in Europe for direct broadcasting satellites proposed EIRPs of 60 dBW or higher. This was feasible since usually only one beam with a maximum of five channels was required to serve a substantial market. Companies planning DBS service in the United States have proposed EIRPs ranging from 54 to 59 dBW. In Canada, with a very large area to cover and a smaller market, EIRP becomes an important consideration. It must be kept as low as possible to keep satellite costs down, but it must be high enough to permit good quality reception with low-cost home receivers using small antennas.

Two satellite power levels have been modelled: EIRPs at beam edges of about 54 dBW and about 50 dBW.[6] These levels were chosen taking into account such factors as the availability of suitable spacecraft structures (buses) and the wish to provide consumers with signals of strength comparable to those likely to be available from U.S. satellites. In particular, a 54 dBW system would represent only minor compromises with a higher powered one, say 57 dBW. If and when satellite transmitters of higher power become cheaper, higher power may be used. This is not likely to require existing users to change their equipment. However, when the geostationary orbit is used to capacity, such an increase in power would require that all DBS systems undergo a similar increase in power; mutual interference would become excessive otherwise.

The modulation system currently favored for DBS is frequency modulation (FM). Although at first sight it might seem more logical to use the same system used by terrestrial TV transmitters (amplitude modulation or AM), this would require many times more power in the satellite, and the cost would be unacceptably high. Frequency modulation has properties well suited to DBS applications: low satellite power requirements, well-understood performance, well-developed circuit technology, and good subjective performance under fading conditions (that is, viewers find the reception acceptable).

[6] Typical home receiver antennas will be 0.8-1.0 m in diameter for a 54 dBW system and 1.2-1.5 m for the same performance with a 50 dBW system.

Several other modulation systems have been proposed, but these are in general more complex and expensive. Nevertheless, as large-scale integrated circuits become cheaper, advanced digital systems may become viable, especially if and when a demand develops for enhanced picture quality.

All modulation systems will permit the addition of several audio or data channels in addition to the video on each channel.

Satellites are subject to various forces in space which necessitate the use of non-renewable fuel to keep them stationary and stable. The amount of fuel carried is usually sufficient to match the life expectancy of the electronic and mechanical components. Increasing the amount of fuel adds to the weight of the satellite and thus to the cost of launching.

When considering the trade-off between system reliability and cost, four factors must be taken into account: the design lifetime, the number of operational spacecraft, the number of spares (both in orbit and on the ground) and the system growth plan. Table 10 gives the basic information on these factors for four-beam and six-beam system models.

Table 10

Phased implementation of four-beam and six-beam system model alternatives

	Four-beam model	Six-beam model
Orbit locations	2	3
Phase 1A		
Satellites – operating	2	3
– spare	1	1
Channels/beam	8	10
Phase 1B following in four years		
Satellites – operating	4	6
– spare	1	2
Channels/beam	16	20
System availability*	70% in year 7	

* Probability of total planned number of channels being available

Top-level technical parameters are given in table 11 for four system models – a four-beam system using satellite power levels of 50 dBW or 54 dBW and a six-beam system with the same satellite power options. The satellites comprising a system would be virtually identical in all four cases, and each would provide two beams. Both beams would use circular polarization (left-hand and right-hand) and would have eight to ten channels. A bandwidth of 18 MHz per channel is shown, although 24 MHz could be used equally well. Larger bandwidth could be used at the expense of a reduction in the final total number of channels available. In addition to its operating TWTAs, each spacecraft would have four spares. It was found possible to have 20 operating TWTAs on the satellite for the six-beam model as opposed to 16 for the four-beam model because of the lower power required for the smaller beams.

Table 11

Parameters of direct broadcasting satellites modelled for meeting Canadian requirements

	Four-beam model		Six-beam model	
EIRP (edge of coverage)	**54 dBW**	**50 dBW**	**54 dBW**	**50 dBW**
TWT output power	166 W	66 W	126 W	50 W
Total satellite power	7.4 kW	2.9 kW	7.1 kW	2.8 kW
Bus type	L-SAT	RCA	L-SAT	RCA
Transfer orbit weight	3145 kg	2336 kg	3165 kg	2440 kg
Launch vehicle	STS & IUS or Ariane 4	STS & PAM A or Ariane 4	STS & IUS or Ariane 4	STS & PAM A or Ariane 4
Beams per satellite	2		2	
Polarization	Circular		Circular	
Channels per beam	8		10	
Channel bandwidth	18 MHz		18 MHz	
Number of TWTAs (in operation)	20 (16)		24 (20)	
Satellite design life time	7 years		7 years	

Buses assumed for the modelling exercise were the European Space Agency (ESA) L-SAT (for the 54 dBW option) and the RCA Astroelectronics Division bus (for the 50 dBW option). In both cases the payloads approached the upper limits of the design capacity, thus providing the best cost-effectiveness. Either a version of ESA's Ariane 4 rocket or the U.S. Space Transportation System (STS, or Space Shuttle) in combination with a perigee stage rocket, could be used as the launch vehicle.

Assuming orbital positions of 100°W and 130°W, eclipse of the satellite would occur after 0100 local time in every case except for the most westerly beam. To maintain regular service in the westernmost beam, batteries would need to be provided for 39 per cent of the total system power requirements in the four-beam case and 26 per cent in the six-beam case. The conceptual designs assumed that batteries would be provided to permit operation at 50 per cent capacity. This would ensure that all viewers could receive signals at least up to 0100 local time on every day of the year.

An even higher powered system was not modeled because preliminary studies indicated that costs would be excessive. However, the 54 dBW model, which uses the full capacity of the largest available bus, can be used to derive approximate parameters of a 57 dBW model. A 57 dBW model would require TWTAs of approximately twice the power, and therefore the solar array and satellite power system would be able to support only half as many TWTAs as a 54 dBW satellite. Thus the impact of raising EIRP to 57 dBW would be that two operating satellites would be required to provide the same number of channels as one 54 dBW satellite.

Non-television broadcasting services

Although radio broadcast services are extensive and well established in Canada's major population centres, such is not the case in small cities and in the rural and remote areas. The primary interest in a DBS service has been television: another logical use of the service would be to provide radio programming of national and regional interest. A number of studies in the DBS Studies Program investigated the addition of high-quality monophonic and stereophonic radio programming to a direct broadcast television service that was assumed to be already in existence.[7]

Analog and digital transmission schemes in single-channel-per-carrier (SCPC) and television subcarrier format were investigated both in a satellite channel dedicated to radio and in a channel shared with television, assuming that up to 20 sound channels would be required in each beam. The conclusions of the studies were as follows:

- SCPC transmission will provide greater flexibility on the uplink than will the TV subcarrier format. SCPC would permit radio programs to be transmitted to the satellite from different uplinks at different locations, thus eliminating the requirement for interconnecting links to a central uplink station.
- It is easier to provide a very high quality sound program by digital techniques than by FM techniques.
- Digital SCPC is more power-efficient and less bandwidth-efficient than FM SCPC. However, the power efficiency of FM SCPC can be made to approach that of digital systems through the use of a companding technique.
- For dedicated satellite channel operation, digital multiplexing on a single carrier is 4-5 dB more power-efficient than SCPC operation. When a channel is shared between radio and television, digital multiplexing saves about 1 dB of power. It also provides a substantial bandwidth saving and eliminates the possibility of degradation of the video signal due to intermodulation products from multiple SCPC signals.
- For a small number – three or fewer sound channels per video channel – the FM subcarrier technique is the most promising and cost-effective. The addition of subcarrier receivers to the television home receivers is inexpensive.
- For a large number of sound channels, SCPC is the most promising (uncompanded FM for moderate quality and digital for high quality), provided that a low-cost automatic frequency control (AFC) technique can be implemented and the problems of interference from adjacent satellites can be avoided.

  Because of recent developments in digital technology, combining sound channels on a high-speed time division multiplexing (TDM) carrier has great potential, especially for high-quality stereo distribution.

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[7] Miller Communications Ltd., *Study of Digital Modulation and Multiplexing Techniques Appropriate to the Distribution of Radio Programs by Satellite.*

- For digital transmission the time division multiplexed subcarrier technique is more power-efficient than SCPC in the shared transponder operation.
- For digital transmission of high-quality radio programs, it is recommended that pulse-code modulation (PCM) be used for source coding. Continuous multiplexing of all sound channels should be employed because simpler receivers could then be used. Differential binary phase shift-keying (BPSK) and differential minimal shift-keying (MSK) are the most promising modulation techniques for dedicated transponder operation, while coherent quadrature phase shift-keying (QPSK) is more suitable for the shared transponder scenario due to its bandwidth efficiency. Error concealment techniques can also be used to improve subjective performance, and forward-acting error correction should be used to achieve better objective performance.

Although these technical options are presented here in the context of radio services, they can also be applied to other services, such as broadcast teletext (which provides a few hundred pages of information accessible to all users if transmitted in a channel shared with television, or a few thousand pages if transmitted in a dedicated channel) and similar data services.

Cost of major elements

Estimates of the cost of the most promising DBS system models were made by Spar using quotes from suppliers for buses which are currently available.[8] These have been modified slightly to allow for the more competitive bus supply situation which is expected to apply to the 50 dBW model. Modified estimates are given in table 12.

Table 12

Estimated system costs (millions of 1982 Canadian dollars)

System Model Description: EIRP

Beams/ orbits	Channels per beam	Spacecraft and launcher	Spacecraft cost	Launch cost	Spacecraft per system	System cost
Low 50 dBW						
4 beam	Initial 8	RCA-DBS	$89	$38	3	$ 381
2 orbit	Final 16	STS and PAM A	84	38	5	625
6 beam	Initial 10	RCA-DBS	82	38	4	490
3 orbit	Final 20	STS and PAM S	72	38	8	920
High 54 dBW						
4 beam	Initial 8	L-SAT	96	74	3	510
2 orbit	Final 16	Ariane 4	87	74	5	832
6 beam	Initial 10	L-SAT	90	74	4	656
3 orbit	Final 20	Ariane 4	82	74	8	1,280

8 *Direct Broadcasting Satellite System Concepts*, Spar Aerospace Limited.

To simplify cost comparisons between four-beam and six-beam models, the same spacecraft bus and payload costs were assumed for each. The initial channel capacity per beam of the six-beam spacecraft is assumed to be ten, while the four-beam spacecraft is assumed to have an initial capacity of eight channels. This reflects the lower per-channel power requirements of the six-beam design.

Table 12 shows that the low-EIRP systems cost approximately 75 per cent as much as the high-EIRP systems. This is surprisingly high considering that the low-EIRP spacecraft are one-half the size of the high-EIRP spacecraft, and that the launch costs are also about one-half. Several factors combine to produce this result.

- The weight and power demands of the low-EIRP spacecraft exceed the STS PAM D category of spacecraft and move into the PAM A category, increasing launch costs.
- The low-EIRP spacecraft estimate contains a high non-recurring element, characteristic of a stand-alone program.
- The high-EIRP spacecraft cost estimate contains a low non-recurring element (because a large part of the development has been absorbed in the L-SAT program) and a notably low recurring cost because of the forecast market for this size of bus.
- The duration and content of the spacecraft construction program were assumed to be identical for both categories of spacecraft, whereas in practice, program management costs would favor the smaller spacecraft.

Basis of estimates

Spacecraft costs for high-EIRP systems include budgetary quotations from British Aerospace for recurring and non-recurring costs of the L-SAT bus modified for maximum power operation. Payload, program management, integration and test estimates are based on current Spar experience, with allowances for program complexity and duration. TWTA cost and delivery indications provided by Telesat Canada are based on discussions with potential TWTA suppliers and apply to a relatively small quantity (approximately 20).

The program schedule is assumed to be the same for both high-power and low-power spacecraft and consists of an 18-month system definition and advanced development phase, followed by a 42-month design and fabrication phase. In practice, the duration of the program phases will vary for different spacecraft concepts, reflecting the maturity of the design and external factors such as timing and resource allocation.

Appendix 4 provides launch and spacecraft costs for other systems, both existing and planned, for purposes of comparison.

Cash flow

Estimated cash-flow requirements for representative low-EIRP and high-EIRP systems are shown in table 13. The system is assumed to be a four-beam system providing an initial eight channels per beam using two operating satellites and one spare. Cash-flows likely to be required for both spacecraft and launching are shown. The spacecraft cash-flow calculations are based on Telesat's experience with Anik D and are adjusted for the assumed DBS schedule and system components. The first two launches are assumed to take place in the same year, with the third taking place one year later.

Table 13

Estimated cash-flow for low-EIRP and high-EIRP four-beam DBS systems (in millions of 1982 Canadian dollars)

Year	Launches	Low-EIRP		High-EIRP	
		spacecraft	launch	spacecraft	launch
84		19		16	
85		19	18	24	35
86		72	36	77	70
87		89	36	96	71
88	first and second	40	19	43	37
89	third	28	5	32	9
Total		267	114	288	222
Grand total		381		510	

Future developments

The rapidity of technological change today makes predictions about the future harder than ever. The extrapolation of present trends beyond a few years is a notoriously unreliable method of forecasting. The prudent course, therefore, is to avoid as far as possible any decisions which foreclose future options, even if this necessitates adopting less than ideal solutions to current problems. This approach, supported by Canada at the 1979 WARC, has already paid off in that Region 2 is not tied into the rigid system adopted in other regions of the world.

It is essential to allocate orbital positions and to specify basic operating parameters within limits, but every effort must be made to avoid setting these limits too narrowly. For instance, individual channel bandwidths should not be constrained on the basis of existing practice. The heightened interest in high-definition television and the many non-television services which are being proposed may eventually make the use of larger bandwidths preferable. On the other hand, break-throughs in bandwidth reduction techniques could conceivably favor narrower channels. Thus, although allocations between nations have to be precisely defined and limited, within a nation the system must be as flexible and adaptable as possible. A good compromise is to establish a system which permits units of bandwidth to be combined, or sub-divided, as needed.

In the case of satellite power, the limits have to be established more specifically, since the minimum size of earth-station antenna will be determined by allowable inter-satellite and inter-system interference.

Receiver noise factor is frequently an area for potential improvement in a space system. However, considerable improvements have already taken place and receiver noise factors have been reduced from 6 dB in the late 1970s to less than 3 dB today. Further improvements in home receiver noise factors of more than a decibel will produce diminishing returns, since external sources of noise will limit possible gains.

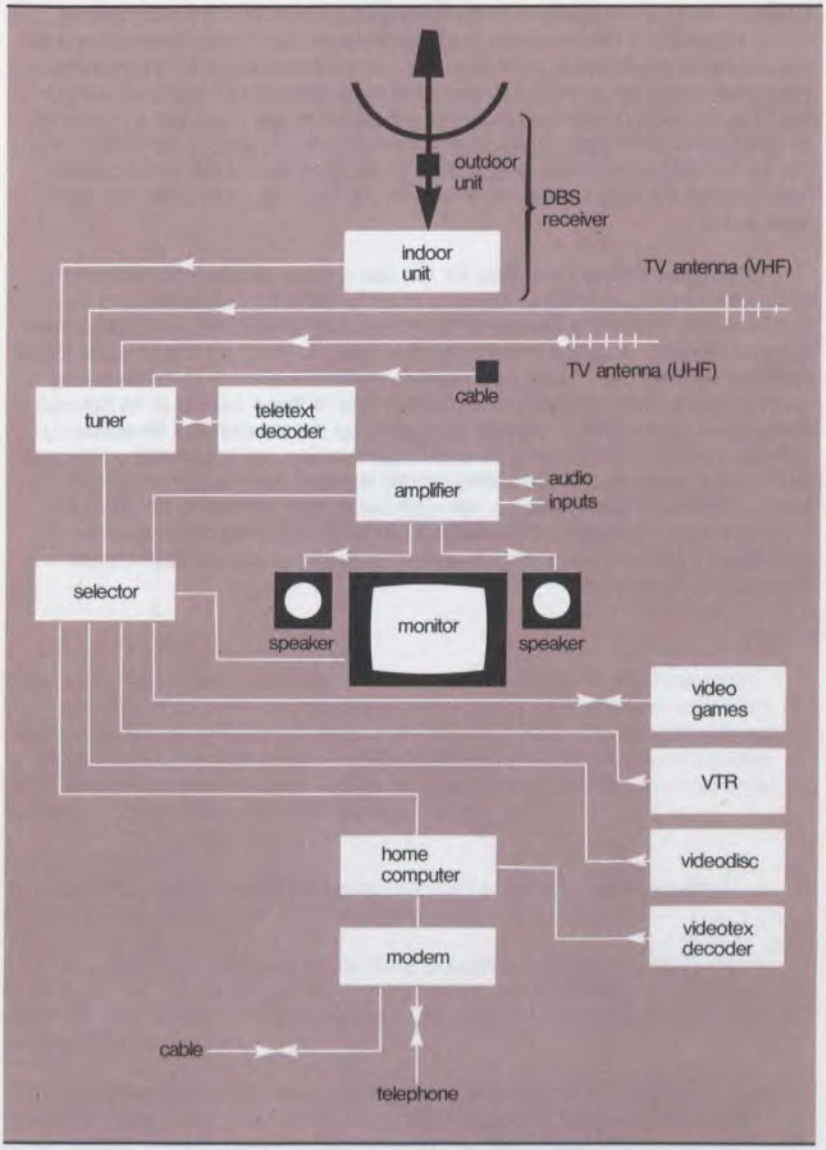
While the prediction of developments in technology is both important and hazardous, the prediction of market behavior is equally so. It is probably true to say that most recent predictions of market growth have erred on the optimistic side in terms of both the depth and the rate of market penetration by new technologies. For example, two decades ago it was confidently predicted that by the early 1980s we all would have unlimited supplies of nuclear electricity, cheap and abundant air travel, universal electronic funds transfer systems, and so on. What seems to happen is that before each new technology is universally applied, it is overtaken by a new one – or by some other imperative. Given this poor record in making predictions, planners should not confine planning to a scenario of rapid expansion until saturation is reached; they should also ensure that commercial operation can continue through a period of slow growth up to only a modest level of service. The phased approach suggested in table 10 would provide flexibility to adapt to actual growth conditions.

Bearing in mind the cautions expressed above, some consumer trends are clearly apparent at this time and should be taken into account. The first of these is a trend towards improved performance in television receiving equipment – better definition, larger screens, stereo sound. Secondly, there is a movement towards integration of audio and video equipment in a "component" or "building block" approach, as depicted in figure 15. This second tendency is in part a result of the proliferation of video input devices, which include video cameras, recorders and disc players, games and computer interfaces. Already stand-alone video monitors are coming onto the consumer market, and new TV receivers in France and Germany are being provided with RGB input connections which will permit easy interfacing with new input devices as they come along. Separate audio and video systems, for example, will be combined; there seems little sense in having an independent audio system for the television when most living rooms already boast a hi-fi system.

A third trend, which may not become universal but which also must be taken into account, is towards pay-TV in its various forms. Some of the issues related to its introduction are discussed elsewhere in this report. Pay-TV requires some technical features to prevent pirating of the signals. The method used to ensure that signals can be received only by those viewers who have paid to see them is known as scrambling. This is a technique whereby the video or audio signals (or both) are electronically processed in such a way as to make them unuseable unless the recipient is provided with de-scrambling equipment. This equipment may be individually addressable, that is, switched on and off by the incoming signals for each customer. Arrangements are made for the viewer to pay the signal originator for the privilege of watching a specific program or programs in exchange for activation of the de-scrambler. Various technologies have been proposed with varying degrees of security. High-security systems invariably employ digital techniques which permit numerical manipulation (encryption).

Figure 15

Components of a home video set-up



All the technical discussions so far have assumed the use of the standard NTSC (CCIR System "M") 525-line format for transmission of color television.[9] This system is universal in North America. In Europe, a 625-line format is used, together with two somewhat different methods for transmitting the color (chrominance) information. The two basic European systems have some advantages over that used in North America. However, all three were developed on the assumption that signals would be broadcast by terrestrial transmitters using amplitude modulation. This modulation technique is simple and effective, but it requires the transmitter to provide much higher power than is necessary for frequency modulation. For FM, the power is approximately constant. Because of this, all non-digital satellite DBS systems are likely to use FM, in view of the very high cost of satellite transmitter power.

The signal formats developed for AM use are not ideal for FM transmission for various reasons, in particular because noise tends to be concentrated at the high-frequency end of the baseband signal spectrum, where the chrominance information is situated. A unique opportunity now exists to introduce a new signal format optimized for DBS use. Some new signal formats have recently been proposed which appear to have significant advantages. One of these, known as Multiplexed Analog Component (MAC), originally developed by the Independent Broadcasting Authority (IBA) in Great Britain, shows particular promise and is now being examined as a possible basis for a broadcasting satellite standard, both in Europe and (in another version) in North America. Although much work remains to be done, this system promises significant performance improvement at small cost, while also permitting an optional greater degree of picture enhancement (for large screen projection) at higher cost.

[9] This is the standard established by the National Television System Committee.

6

Some economic considerations

This chapter begins with a discussion of the potential market for DBS services in Canada, based on information obtained from surveys conducted by market research firms in rural and urban Canada in 1981 and 1982. The chapter goes on to present an analysis of the costs of establishing and maintaining four alternative DBS systems and the revenues required to ensure their operation as commercial ventures. System costs are those given in chapter 5.

Potential markets

The consumer market for DBS-originated services in Canada has two distinct segments – the rural market and the urban market.

The rural market consists of the thinly populated regions of Canada where cable TV is not available and where there is little or no reception of over-the-air television. This market can be served by a DBS system through individually owned or leased home receivers.

The urban market is characterized by a high density of households in more populated areas. A large percentage of urban households could use individual home receivers, but most are expected to receive DBS programming through cable TV systems. The potential market for cable-distributed DBS programming is defined indirectly by the extent to which households have access to cable TV as well as by actual cable TV penetration.

Direct home reception and cable distribution are not the only alternatives, however. Clustered households may choose to be served with a community antenna and a low-cost secondary distribution system specially designed for small numbers of subscribers. Consumers considering this alternative would have to weigh such factors as convenience of reception, their perception of the best time to start receiving DBS services and the relative costs of home receivers and community systems.

A number of other important variables will affect the market for DBS services. Among these are the quantity and type of programming available, the pricing of subscription services and the split between advertiser-supported and subscription services. (More advertiser- or public-supported services could be expected to lead to a larger market because direct costs to consumers would be lower.)

In areas where cable TV systems already exist, the penetration of cable and its pricing will affect the home-reception market. The cost of a cable subscription and the nature and costs of services other than television that are available over cable will influence the choice consumers make between cable distribution and direct home reception.

The purchase price of receivers also will influence this choice. Because economies of scale can be achieved in mass production, the larger market will mean that more home receivers are needed and unit costs will be lower. Satellite power also can be expected to affect the price of receivers: higher-powered satellites will make it possible for consumers to use smaller, less expensive receiving dishes. The lower the cost of receivers, the easier it is for consumers to opt for direct home reception.

The rural market

Both rural and urban surveys were carried out to determine the potential market for DBS services. The results of the rural-market survey are reported in *An Analysis of the Demand for Improved Residential Television Service in Rural Canada*, by Demand Research Consultants Incorporated. The data for the analysis were obtained in a survey conducted in rural Canada in 1981 by Canadian Facts Ltd. Rural was defined as those census enumeration areas having a population density of greater than 0.8 persons per square mile, and up to 1,000 per square mile, but excluding any concentration of population over 2,500.

Interviewers administered a questionnaire in person to 2,667 rural householders, representing a survey universe of 1.48 million households or 84 per cent of rural and remote households in Canada as defined in chapter 4. These interviews were divided among five Canadian regions and were sufficient to allow estimates on the regional level of market demand to be made with an accuracy of plus or minus 5 per cent at the 95 per cent level of confidence. The hypothetical service offered to the survey respondents was described as requiring the purchase of a special reception unit (a DBS home receiver) and including the following features:

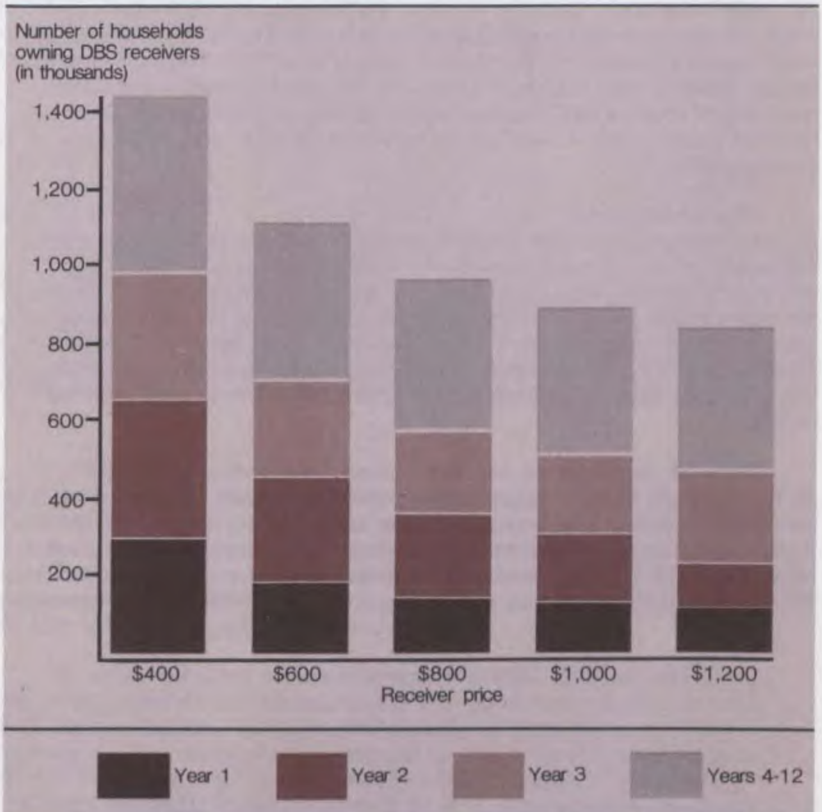
- availability of at least six different TV channels in the respondent's own language (English or French)
- excellent reception on each channel
- same type of programming as that currently received
- a new receiving unit which would replace all existing external equipment, including antenna, booster amplifier and antenna rotor.

Respondents were asked whether they would be willing to buy the new receivers at hypothetical prices of $400, $600 and $800. (The results later were projected to cover receivers costing $1,000 and $1,200.)

The survey findings are shown graphically in figure 16. At a price of $400, 1.44 million households out of the 1.48 represented in the survey would have purchased DBS receivers by the end of twelve years – a market penetration of 97 per cent. Higher receiver prices would mean lower market penetration. For example, at a hypothetical price of $800, 0.96 million rural households would purchase DBS receivers during a twelve-year period – 72 per cent of the potential market of 1.48 million.

Figure 16

Rural market forecast for DBS receivers by receiver price and year



Source: Based on *An Analysis of the Demand for Improved Residential Television Service in Rural Canada*, by Demand Research Consultants Incorporated.

An outstanding feature of the rural demand forecast is the rapid penetration rate. More than 50 per cent of the potential market would be penetrated within three years after DBS services became available, at any of the receiver prices. This is consistent with another finding of the survey that television ranked second only to roads as the public service perceived as needing the most improvement.

To forecast the total rural and remote market demand for a DBS service, adjustments were applied to the data to account for the total population and for population changes over time. For the latter, a 1 per cent annual rate of increase was taken to be a reasonable average until the mid-1990s.

A further factor influencing rural demand for DBS would be the effect of subscription fees if pay-TV were the only DBS service offered.[1] A probable rural-penetration figure for this scenario could be obtained by superimposing the pay-TV demand rate on the DBS-receiver demand rate to obtain a composite market-penetration curve.

Figure 17 shows projected rural market penetration for direct-to-home pay-TV service using Anik C beginning in 1984. On the assumption that a dedicated satellite system for direct broadcasting would be launched in 1988, the figure also shows market penetration for two sizes of home receiver (0.8 m and 1.2 m which typically would be used to receive signals from satellites broadcasting at 54 dBW and 50 dBW power levels.) The figure assumes that purchasers of Anik C home receivers would continue to use their equipment for reception from the higher-powered DBS system.[2]

The urban market

In 1981 there were 6.6 million urban households in Canada. Of these, 6.1 million had access to cable, although more than 1.5 million were not subscribers. About 540,000 households, however, did not have access to cable, either because of the failure of cable licensees to extend service to all households in their licensed areas or because areas remained unlicensed. All three classes of household are potential markets for DBS-delivered programming. Households with cable access would have the option of receiving services over cable or with an individual home receiver.

The urban market for DBS-delivered television is described in *The DBS Market in Canada*, by Woods Gordon Management Consultants. Data about the market were obtained through an urban survey carried out by Market Facts of Canada Ltd., using a questionnaire mailed to a panel of consumers. Four thousand urban households were screened for suitability to participate in the survey, nearly eighteen hundred questionnaires were distributed, and more than fourteen hundred

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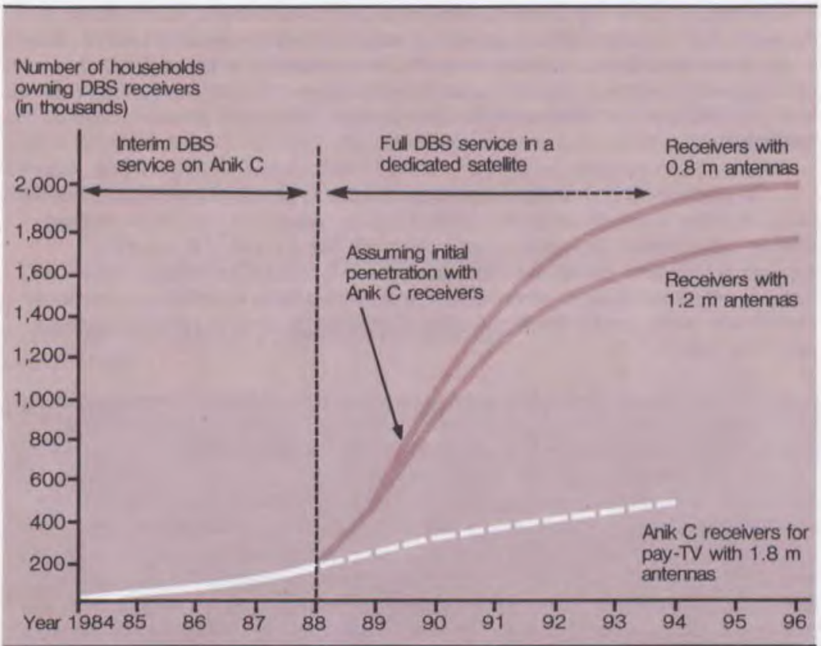
1 Northstar Home Theatre, Inc. has already developed plans to offer pay-TV via Anik C to subscribers who purchase home receivers.

2 Some Anik C receivers might require modification to work in the DBS frequency band. This will depend on whether the receiver was designed to work in both bands.

Figure 17

Home receiver market penetration forecasts – rural and remote areas



Note: The following assumptions were made about receiver price (1982 dollars).

Anik C 1984 – $1,200; 1985 – $1,000; thereafter $800

0.8 m 1988 – $600; 1989 – $500; thereafter $400

1.2 m 1988 – $600; thereafter $500

returns were received. Participants were asked numerous questions, including whether they would buy a DBS receiver at prices of $400, $600, $800 and $1,200 and whether they would prefer to receive the same service on cable for a subscription fee. Programming scenarios described ranged from programming available from a Canadian DBS system only to programming which could be available from both Canadian and U.S. DBS systems.

The survey found that projected penetration of DBS home receivers in urban areas would be much more sensitive to price than penetration in rural areas would be, as might be expected considering the availability of alternative sources of TV programming. Data resulting from the analysis by Woods Gordon indicate that the market at a $600 price for receivers would be only one third of the market at a $400 price, and would virtually disappear at $1,200. Among householders with cable available to them, cable subscribers are more interested in home receivers than are non-subscribers, reflecting their orientation toward more TV. The survey showed that cable subscribers received an average of thirteen channels satisfactorily, while non-subscribers received only six. Those without cable available showed only a slightly greater interest in home receivers than cable subscribers. This group indicated that seven channels could be received satisfactorily over the air.

The availability of U.S. programming was found to have a significant effect on the market. (U.S. programming would be available because receiver owners might point their antennas at U.S. as well as Canadian satellites.) Two examples from the Woods Gordon report will be cited here.[3] For the case of a $400 receiver price, the market penetration by the year 1996 was projected to be 889,000 if full American and Canadian DBS programming were receivable, dropping to 218,000 if only Canadian DBS service were available. For a receiver price of $800, the corresponding market penetration was projected to be 178,000 if both Canadian and U.S. DBS services were available, falling to 56,000 if only Canadian services were available.

In practice, all U.S. DBS services are unlikely to be available to Canadians because many channels will be transmitted in scrambled form and will be available only by subscription. However, all indications are that a number of advertiser-supported networks, public and some special services such as religious broadcasting, will be transmitted without scrambling. This is likely to satisfy most receiver purchasers, since survey results indicated a preference for U.S. network channels over U.S. pay-TV.

The study data have been used to generate a "most likely" forecast of the home-receiver market among urban householders. This forecast assumes that direct-to-home service using Anik C will be of little interest to urban Canadians because this programming is already available on cable and Anik C receivers are comparatively large and expensive. Consequently, an urban market for home receivers would develop only after a dedicated DBS system was implemented; implementation is assumed to take place in 1988. By that time the price is expected to be falling on the way to an eventual level of $400 because of mass production for the U.S. market. In addition to accessing programming on a Canadian DBS system, it was assumed that most receivers could be used to access any programming transmitted unscrambled on U.S. satellites. Figure 18 gives a projected penetration of the "most likely" urban market. Eight years after a dedicated DBS system became available, six hundred thousand urban households – some 10 per cent of the urban market – would be expected to own 0.8 m receivers. If 1.2 m receivers are required, the urban market is forecast to be three hundred thousand.

From figures 17 and 18, the total rural and urban market forecast is for 2.5 million 0.8 m receivers by 1996, assuming that a 54 dBW Canadian DBS system is launched in 1988, or 2.0 million 1.2 m receivers if a 50 dBW system is launched. The accuracy of the forecast is, of course, dependent on how the assumptions used in the surveys match market conditions at the time service is offered. Programming carried on a DBS system should also be accessible to about 5.8 million households via cable if cable operators choose to distribute it.

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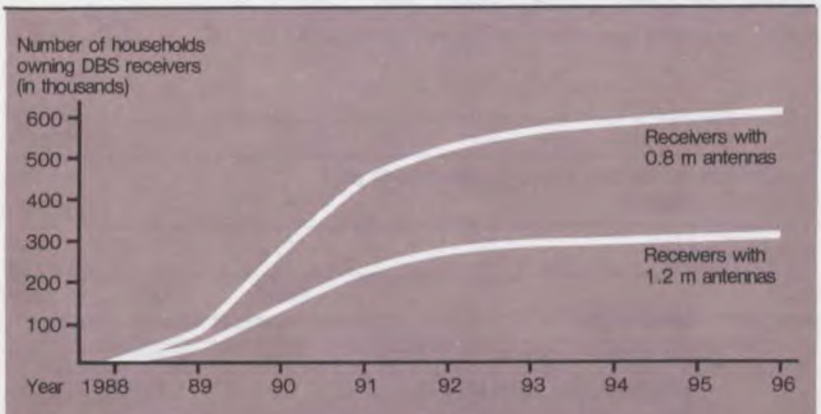
[3] Tables E7 and E8, *The DBS Market in Canada*,, Woods Gordon Management Consultants.

Canadian market distribution

The Canadian DBS market would be divided into four or six areas corresponding to the coverage areas served by the satellite beams.[4] The population in each service area is shown in table 14. In the six-beam case there are more than five times as many people in the service area with the highest population as in the area with the lowest. In the four-beam case, the disparity is somewhat less severe. While this uneven population distribution will not affect services offered to the total market, it will have implications for commercially supported service offered in the individual beams. For example, the greater number of households in Ontario and Quebec beams would be a more attractive market for advertiser-supported and subscription services, and the per household cost of publicly supported services would be considerably lower than in the less populated coverage areas.

Figure 18

Home receiver market penetration forecasts - urban areas



Note: Based on assumption that all Canadian services would be available, that unscrambled U.S. DBS channels would be receivable by most Canadians, and that a dedicated DBS system would become available in 1988.

DBS systems as commercial operations

The operation of DBS systems as commercially profitable ventures will depend on their earning enough revenues to cover expenses and provide for an adequate return on investment. The following analyses assume that the commercial operation of a DBS system consists of two different types of businesses: satellite operators and DBS broadcasters. The role of the satellite operator is to procure, launch and

[4] See chapter 5 for an illustration of the coverage areas.

operate a DBS satellite. The satellite operator earns revenue by leasing satellite capacity to broadcasters. The DBS broadcaster uses satellite capacity leased from the satellite operator to distribute programming to consumers and recovers the cost of program delivery from advertising or subscription sales, from publicly supported programs or from a combination of these.

Financial analyses were carried out for four system alternatives based on two different satellite-power levels (50 dBW and 54 dBW) and on four-beam and six-beam coverage of Canada. The total cost to the satellite operator includes capital costs for satellite design, construction, launch and insurance; and operating costs for satellite telemetry, tracking and control. The total cost to the television broadcaster for program delivery includes capital costs for satellite uplinks and operating costs for equipment maintenance and lease of satellite capacity. Tables 15 and 16 show cash flow requirements for satellites, launches, insurance, tracking stations and uplink stations for each of the four DBS system alternatives considered. Satellite and launch costs are those given in chapter 5.

An internal rate of return method was used to calculate the revenue required to provide an adequate return on investment to satellite operators and broadcasters. The calculation was based on the system costs shown in tables 15 and 16 and on the market penetration rates shown in figures 17 and 18.

Table 14

Population in service areas for six-beam and four-beam models

Six-beam model

Beam number	**Service area**	**Rural**	**Urban**	**Total**
		Number of people (in thousands)		
1	**Pacific (B.C./Y.T.)**	620	2,180	2,800
2	**Mountain (Alta./Sask./N.W.T.)**	990	1,710	2,700
3	**Central (Sask./Man./N.W.T.)**	340	1,260	1,600
4	**Ontario**	1,700	7,000	8,700
5	**Quebec (Que./N.W.T.)**	1,500	5,000	6,500
6	**Atlantic**	1,120	1,180	2,300
Total		6,270	18,330	24,600

Four-beam model

Beam number	**Service area**	**Rural**	**Urban**	**Total**
		Number of people (in thousands)		
1	**Western (B.C./Alta./Y.T./N.W.T.)**	1,140	3,960	5,100
2	**Central (Sask./Man./N.W.T.)**	810	1,190	2,000
3	**Ontario**	1,700	7,000	8,700
4	**Eastern (Que./Atl./N.W.T.)**	2,620	6,180	8,800
Total		6,270	18,330	24,600

A real rate of return (that is, the rate of return after the effect of inflation is removed) of 6 per cent was used in estimating the revenue required by a commercial DBS. This is slightly higher than the historic real rates of return in the telecommunications industry which range from 4 to 5 per cent.

Table 15

Costs of implementing a four-beam DBS system

Launch date	1988
Satellites – operating	2
– spare (in orbit)	1
Channels per beam	8
Uplinks per channel	1

Capital costs (millions of 1982 dollars)

	1984	1985	1986	1987	1988	1989	Total
50 dBW satellites	18.7	18.7	72.1	89.0	40.0	28.5	267.0
Launches		17.9	36.0	36.5	19.0	4.6	114.0
Insurance					11.2	5.6	16.8
54 dBW satellites	20.2	20.2	77.8	96.0	43.2	30.7	288.0
Launches		34.8	70.3	71.0	37.0	8.9	222.0
Insurance					15.4	7.7	23.1
Tracking, telemetry and control				4.0			4.0
Uplinks (32)					9.6		9.6
Totals							
50 dBW system	18.7	36.6	108.1	129.5	79.8	38.7	411.4
54 dBW system	20.2	55.0	148.1	168.0	105.2	47.3	546.7

Operating costs (annually, 1988 onwards)

Tracking, telemetry and control	$300,000
Uplinks	$1,150,000

Table 16

Costs of implementing a six-beam DBS system

Launch date	1988
Satellites – operating	3
– spare (in orbit)	1
Channels per beam	10
Uplinks per channel	1

Capital costs (millions of 1982 dollars)

	1984	1985	1986	1987	1988	1989	Total
50 dBW satellites	24.6	24.6	90.2	106.6	45.1	36.9	328.0
Launches		22.8	49.4	49.4	22.8	7.6	152.0
Insurance					16.8	5.6	22.4
54 dBW satellites	27.0	27.0	99.0	117.0	49.5	40.5	360.0
Launches		44.4	96.2	96.2	44.4	14.8	296.0
Insurance					23.1	7.7	30.8
Tracking, telemetry and control				6.0			6.0
Uplinks (60)					18.0		18.0
Totals							
50 dBW system	24.6	47.4	139.6	162.0	102.7	50.1	526.4
54 dBW system	27.0	71.4	195.2	219.2	135.0	63.0	710.8

Operating costs (annually, 1988 onwards)

Tracking, telemetry and control	$450,000
Uplinks	$2,160,000

In the calculation of annual channel cost, full leasing of all satellite channels was assumed for a period of seven and a half years and a real rate of return of 6 per cent was allocated to the satellite operator. In the calculation of monthly costs per subscriber, costs were assumed to be the lease fees paid by TV broadcasters for the satellite channels plus a further 6 per cent real rate of return allocated to the broadcasters. The results of the calculations are shown in table 17.

Since a detailed system model providing a 57 dBW power link was not studied, corresponding costs estimates for implementing a system were not developed. However, it is a reasonable assumption that it would require twice the number of operating satellites as the 54 dBW system, and would cost nearly twice as much to implement. (Twice the number of spares would not necessarily be required). However, the market could not be assumed to increase over that for a 54 dBW system. Despite the higher satellite power, receiver antenna size could not be reduced much below 0.8 m because the wider beam of a smaller antenna would increase interference from a satellite serving neighboring areas to levels affecting picture quality.

Table 17

Financial analysis of alternative DBS system models for Canadian service (constant 1982 dollars)

Canada coverage	Four-beam model		Six-beam model	
Satellite power level	50 dBW	54 dBW	50 dBW	54 dBW
Capital costs of space segement	$402 M	$537 M	$508 M	$693 M
Annual cost per channel	$2.4 M	$3.2 M	$1.6 M	$2.2 M
Number of channels	8	8	10	10
Rural market only				
Subscribers	1.7 M	1.95 M	1.7 M	1.95 M
Monthly cost per subscriber for all channels	$6.01	$7.02	$7.75	$9.17
Monthly cost per subscriber per channel *	$ .75	$ .88	$ .78	$ .92
Rural and urban markets combined				
Subscribers	2.0 M	2.55 M	2.0 M	2.55 M
Monthly cost per subscriber for all channels	$5.15	$5.41	$6.63	$7.08
Monthly cost per subscriber per channel *	$ .64	$ .67	$ .66	$ .71

* Assuming all subscribers take all channels.

Note: Calculations of costs include a real rate of return of 6 per cent.
Source: Department of Communications.

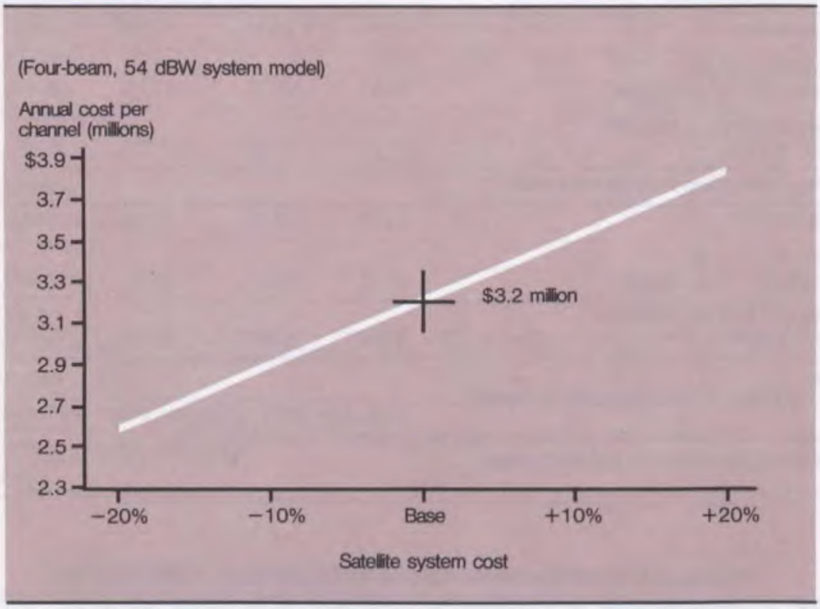
The cost of DBS service will be sensitive to satellite costs, market size and rate of return expected. To investigate cost sensitivity, these factors have been varied for one example, the four-beam 54 dBW system model. Similar results can be expected for the other models. Figure 19 shows the variation in the annual cost per channel as the cost of implementing the space segment varies from minus 20 per cent to plus 20 per cent of the $537 million cost shown in table 17. The figure shows a linear relationship with annual channel costs varying in proportion to capital cost.

The calculation of the cost of delivering television via DBS was based on projections derived from surveys carried out in 1981 and 1982. When a DBS system is implemented, the actual market may be different because of conditions prevailing at that time. Figure 20 shows the variation in monthly cost per subscriber if the total market size (rural and urban) varies from minus 20 per cent to plus 20 per cent. As the market size declines monthly costs rise more steeply. The rate of fall in monthly costs declines as market size increases. If the market size by 1996 was two million rather than two and a half-million – a decrease of 20 per cent – the monthly cost per subscriber would be $6.75 rather than $5.41 – an increase of 25 per cent. On the other hand, a 20 per cent increase in the market shows only a 16 per cent decrease in monthly cost per subscriber.

The variation in annual cost per satellite channel with variations in rate of return is shown in figure 21. A reduction in rate of return from 6 per cent to 4 per cent would result in a 10 per cent decrease in annual cost per channel. An increase in rate of return to 8 per cent would result in a 12 per cent increase in annual cost per channel.

Figure 19

Sensitivity of annual cost per channel to satellite system capital costs



The cost of delivering a single channel of television via a DBS system, as postulated by the models, falls in the range of \$.65 to \$.70 per household per month for the total projected market, or \$.75 to \$.90 per household per month for the rural market only. To give an idea of their relative magnitude vis-à-vis broadcasting industry costs and revenues, these figures can be compared with some statistics concerning existing commercial ventures that deliver television programs.

Figure 20

Sensitivity of monthly cost per subscriber to market size

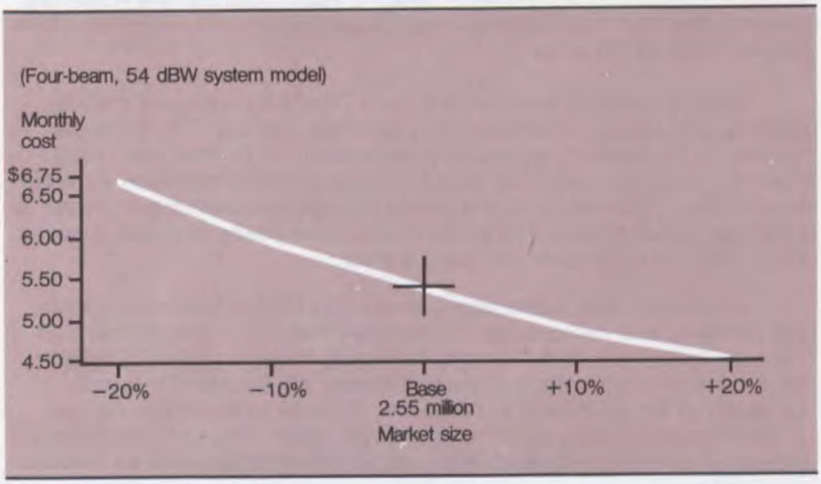
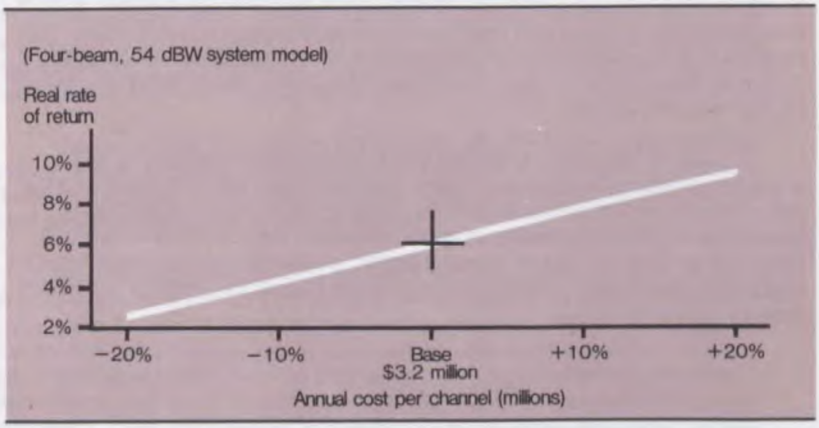


Figure 21

Sensitivity of satellite channel costs to real rate of return



The majority of existing television broadcasting is supported by advertising. Revenues from the sale of advertising time are used to pay for program material and for program delivery. In 1982, Canadian television broadcasters reported net advertising revenues of $779 million.[5] With 7.6 million urban and rural households receiving television,[6] the average advertising expenditure per household was $103 per year or $8.55 per month.

A limited number of television channels in Canada are supported solely or in part by public funds. Seventy-five per cent of the operating costs of the CBC, for instance, is covered by parliamentary appropriation. In the fiscal year ending March 31, 1982, the cost to the CBC for television network distribution amounted to $38 million.[7] The cost for CBC's national program distribution of one channel via a DBS system would range from $9.6 million for a low-power, four-beam system to $13.2 million for a high-power, six-beam system.

In February 1983, subscription television (pay-TV) was launched in Canada. The monthly cost to the consumer for each pay-TV service is approximately $16. This subscription fee is divided more or less evenly between the pay-TV operator for procurement and packaging of program material and the cable TV operator for delivery of the programs to the consumer. Thus the cable share of the cost of pay-TV is approximately $8 per subscriber per month. Of course, this includes marketing, operating costs, billing, and so on, as well as some portion for the actual signal delivery.

Although this comparison of DBS with existing commercial television distribution operations is extremely general, it suggests that the cost of delivery of television via DBS is in a reasonable range.

The analysis presented in this chapter also shows the amount of revenue required for each of the four different satellite-system models to be operated as commercial ventures. Although the higher-power systems require greater capital investment, there is little difference between the lower-power and higher-power systems in channel costs per subscriber. This is due mainly to the larger market forecast for the higher-power system.

It could be concluded, therefore, that the higher-power system would be of greater benefit to the consumer; home receivers would be a little lower in price, and social, cultural and broadcast policy benefits would accrue to more people because of the larger penetration of home receivers. The fact remains, however, that implementation of a higher-powered system would represent a greater financing challenge because a larger initial investment would have to be made by the satellite operator.

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5 *The Globe and Mail*, Toronto, November 5, 1982.

6 *DOC Annual Report*, 1980-81.

7 *CBC Annual Report*, 1981-1982. Contracts for satellite and microwave distribution for its four network services.

7

Some factors particular to the establishment of DBS in Canada

Establishment of a DBS system should take into consideration the existing satellite and broadcasting situation. In Canada several factors require examination: the existence of Anik C – a satellite system which could be used to initiate service, the high penetration of cable in urban areas, the spillover of U.S. DBS services, and the need for achieving economies to serve a large area with a relatively small population.

The use of Anik C for interim DBS service would help in securing the initial market, at least in the non-cabled areas of the country. During an interim-service period of about five years, a marketing plan could be developed to stimulate the rapid growth and adoption of DBS in Canada.

Although the market for DBS service in rural and remote areas would appear to be sufficient to support a DBS system, the prospect of an additional urban market would make it easier to attract start-up funding. However, this would call into question present policy with respect to superstations. Significant penetration of the urban market would depend on the DBS system carrying programming for cable distribution as well as for direct home reception. As market surveys have shown, penetration of the urban market by individual home receivers will depend on their cost. The large audience of the combined rural and urban markets would contribute particularly to the viability of advertiser supported and subscription DBS services.

The development of a Canadian DBS system could also be affected by the spillover of American DBS services. A competitive Canadian response would be required if the impact of such spillover on the Canadian broadcasting industry was foreseen to be significantly negative.

Anik C as an interim DBS service

The launch of the Canada's first commercial 14/12 GHz satellite, Anik C3, in November 1982 marked the establishment of a Canadian satellite system capable of providing television and radio services to virtually all Canadians. Although 6/4 GHz satellite systems have already improved services greatly to underserved areas in Canada, it is estimated that about 1 per cent of Canadians still do not receive CBC programs and some 800,000 households in less densely populated areas where terrestrial distribution facilities are not economically viable would not be able to receive Cancom services. Anik C now offers the possibility of an interim direct broadcasting satellite service which could be accessed by these people. Anik C is already being used for the delivery of television services to cable systems and there are plans to also market pay-TV programs delivered by Anik C directly to homes in non-cabled areas.

Anik C is capable of providing acceptable direct broadcasting service if the antenna size of home receivers is about 1.2 m and a single TV program signal per satellite channel is transmitted. If two TV program signals per satellite channel are to be transmitted, antenna size must be increased to 1.8 m. In effect, Anik C can be considered a quasi direct broadcasting satellite.

Through on-board switching, the footprints of the Anik C satellites can be configured to provide four-beam or two-beam coverage of Canada. This is shown in figure 22, where a 0.25° northern tilt of the antenna pattern is assumed in order to improve coverage of northern Canada and a single TV program signal per satellite channel is transmitted. Sixteen satellite channels are available on Anik C. In the four-beam coverage mode, four satellite channels are available in each beam; in the two-beam mode, eight satellite channels are available in each half of the country.

Since the Anik C satellite will operate at a slightly different frequency than will future DBS systems, owners of receivers would need to make some adjustments to their equipment when future DBS systems start broadcasting. However, these would not be major if the need for the adjustment were taken into account in the original design of receivers.

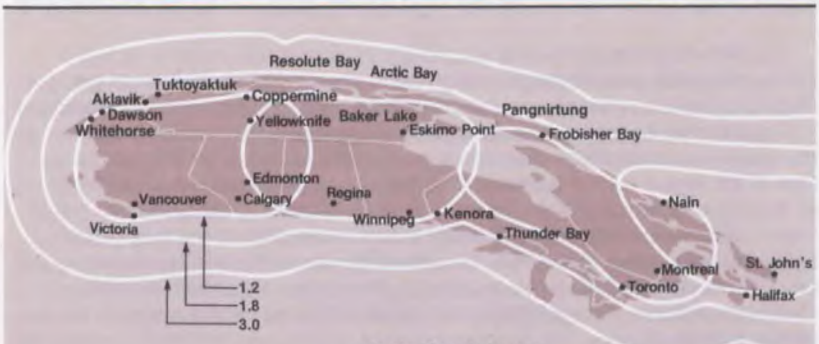
Market for interim DBS service

The economic viability of an interim DBS service on Anik C would depend on the availability of a package of programs sufficiently attractive that potential viewers will be willing to invest in receivers. Such a package could consist of basic Canadian television services such as CBC or CBC specialized programs, educational television programs, private advertiser-supported television stations or networks, and pay-TV services.

The largest potential market for direct home reception of DBS services is in presently underserved rural and remote areas of Canada. There are more than 1.5 million households in such areas, too dispersed to be served by cable distribution systems. The Rural Demand Survey described in chapter 6 found that within the first three years more than half of this market could be expected to be penetrated at a $400 receiver-price level, and one third of the market at $1,200 per unit. Even at the highest end of the price-range, perhaps typical of what a receiver suitable for Anik C would cost when first introduced, 60 per cent of rural households could be expected to buy one eventually. However, some part of this market would also have access to Cancom signals delivered by cable or rebroadcast and might be attracted by the fact that a special receiver does not need to be purchased for Cancom services.

Size of home receiver antennas required with Anik C

Anik C terminal size in metres 0.25° northern tilt
1 TV channel per RF channel S/N.42dB C/N.12dB



Quarter Canada beams

Half Canada beams

Cost and economic viability

Each Anik C provides 16 satellite channels, each of which costs approximately $1.8 million (1982 dollars) a year to lease on an unprotected non-preemptible basis. Each channel can carry one or two television programs, and transmit into either quarter-Canada or half-Canada beams. Ideally, a DBS service on Anik C would carry one television program per channel and use quarter-Canada beams. This would result in a satellite cost of about $7.2 million per television channel for full-Canada coverage. This cost could be reduced to one-half using half-Canada beams, while still retaining the use of 1.2 m antennas. Use of half-Canada beams would, however, result in some loss of time-zone sensitivity. Pay-TV operators and other Anik C lessees are actually carrying two television channels per satellite channel in half-Canada and quarter-Canada beams, thus achieving the minimum cost of $1.8 million per television channel for full-Canada coverage and $0.9 million for half-Canada coverage.

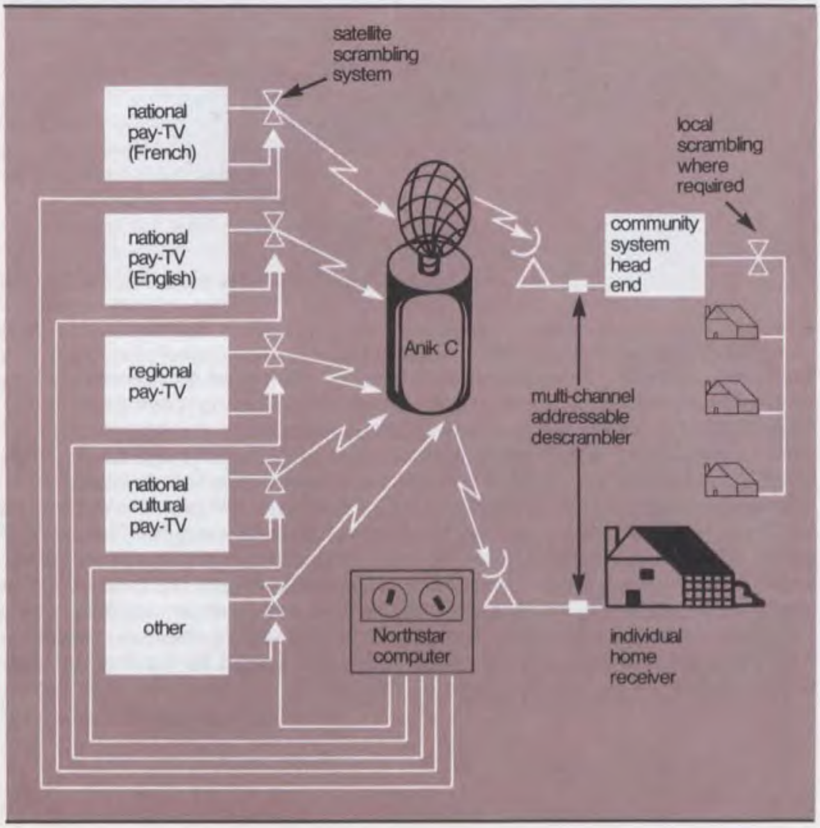
There could be a substantial demand for a direct-to-home service on Anik C, given that more than one million householders have indicated a willingness to purchase receivers if a sufficiently attractive package of programs is available. However, studies indicate that in the first few years, before there is any significant market penetration, these services would require a market base beyond the direct-to-home market to become economically viable. This base could be provided by cable carriage of television signals delivered by Anik C.

Current plans for Anik C

Private and public interests began using Anik C in early 1983. While most have used two television channels per satellite channel, a mode which normally requires 1.8 m antennas for reception, some users have indicated they would consider changing to a one-television-channel-per-satellite-channel mode within a year or so. One of the largest current applications of Anik C is distribution of pay-TV. Pay-TV is, therefore, technically receivable with 1.8 m, or possibly in the future with 1.2 m home receivers, with performance similar to that experienced in the Anik B field trials. Northstar Home Theatre Inc. has offered to market the programming of pay-TV licensees via DBS home receivers in those areas not served by cable distribution systems. The Northstar direct satellite-to-home television system is shown in figure 23.

Figure 23

Northstar Home Theatre Inc. direct satellite-to-home television system



In addition to pay-TV, several regionally oriented educational and commercial television services are distributed via Anik C. While these services are intended principally for reception by cable head-ends and subsequent distribution to households via cable systems, DBS receivers with antennas small enough for individual home installation could be used to extend these services to areas not served by cable. Direct broadcasting from Anik C to small home receivers thus could become an operational service in Canada in 1983.

A U.S. company has proposed to broadcast five channels of entertainment programs via Anik C direct to homes in the eastern United States, transmitting one television channel per satellite channel. While these programs would be intended for reception only in the United States and are expected to be scrambled they could be received by some householders in eastern Canada equipped with home receivers with antennas as small as 1.2 m in diameter.

Although the availability of Anik C for interim DBS services predates the higher-powered DBS era, the operational services planned on Anik C will establish a trend that could influence the direction and development of a dedicated DBS system. At present, the principal application of Anik C technology in Canada is distribution of television programs to terrestrial redistribution systems rather than direct-to-home broadcasting. Even if a significant number of rural and remote households purchase home receivers and subscribe to pay-services provided on Anik C, the major revenues will come from cable operations which carry these programs. Inevitably, this will create an environment, form attitudes, and shape institutional arrangements for the immediate future which will raise issues concerning the post Anik C satellite systems. One effect might be consideration of continued use of systems like Anik C rather than establishment of a higher powered DBS system in Canada. Such a system would mean that the Canadian system would not be compatible with U.S. high-powered DBS systems and that individuals could not use the same equipment to receive programming from both systems.

The implementation of an interim DBS service in Canada would have a number of benefits. There would be an immediate improvement in the availability of television services to Canadians, particularly to the currently underserved population. A market base would be developed that would enhance the economic viability of a later higher-capacity, higher-power and more costly system. Such an interim service would enable a Canadian system to evolve along with U.S. DBS services which may begin in 1983 on the Anik C system. An interim DBS service would also result in economic benefits if a large percentage of the receivers were to be manufactured in Canada. This would create employment in manufacturing, sales, installation and maintenance. This domestic production would also place Canadian industry in a good position to compete in the export market, particularly in the United States.

Urban penetration issues

While television services delivered by DBS are expected to be of primary interest to the underserved rural population, the commercial success of DBS would be more assured if at least some of the programming were attractive to the urban market. Of course, the urban market need not be served with individual home receivers; cable-served households would undoubtedly find it more convenient to receive DBS programming via cable. As shown in the Tamec study on the economics of program packages that might be carried on a DBS system,[1] the additional market represented by urban viewers would be of particular importance to commercially supported programming where advertising revenues are determined by the size of the potential viewing audience. Subscription-supported programming would also benefit from an enlarged potential market.

The most important factor in attracting urban viewers would undoubtedly be the nature of programming carried by DBS. It could not merely duplicate fare already available, but would have to be competitive in content and quality and be attractive to all Canadians.

The Tamec study concluded that a number of programming packages could be commercially viable. These can be characterized as being new; addressing a large audience; competing with programming which is presently popular, profitable and lacking competition; or filling a specific regional need. Pay-TV, French-language general entertainment for Quebec, all-Canada general entertainment, and general entertainment for Atlantic Canada are examples of such programs. Other program packages of a more specialized nature could also be viable if the national coverage afforded by DBS aggregated a large enough audience.

When both the cable and the direct-to-home television markets are considered, about 70 per cent of the householders would receive DBS programming via cable, and 30 per cent through individual home receivers. By the time a full-fledged DBS system could be launched, many television programs will be delivered to cable systems via the Anik C and Anik D fixed service satellites, and some penetration of the individual home market may have taken place with Anik C. However, the remaining direct home reception market would probably still be large enough to warrant broadcasters changing from fixed to direct broadcasting satellites. Thus a DBS system would fulfill the dual function of distribution to cable head-ends and direct broadcasting. The direct home reception market would then need to warrant only the difference in cost between transmitting via DBS and using Anik C or Anik D. This would result in a reduced cost per television channel per subscriber over costs calculated in chapter 6.

[1] *A Feasibility Study for a Canadian DBS Program Package*, Tamec Inc.

A high penetration of home receivers in the urban market is not expected if programming carried by a Canadian DBS were to be available on cable. However, some penetration will undoubtedly take place. Some reasons were suggested by the urban market survey. Among these were the desire to receive U.S. DBS programs not available via cable; a decision that the selection of programming available from both Canadian and U.S. DBS systems was an adequate alternative to the selection available on cable; the desire to own receiving equipment rather than pay a monthly fee; and the desire for better reception quality. Television systems giving enhanced quality television pictures, such as the multiplexed analog component (MAC) system, may also be introduced on DBS, and persuade urban householders to purchase home receivers. The degree to which these motivations influence urban penetration will depend largely on market factors prevalent at the time.

Carriage of DBS service by cable

Several analyses conducted within the DBS Studies Program suggest that cable licensees should carry DBS service to improve the economic viability of a Canadian DBS system.[2] If DBS service were offered on a subscription basis, it could be marketed as part of a cable operator's tiered structure. Cable operators will no doubt be eager to carry DBS programming not otherwise available, given their desire to offer a wider range of services to subscribers.

Small cable systems generally do not have the capacity to accommodate a great deal of additional programming. An initial DBS service is postulated as providing eight channels, growing to 16 and eventually to 36 or more. Some of the initial eight channels can be expected to be transferred to a DBS system from fixed service satellites, and thus would already be on cable, but some will be new and certainly growth is most likely to arise from more new program offerings. Of the more than 600 cable systems in Canada, many small systems can carry only 12 channels. For these systems to carry additional programming, and indeed to compete with DBS on a capacity basis, they will have to upgrade their plant. As of 1981, the total investment in cable system plant was $767 million on which the net profit after taxes as a percentage of revenue has been decreasing significantly (4.4 per cent in 1981 vs. 9.3 percent in 1976).[3] As a result the rate of investment in plant has also been decreasing. These financial circumstances may prevent many of these smaller systems from expanding their capacity to carry additional programming. This fact could lead to increased domination of the market by a limited number of large operators who would be in a position to acquire the smaller cable companies and to invest the funds for the necessary system upgrading.

If cable carriage of DBS signals is to be allowed, then the CRTC's "must carry" rules will need re-interpretation or modification. At present, cable TV continues to be regulated on the premise that extension and expansion of cable should be done in such a way as to protect the over the air broadcasting system. The major components of the CRTC's cable TV policy have been designed with the protection of local Canadian broadcast stations in mind, and in his report, *Regulatory and Policy Implications of a Direct Broadcasting Satellite System*, Spiller argues that such a philosophy would need to be modified given the thrust of technological developments which will permit direct home reception of satellite signals. It should be noted that under section 3 of the existing Radio Act a receiver intended only for

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[2] *A Feasibility Study for a Canadian DBS Program Package*, and *Cost Analysis of Alternative Arrangements for the Delivery of DBS Signals*, Tamec Inc.

[3] *Cable Television*, Statistics Canada, Publication No. 56-205.

reception of broadcast signals or in combination with any other radiocommunication approved by a regulation made by the Minister is exempt from any radio licensing requirements. Thus any signal on a DBS, be it Canadian or American, might be available for reception without the requirement for a radio licence. Consequently, the continuation of a policy intended to protect local stations may well have to be based on a different approach.

With a broadcasting infrastructure which would be dominated by satellite delivery and cable distribution, the continued operation of the existing terrestrial distribution by VHF/UHF transmitters will become a question. Cable penetration is so high that in some areas a large majority, in some instances approaching 90 per cent, of the viewing of the local television station is via cable rather than directly over the air. A development over the long term if DBS home receiver penetration reaches very high percentages could be that some broadcasters may decide to phase out their terrestrial transmitters. This could result in overall cost saving and at the same time release valuable spectrum for other uses. Their services would then be delivered only via cable or direct-to-home via satellite.

Affordable home receivers

The unit cost of DBS home receivers would have an impact on the market penetration of a new DBS service in rural areas during the first years of operation. In more urban areas, however, where a majority of DBS viewers would receive DBS signals not through individually owned receivers but through local cable or MATV distribution systems, the unit cost of earth stations would likely have no measurable impact on the success of DBS services. This cost would be of little concern to cable operators since in most cases it would be extremely small in relation to the overall capital outlay for cable systems.

The largest number of DBS receivers is expected to be purchased by residents in rural Canada who, for economic reasons, will not be served by local community distribution systems. An investigation of the relative importance of selected attributes of television service indicated that in Canada price is of primary importance.[4] Several studies have investigated the sensitivity of market penetration rates to variations in the cost of earth terminals. In the case of improved TV service through satellite technology, the Rural Demand Survey indicated that a little over a quarter (27 per cent) of the rural population would be interested in purchasing a DBS receiver at a price of $400 in the first year the service was offered. This percentage would fall to 18 per cent if the DBS receivers cost $800.

Projections for the likely cost of earth stations, based upon volume production, indicate that the likely bottom line figure will be in the range of $400 to $500 (1982 Canadian dollars). This figure would include the outdoor antenna, low noise amplifier and demodulator required to operate with the basic television sets available on the market today. In the United States, the Satellite Television Corporation (a wholly owned subsidiary of COMSAT, the Communications Satellite Corporation) in promoting its DBS plans has quoted earth station costs in the range of $200 to 300 (U.S.).

4 *An Analysis of the Demand for Improved Residential Television Service in Rural Canada*, Demand Research Consultants Incorporated.

There is every likelihood that the domestic television sets in the next decade will be satellite compatible. Manufacturers are presently developing plug-in modules for sets which would eliminate the need for the indoor units associated with today's DBS home receivers. This in fact follows a natural progression in the design of domestic television receivers. Early models were equipped with front-end tuners for the VHF band (channels 2-13) only; later designs included UHF tuners; and current models are cable-compatible (the external converter used with cable systems is already built into the set, allowing for the reception of signals distributed on the mid-band and super-band channels of cable systems). The next logical step is to market a set containing the additional electronics necessary for satellite reception, at least as an option. This could assist in keeping the costs of DBS receiving equipment down to a figure as low as $300 more than the cost of a basic set.

At present, it would appear that a price-range between $500 and $700 for DBS receivers would be acceptable to a large majority of the potential market. The cost would have to include the decoding equipment which would be required for premium services distributed via DBS in scrambled form.

Potential impact of U.S. DBS services on Canada

Among the principles that have governed broadcasting in Canada is the notion that it should be regulated in a way that will strengthen and protect Canadian identity and sovereignty. Canada has had to deal with the abundant availability of American television stations for years. The potential influence of U.S. DBS services on Canada is, therefore, not an entirely new concern. However, Canada will have to review and respond to the following facts:

- signals from U.S. DBS systems will probably spill over in the populous areas of Canada within the next few years. It is too costly to reduce unintended spillover and even then, consumers could get larger dishes to overcome signal quality reduction.
- Some of the U.S. DBS signals will not be scrambled. Canadian households would be able to receive these programs.
- Many of the U.S. DBS signals will be scrambled. The only way these programs could be widely viewed in Canada would be if U.S. DBS operators were permitted to market subscriptions in Canada.
- U.S. DBS operators would not be able to sell subscriptions in Canada unless they obtained the permission of both countries, as well as any necessary authorizations under the applicable laws of each country.

A study on the potential impact of U.S. DBS services on Canada was conducted by Nordicity Group Ltd. The results of this study provide a considerable amount of information concerning the potential impact U.S. DBS signals might have upon Canadian advertiser supported and subscription services. Description of the postulated scenarios and assumptions are found in chapter 7 of the Nordicity report.

In considering the impact of U.S. advertiser supported services, Nordicity Group Ltd. went on the premise that U.S. network programming was available to underserved areas in Canada via Cancom or another form of Canadian satellite delivery. Under the assumption of this availability on Canadian facilities, the economic impact of additional advertiser supported U.S. DBS programming was not found to be significant. Reasons include:

- Most U.S. DBS services are likely to be subscription based, and a large number of advertiser supported channels are not expected.
- U.S. networks have not indicated any intention of abandoning their affiliates for DBS delivery.
- Even if commercial U.S. network programming is eventually distributed via DBS and available on a free basis, its impact would be primarily on the potential sales of Canadian home receivers.
- New advertising-supported services which would be made available to viewers with no charge would likely be specialized services which would cause only a very minor diversion of audience from conventional television services.

With respect to the potential impact of subscription services, the Nordicity study indicates that if U.S. DBS operators were reasonably successful in penetrating the American market, and if they were allowed to sell subscription services in Canada, their impact in Canada could be substantial. The Canadian broadcasting industry would be affected most by U.S. DBS penetration of the remote and rural market. Two of the scenarios suggest that if there were no competitive Canadian alternative, currently underserved Canadian households may be receiving a large number of U.S. pay-TV services by the end of the decade. Reception of U.S. DBS services by Canadian MATV systems, if allowed, also could result in severe competition for Canadian pay-TV and cable operations.

In other words, successful American DBS subscription operations in the United States and the marketing of these services in Canada would result in a negative economic impact on the Canadian broadcasting environment. While the impact on Canadian commercial broadcasters and their advertising revenues would not be significant, the impact on Canadian subscription services would be considerably more important. This would seem to indicate the need to offer competitive Canadian DBS pay-TV services while maintaining protective measures to preserve the integrity of the Canadian broadcasting system.

Effective implementation of a DBS service

The effective managing and marketing of an integrated service becomes a critical issue when one considers the high initial investment involved in implementing a DBS system and the lifetime of the DBS space segment. Projected satellite system costs were outlined in chapter 5. This capital cost must be recovered over the seven to ten year operating life of the satellites. For a DBS system to be economicaly viable, the initial market must be significant and maximum market penetration must be achieved rapidly.

The problem of an initial market could be partially resolved by utilizing Anik C as an interim DBS system. This would provide at least a five-year period to develop the initial market; to form a policy, regulatory and institutional environment that would accommodate rapid growth of a DBS market; and to implement a marketing and advertising plan that would engender rapid utilization and growth of a DBS system.

The Canadian market is not large enough to support a multiplicity of systems. However, it may be large enough to support one system shared by both public and private broadcasters, permitting them to take advantage of the economies of scale of a shared system. For a shared system to evolve will require the co-operation of the enterprises involved in Canadian broadcasting and serving the Canadian broadcasting industry. This implies the establishment of an organization comprising the co-operating parties for the purpose of establishing a Canadian DBS system. A regulatory environment conducive to the establishment of the required co-operation will be a prerequisite for it. This must recognize the need for benefits to the co-operating organizations commensurate with the risks involved. Chapter 10 discusses the roles that might be played by the various entities involved.

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Potential impact on industry

Reliable information is an important factor in the making of policy to influence and regulate the use of direct broadcasting by satellite. An ongoing concern will be the effects of the introduction of DBS on the economic, political, social and cultural life of Canada. Because no country yet has long experience with DBS, few hard statistical data exist about the effects of this new technology. To be able to "see" into the future – to speculate on the effects of DBS – it is necessary to make projections based on hypothetical models and scenarios. This chapter describes studies in which the impact of DBS on the television broadcasting industry, on TV program production, and on manufacturers have been projected using models and scenarios.

Impact on TV broadcasting industry

A study of the impact of DBS on the Canadian television broadcasting industry was carried out by Raymond, Chabot, Martin, Paré et Cie.[1] To do this, a specific hypothetical scenario for the development of DBS in Canada was constructed to serve as the basis for analysis. A scenario likely to expose a maximum possible impact was postulated. This scenario and its probable impact are described in appendix 5. However, it is only one possible long-term scenario; numerous other courses could be and may be adopted by the institutions involved.

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[1] *Study of the Socio-Economic Impact of Direct Broadcast Satellites on the Canadian TV Broadcasting Industry*, commissioned by the Department of Communications under the DBS Studies Program.

While the scenario selected to gauge impact of the introduction of DBS postulated substantial changes in the operation of public broadcasting, drastic changes are not foreseen as being likely in the light of present policies and plans for the future. DBS technology is likely to result in changes to the structure of the Canadian broadcasting industry only if, after introduction, market forces suggest that changes would be beneficial.

In general, the impact of DBS in Canada is expected to be positive. The CBC could use the technology to advantage. Initially, DBS would extend coverage to the small percentage of the population that is not within range of CBC transmitters. When DBS receivers approach full market penetration in rural and remote areas, DBS may also obviate the need to replace low-power repeaters as they become obsolete. DBS would also present an opportunity to introduce specialized CBC services to all Canadians.

Educational television services could benefit from a DBS delivery system. Some already use Anik C, while others are considering the use of satellites in their longer-range plans. Although DBS transmission would cost more, most of the interviewed officials of educational TV networks viewed the universal coverage that could be achieved as a positive development. Radio-Québec, however, had reservations; DBS would not be consistent with Radio-Québec's practice of airing local programming in the community of origin. However, it could take some advantage of DBS transmission.

The impact of DBS on the private TV broadcasting sector was found difficult to assess. To grapple with this question, the study assumed that private broadcasters would take advantage of DBS carriage but would continue to offer currently available over-the-air services. Private commercial TV stations broadcasting via satellite would become Canada's first superstations. More specifically, it was assumed that either CTV or an independent station would occupy one DBS channel and that TVA would occupy another.

Broadcasters in smaller markets would be the most vulnerable to the effects of any competition that more signals delivered in their markets would provide. The affiliates of both the private networks and the CBC could be affected by market fragmentation, and might require a greater share of network revenue from programming carrying national advertising. However, DBS could not pose any competition for advertising intended for local markets.

The impact on cable companies is also likely to be related to size. While all companies generally welcome the availability of additional programming which they can offer to their customers, cable companies in many smaller communities would be faced with expanding their capacity to be able to carry extra channels. Without such expansion, customers in these smaller communities could decide that the choice of programming offered on a DBS system was a suitable alternative to the offering by their local cable company. Such an impact is not expected to be experienced by large cable systems already carrying many channels.

Impact on program production industry

Most Canadian television programs are produced by Canadian broadcasters or by their affiliated production companies. With a few notable exceptions these programs have not been successfully exported to foreign television markets. Hence, full production costs generally have been borne by the Canadian market.

But Canadian broadcasters can acquire U.S. television at about one-tenth the cost of Canadian programming of comparable quality – a not surprising fact when one considers that the U.S. market is ten times as large as the Canadian one. Because of this and because of the wholesale spillover of U.S. television signals and the popularity of U.S. programs in Canada, Canadian programming has been far from successful financially. One might speculate that the Canadian television program production industry would be moribund today were it not for the CBC and for the CRTC's Canadian content rules.

To offset the unfavorable economics that beset Canadian television programming, Canadian television program producers have relied and will continue to rely on government regulatory intervention to secure a continuing market. The regulatory decisions of the CRTC, government policy and special incentive programs undoubtedly will be primary determinants of the program production industry's success in the future.

On January 31, 1983 the CRTC issued a policy statement which proposes that Canadian content rules become more precise and rigorous, primarily during the mid-evening hours. The commission proposes to introduce a definition of Canadian programming based on a point system and to change the reporting period for the measurement of Canadian content from an annual to a semi-annual basis. Canadian content would be increased to 35 per cent as a minimal goal during the mid-evening hours. These draft amendments are currently open to public comment.

Canadian content requirements have also been applied to Canadian pay-TV licensees by the CRTC through individual licence conditions which require them to devote specified percentages of air-time and revenues to Canadian programming over their first five-year licence terms.

Special funding for Canadian production is part of the recently announced Broadcasting Strategy for Canada. A Canadian Broadcast Program Development Fund has been set up, to be administered with funding rising from $35 million in the first year of operation to $60 million in the fifth.

As an alternative method of delivering television programming to home viewers, DBS might be expected to have little direct impact on program production. However, since its intrinsic characteristics may make it a superior means of distribution for certain categories of programming services, it could serve new markets or expand existing ones.

The impact of a Canadian DBS system on the program production industry was analyzed in a study by Woods Gordon Management Consultants, *The Industrial Impact of a Program to Implement a Direct Broadcasting Satellite System in Canada*. The results of the study are summarized in appendix 6. The study postulated programming which could be carried by a Canadian DBS system, and found that many were services that are already in existence, such as the CBC, educational channels, advertiser-supported channels and the newly available pay-TV services. The study concluded that the major impact of DBS on programming would be due to the larger market made available for pay-TV, and that new programming would come into being only if services not now generally available, such as programming for native peoples and religious programming, were fully developed.

Table 18 summarizes estimated possible additional expenditures on Canadian pay-TV programming because of the extra market from DBS delivery, and employment created, over 15 years. The estimates are given for three different market penetration rates. Estimated expenditures range from $425 million to $708 million, and estimated employment created ranges from 18,800 to 31,300 person-years.

Table 18

Estimated impact of DBS pay-TV on Canadian programming over fifteen years

Market penetration	Estimated expenditure (millions of 1982 dollars)	Estimated employment created (job-years)
30%	$425	18,800
40%	$567	25,100
50%	$708	31,300

Note: Estimates are based on 20 per cent of pay-TV subscribers taking two services.

Source: Woods Gordon Management Consultants.

The study assumed that only two channels of new special-interest programming, such as native or religious programming, would develop over the next 15-year period. These were assumed to be independent of market size; they might, for example, be funded by institutions or by grants. The estimated expenditures on such production are shown in table 19, along with number of the job-years expected to be created. Expenditures over 15 years on Canadian programming would total $84 million, while some 2,000 person-years of employment would be created. Comparison of these data with those for pay-TV programming suggests much more significant economic effects on Canadian program production from pay-TV's penetration of the uncabled market in Canada than from new DBS channels which are independent of market size.

Table 19

Employment and financial impact of two special-interest DBS channels over fifteen years

	Estimated expenditures on programming (millions of 1982 dollars)	Estimated employment created (job-years)
Canadian programs	$36	1,200
Imported programs	$84	2,000
Total	$120	3,200

Source: Woods Gordon Management Consultants.

The overall findings of the Woods Gordon study indicate that DBS is not likely to stimulate new program production directly. However, re-investment in program production of the likely substantial new revenues earned by DBS pay-TV could result in a more vigorous program production industry.

Impact on Canadian manufacturing industries

Television broadcasting and program production are not the only segments of Canadian industry that would be affected by the introduction of a direct broadcasting satellite service for Canada. DBS would also have the potential to influence the domestic space technology and communications industries. The industries most likely to be affected by the introduction of DBS are those related to satellite and receiver manufacturing, receiver sales and service, and system operations and control.

The potential impact on manufacturing industries was analyzed in the Woods Gordon study, cited earlier in this chapter. The study covered a 15-year period (1984-1998) and projected expenditures for the physical elements of DBS system and the number of new jobs likely to be created as a result of these expenditures. The details of the study results are shown in appendix 6.

The study covered three possible system models and three market scenarios. The first system model was based on Anik C satellites being used for the entire 15-year period. The other two system models assumed to use of Anik C for interim service until 1988, when it would be replaced with higher powered DBS service, providing eight to ten channels of television per beam in either four beams or six beams. This was assumed to increase in 1992 to 16 to 20 channels per beam for each model. The three market scenarios were based on market size – low, medium and high. Hardware quantities were derived from these scenarios. From 4 to 12 satellites would be needed to cover the range of system models and market scenarios, 32 to 136 uplink stations, and 0.8 to 1.7 million home receivers.

Estimated total expenditures for space segment and earth segment hardware for the three DBS system models ranges from $1.3 to $3.8 billion over the 15-year period considered by the study. The manpower requirements to produce the hardware, to operate the satellites and uplink stations, and to market, install and maintain community and home receivers range from 31,700 job-years for the low market, Anik C system scenario to 73,200 for the high market, large system scenario. In general the study projected four times as many jobs concerned with earth segment hardware as for space segment hardware.

Summary of impact on the manufacturing and program production industries

Figures 24 and 25 show how estimated expenditures and job-years for a Canadian DBS system are apportioned to the space segment, the earth segment and program production by year over the 15-year period from 1984 to 1998 for the middle model, medium market scenario. For this scenario, expenditures are estimated to total $3.7 billion and to involve creation of 81,000 Canadian job-years. By 1998, the system could be expected to have reached a state of maturity and would be sustaining at least 2,700 jobs in the program production industry and at least 2,500 jobs in the home receiver industry. Employment in satellite manufacturing can be expected to be somewhat uneven. Replenishing the space segment, however, which would have four to six operating satellites by the end of the 15-year period, would be a significant factor in maintaining a high rate of employment in the space technology industry.

Opportunity and competition

It is apparent from the results of the studies described in this chapter that DBS can have substantial effects on broadcasting, on program production and on manufacturing – all dependent, of course, upon the types of DBS service offered, its acceptance by the public and the ways in which it is regulated.

DBS was found to present great opportunities to some parts of the broadcasting industry (pay-TV and superstations) and tough competition to others (small broadcasters). Some small cable TV systems would be faced with capital expenditures to expand the capacity of their systems to be competitive. The pay-TV element of a DBS environment appeared to be the greatest potential source of revenue for new Canadian TV program production. There was also found to be significant potential for new production – and hence new jobs – in manufacturing the hardware required for a DBS system.

Figure 24

Estimated expenditures on program production, earth segment and space segment for DBS System Model 2 under a medium market scenario (in millions of 1982 dollars)

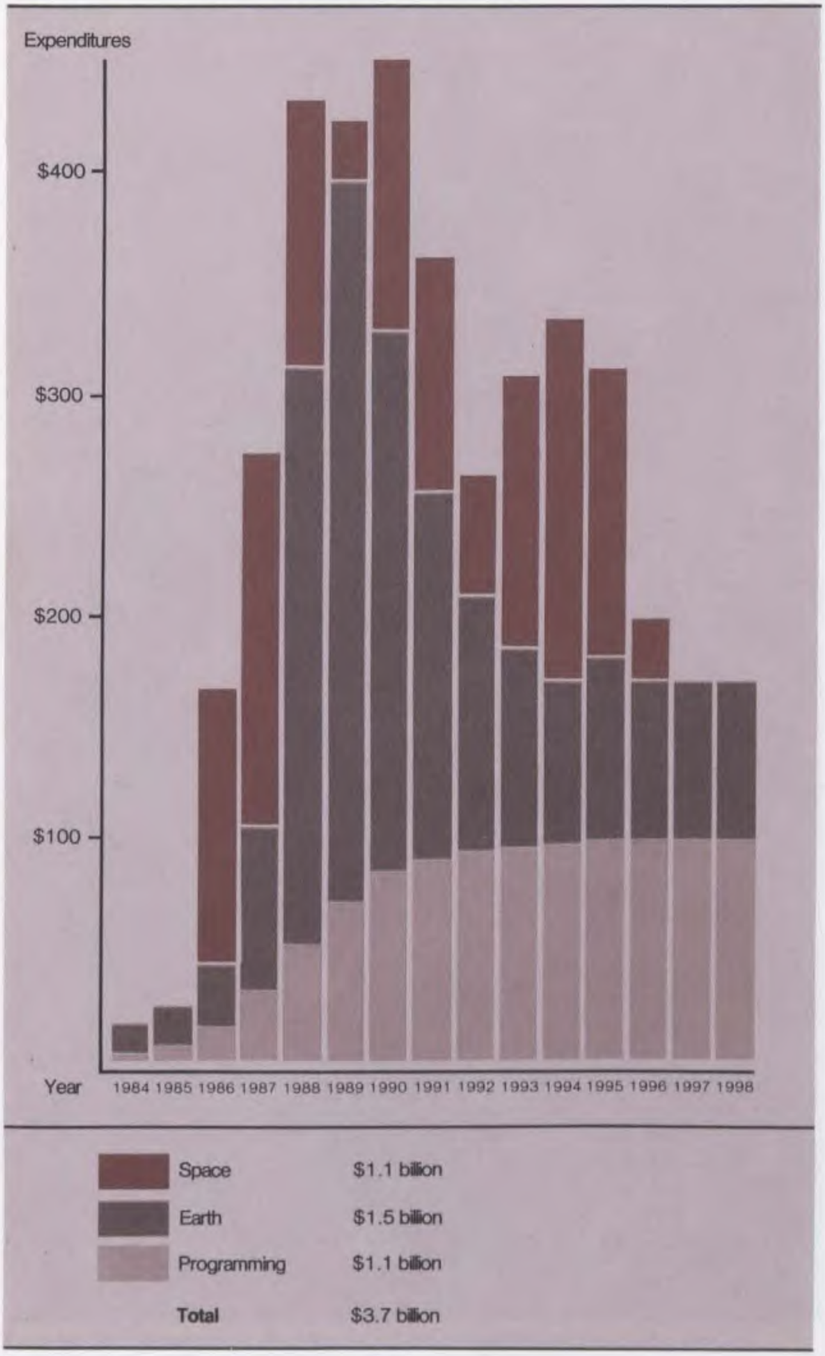
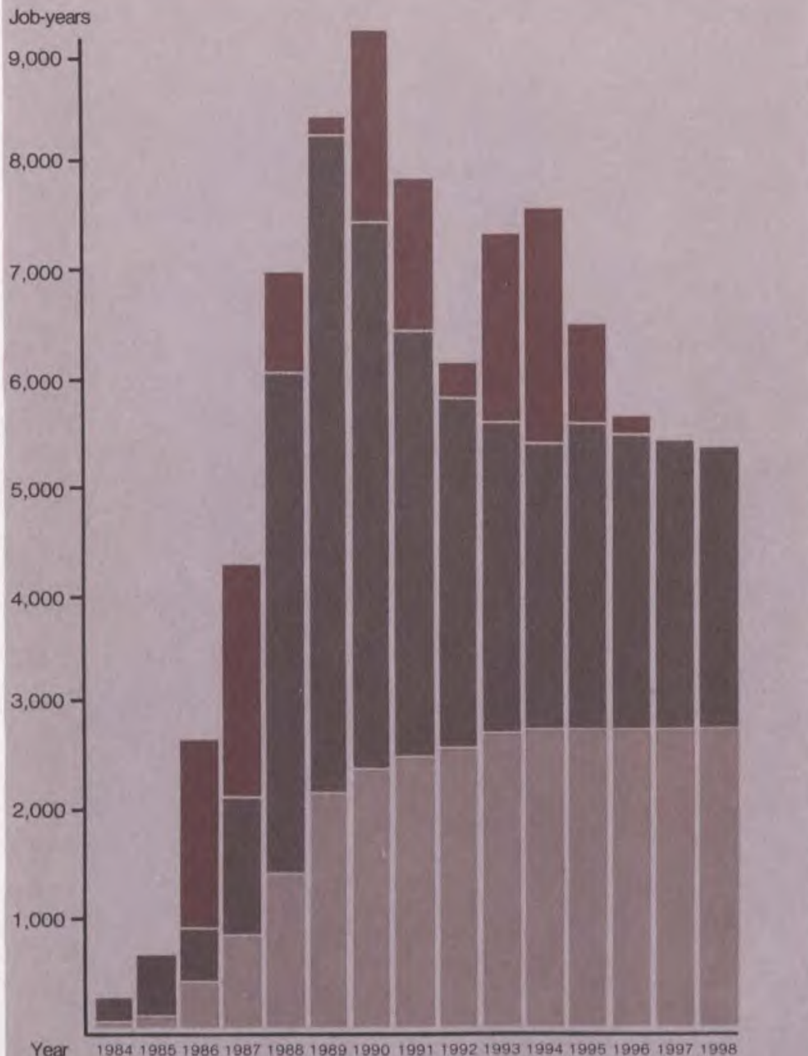


Figure 25

Estimated job-years created through expenditures on program production, earth segment and space segment for DBS System Model 2 under a medium market scenario



Space	13,000 job-years
Earth	40,000 job-years
Programming	28,000 job-years
Total	81,000 job-years

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Regulation of DBS systems

This chapter commences with a brief review of international considerations affecting DBS regulation. Most of the chapter concerns itself with domestic regulation of a Canadian DBS system. In this regard, the chapter provides basic information on the regulatory framework for existing broadcasting and telecommunication services, considers regulatory issues which could arise if DBS were to be introduced into Canada, and suggests possible directions for future regulatory development.

International regulation

Radiocommunication services, including the broadcasting satellite service (as DBS is known internationally), are internationally managed and co-ordinated through the Radio Regulations of the International Telecommunication Union (ITU). Canada is a member of this specialized agency of the United Nations concerned with international telecommunications. The ITU regulations are drawn up by Administrative Radio Conferences which are convened as required to review the regulations dealing with specific telecommunication services. Although the regulatory regime established by the ITU fully recognizes the sovereign right of each ITU member to regulate its own telecommunications, members are bound by the Radio Regulations to the extent necessary to prevent harmful interference with the radio stations of other members. In practical terms, this means that Canada is free to license and regulate DBS systems as it considers appropriate, but must do so within the technical parameters specified in the ITU regulations.

The technical parameters for DBS systems operated by Canada, the United States and all other nations of the Americas (ITU Region 2) will be agreed upon at a Regional Administrative Radio Conference (RARC) scheduled for June 1983 which will develop a plan for DBS services in the western hemisphere. The results of RARC 83 are not expected to place undue constraints on planning a domestic DBS system for Canada. This conference will decide such matters as frequency allocations for DBS, the position and number of orbital slots for each country, and the general technical characteristics of DBS signals. The orbital and frequency allocation plan for DBS in Region 2 will be based on the concept of national DBS systems. Regional systems which might serve a common market made up of Canada and the United States or a common South American market are not envisaged at this time.

Spillover of American DBS signals

The ITU regulations require a country planning its domestic DBS services to use all technical means available to reduce, to the maximum extent practicable, the spillover of DBS signals into neighboring territories. While it is possible to shape the broadcasting beam of a satellite to some degree to correspond with national boundaries, so much of the Canadian population lives close to the Canada-U.S. border that spillover of U.S. domestic DBS signals may be regarded as inevitable. In fact, the vast majority of Canadians will be well within range of American DBS signals. The regulation of DBS in Canada will have to take this unavoidable spillover into account.

Individual Canadians will likely be able to own and operate DBS receivers without a radio licence and will be able to view U.S. DBS signals that are not scrambled. Many of the future U.S. DBS services, however, are expected to be scrambled and marketed on a subscription basis.

Jurisdiction over DBS within Canada

Radiocommunication including DBS is a matter which comes under the exclusive jurisdiction of the Parliament of Canada. Federal authority is divided between the Minister of Communications and the CRTC, an independent regulatory agency.

The minister exercises a broad mandate under the Department of Communications Act to foster the best possible telecommunication services in Canada and to ensure their availability and benefits to as many Canadians as possible. Under the Radio Act, the minister is responsible for technical and policy matters affecting the development and operation of radiocommunications. This includes implementation of technical parameters provided for in the ITU Radio Regulations, allocation of radio frequencies to certain uses, specification of technical standards for radio apparatus, issuance of licences for the operation of such apparatus and investigation of causes of harmful interference.

Under the Broadcasting Act, the CRTC is responsible for the regulation and supervision of all aspects of the Canadian broadcasting system with a view to implementing the broadcasting policy enunciated in section 3 of that act. Section 15 states that the CRTC, in regulating and supervising the broadcasting system, is subject to the Radio Act, while paragraph 22(1)(b) provides that the commission may not issue, amend or renew a broadcasting licence unless the Minister of Communications certifies that the licence applicant has satisfied the requirements of the Radio Act. The commission is also responsible for regulating telecommunication carriers within federal jurisdiction, as provided for in the National Transportation Act and the Railway Act.

Definition of broadcasting

Broadcasting is defined in the Broadcasting Act and the Radio Act as any radio communication in which the transmissions are intended for direct reception by the general public. DBS transmissions are considered to be broadcasting because they are intended for direct reception by the general public.

A view which might be held by some parties is that the definition of broadcasting should be revised to explicitly take into account that first, some DBS signals will likely be scrambled and will therefore be available only to those members of the public willing to pay a subscription fee for the right to decode them, and second, a large proportion of the public will likely receive DBS signals indirectly through cable.

At present, all of Telesat Canada's communication satellites including the Anik C series operate in the ITU fixed satellite service category. This means they are regarded as satellites that transmit to fixed points, providing a point-to-point service. Direct broadcast satellites operate in the ITU's broadcast satellite service (BSS) category, which means they are regarded as satellites that transmit signals intended for direct reception by the general public. The ITU's definition of the BSS category stipulates that direct reception encompasses both individual reception and community reception.

Copyright considerations

Copyright protection in Canada is provided by the Copyright Act which came into force in 1924. Although it has been amended several times, it has never been revised to reflect contemporary cultural conditions or the impact of technological developments such as videotape, cable television, pay-TV, satellites, and information storage and retrieval systems. In view of this, the Department of Communications is working closely with Consumer and Corporate Affairs Canada to prepare proposals for new copyright legislation.

Any revision of the Copyright Act will have to take into account the responsibilities Canada has assumed pursuant to its membership in the two major international copyright conventions: the Berne Convention for the Protection of Literary and Artistic Works, and the Universal Copyright Convention. Both conventions provide for the protection in Canada of copyright material of the nationals of member countries. While Canada has agreed under these conventions to provide copyright protection with respect to the broadcasting of copyright works, neither of these conventions specifically addresses the communication of material by means of satellite.

A convention dealing only with point-to-point satellites and distribution of the signals they transmit was adopted in Brussels in 1974: the Convention Relating to the Distribution of Program Carrying Signals Transmitted by Satellites. Canada is not a member of this convention. At present, there is no convention dealing explicitly with copyright matters in the context of DBS.

Under the Copyright Act, broadcasters are required to pay copyright fees for over-the-air transmission to the public of material protected by copyright. Since a direct broadcasting satellite has the same function as a terrestrial broadcast transmitter, it may be that the present Copyright Act and international conventions would apply to DBS operations. Like the definition of broadcasting, this position may require further consideration given that some DBS signals will be scrambled.

DBS content and satellite carriage

This section examines ownership in relation to the general question of how Canada might choose to license content and satellite carriage for DBS systems and outlines three options for public discussion.

At the outset, it may be useful to clarify what is meant by the terms *content* and *satellite carriage*. First, someone must assemble the programming (content) to be broadcast by the satellite. The question of who should do this would be determined by the CRTC under the Broadcasting Act. Satellite carriage here means the transmission via satellite of broadcast programming (content).

The questions at issue are who may own and operate direct broadcast satellites and under what terms and conditions. Classes of permissable owners would be determined by the Minister of Communications under the Radio Act. By virtue of his powers under sections 4 and 7 of the Radio Act, the minister may establish ownership criteria as a condition of licensing. These criteria could be formulated so as to restrict ownership to telecommunication carriers alone or to broadcasters alone or to make ownership open to any person who wished to invest in such a facility, subject to the maximum number of orbital positions assigned to Canada for direct broadcast satellites.

Licensing option one: content and satellite carriage licensed separately

There is a clear separation of functions in this option. A telecommunication carrier such as Telesat Canada would own and operate the direct broadcast satellite and provide a satellite carriage service regulated under the Railway Act. The telecommunication carrier would lease DBS channels to a number of applicants who had been licensed under the Broadcasting Act to provide programming content for the DBS system. By law, telecommunication carriers are prohibited from interfering with the content of the signals they transmit on behalf of other parties.

This option is similar to the arrangements which now apply to Telesat Canada's fixed satellite service. Broadcasting undertakings such as the CBC, TVOntario, Radio-Québec, Cancom and pay-TV licensees already lease or are planning to lease satellite channels from Telesat for the point-to-point distribution of their programming.

Licensing option two: content and satellite carriage licensed together

There is a merger of functions in this option. A single operator would be licensed under the Broadcasting Act to carry on a broadcasting transmitting undertaking which uses a DBS system. The broadcasting undertaking would own the direct broadcast satellite and be responsible for programming all the DBS channels. This option is analogous to terrestrial broadcasting where the television station owns its transmitting facilities. Telecommunication carriers could not participate in this option since they are not authorized to hold broadcasting licences.

Licensing option three: DBS hybrid

Under this option, a single operator would own the direct broadcast satellite, hold a broadcasting licence and be responsible for programming some of the DBS channels. The remaining satellite channels would be leased to other operators licensed under the Broadcasting Act to program the spare channels. To simplify identification, the owner of the direct broadcast satellite may be referred to as the DBS hybrid, and a firm that leases a satellite channel may be referred to as a DBS channel programmer.

In terms of regulation, the DBS hybrid could be licensed under the Broadcasting Act as a broadcasting transmitting undertaking, subject to broadcasting regulation for those channels which it programs, and subject to common carrier regulation for the channels it leases to other programmers. DBS channel programmers would also be subject to broadcasting regulation. Legislative amendments may be required to implement this option.

The three options compared

Canada may adopt just one of these options as the basis on which to organize DBS systems or it may decide to permit DBS systems to be organized on the basis of any of the three options. (Of course, the range of options may be widened through the process of public discussion.) Under the Radio Act, the Minister of Communications has the power to decide this matter by promulgating ownership criteria as a condition of licensing for direct broadcast satellites. For example, if the minister were to provide that direct broadcast satellites may be owned only by telecommunication carriers, this would effectively establish that content and satellite carriage should be licensed separately for DBS systems.

As a matter of broad principle, it may be in the public interest to establish separation of content and satellite carriage for all communication satellite services in Canada as is the rule now for fixed satellite services. The onus to bring forth persuasive arguments to the contrary should perhaps rest on those parties who wish to argue that separation should not also apply to direct broadcast satellites.

A significant benefit of separation is that it allows several programming entities to have access to a common facility and thus encourages diversity in the control of DBS programming. Option One satisfies the separation principle in all respects whereas Option Three allows separation with respect to those channels not programmed by the DBS hybrid. Option Two, although it merges content and carriage, might nevertheless allow different programming sources access of some sort to the DBS system through corporate policy or diversified ownership of the DBS firm, or through CRTC regulation.

A second significant benefit of separation is that it would permit the CRTC to adopt a competitive licensing procedure in selecting, evaluating and if necessary, replacing licensees who provide DBS programming. Under the Broadcasting Act the commission may issue or renew broadcasting licences for terms of up to five years. If a broadcasting licensee owned the direct broadcasting satellite, it would be difficult for the commission to refuse to renew the licence at the end of its term because this would imply selling the satellite. With separation of content and satellite carriage, the CRTC would be in a position to issue broadcasting licences to a number of programming entities, review their performance at the end of their licence terms, and then, if not satisfied with their performance, call for competitive applications to allow other programmers an opportunity to use the DBS system.

The separation of content and satellite carriage has its drawbacks, however. One drawback is that it would require broadcasters to negotiate with a telecommunications carrier as to conditions of service and to secure meaningful input into satellite system planning so that the service meets their standards. Another drawback could be the need for regulatory approval of the rates charged by the carrier. The CRTC would reach its decision on rates following a tariff hearing. This could delay broadcasters' plans and introduce uncertainty about the financial returns they could expect.

There are also advantages and drawbacks to the merging of content and carriage functions. Options Two and Three would give a vertically integrated licensee greater scope to plan and control all aspects of a DBS service, including the responsibility to secure adequate financing. If long-term financing were required, lending institutions might resist granting loans for a period exceeding the Broadcasting Act's five-year limit for licences. Presumably the licensee would prefer to amortize loans over a longer period of time, such as the expected seven-to-ten-year lifespan of the satellite.

These are some of the advantages and disadvantages of the options outlined here. The discussion is not meant to be exhaustive, but to encourage public comment.

DBS broadcasting licences

Under the Broadcasting Act, the CRTC licenses three general types of broadcasting undertakings: broadcasting transmitting undertakings, broadcasting receiving undertakings and network operations.

A firm that owned direct broadcast satellites and was responsible for providing the programming would perform functions identical to those carried out by conventional, terrestrial TV stations. It is reasonable to expect that the CRTC would license such a vertically integrated operator in the same way as a terrestrial TV station – as a broadcasting transmitting undertaking.

A firm that did not own a direct broadcast satellite but leased a satellite channel for transmission of its programming might be licensed as a broadcasting transmitting undertaking on the basis that it arranged the DBS transmission and controlled the content of the signal broadcast. This approach assumes that owning transmission facilities is not an essential function of a broadcasting transmitting undertaking.

Other approaches to licensing under the Broadcasting Act may be possible depending on the details of the DBS operations proposed. In the early stages of DBS planning, it would be premature to rule out consideration of different licensing approaches. A useful departure point for further discussion of this topic is provided by paragraph 3(j) of the Broadcasting Act:

> The regulation and supervision of the Canadian broadcasting system should be flexible and readily adaptable to scientific and technical advances.

Broadcasting regulation

Under the Broadcasting Act, regulation and supervision of all aspects of the Canadian broadcasting system are the responsibility of the CRTC. The Minister of Communications announced a Broadcasting Strategy for Canada on March 1, 1983, designed to allow the nation's broadcasting system to respond to the technological and programming challenges of the 1980s and 1990s. The strategy indicates that the government will seek parliamentary approval of measures permitting the Cabinet to issue broad policy directions to the CRTC on broadcasting matters.

In light of this, it is possible that the Cabinet could at some future point provide the CRTC with a broad policy direction on DBS. The following analysis assumes that such a policy direction has not been issued to the CRTC, and that the commission would deal with DBS according to the existing provisions of the Broadcasting Act.

In the case of DBS, the CRTC would likely hold a public hearing to consider two basic questions: Should broadcasting services delivered by DBS be introduced into the Canadian broadcasting system? On what terms and conditions? Following the hearing on these issues, the commission would announce whether it was prepared to license Canadian DBS services under the Broadcasting Act, and if so, the regulatory guidelines for such services.

The Broadcasting Act requires the CRTC to regulate and supervise the Canadian broadcasting system with a view to implementing the policy set forth in section 3 of the act. The wording of this section is sufficiently broad that considerable discretion rests with the CRTC in interpreting and applying the policy. Notwithstanding the overall discretion which Parliament has placed in the CRTC, the general principles enunciated in section 3 provide the commission with basic departure points for its consideration of a Canadian DBS system. Three paragraphs in particular describe matters which will no doubt guide the CRTC in its considerations regarding DBS service.

Paragraphs 3(a) and 3(b) speak of a single broadcasting system and portray the broadcasting system as an instrument of national policy that should safeguard, enrich and strengthen the cultural, political, social and economic fabric of Canada. Paragraph 3(d) states that the programming provided by each broadcaster should be of high standard, using predominantly Canadian creative and other resources.

Should it be decided to introduce DBS services into the broadcasting system, the CRTC would then face the task of detailing the terms and conditions on which DBS services should be licensed and regulated under the Broadcasting Act. Other sections of the act give the CRTC the authority to do this. Under section 16, the commission may make broadcasting regulations, and under section 17, the CRTC Executive Committee may issue broadcasting licences for terms not exceeding five years, subject to such conditions related to the circumstances of the licensee as it deems appropriate for the implementation of the broadcasting policy.

Questions which the commission could address in reaching its decisions on the details of licensing and regulation include:

- Nature and number of DBS licences: What types and how many DBS services would the CRTC be prepared to license?
- Canadian content: What percentage of DBS revenues and broadcast time should be devoted to Canadian programming?
- Production of programming: Should DBS licensees be required to purchase their programming from independent producers?
- Access to the means of distribution: Should the CRTC take any measures to improve access by different groups in our society to the DBS medium?
- Provision of DBS services in English and French: Would national services be available in both languages?
- Common ownership of broadcasting undertakings: Should existing broadcasters and cable companies be allowed to invest in DBS services?

- Funding of DBS services: Should both advertiser-supported and subscription services be allowed on the DBS medium?
- Carriage of DBS services on cable: Should DBS services receive priority carriage on cable systems?

Spectrum regulation

In Canada, the federal Minister of Communications derives his authority to regulate the spectrum from the Radio Act. The minister has wide powers to regulate technical and policy matters affecting the development and operation of radiocommunication, including the power under section 7 to make radio regulations.

Under paragraph 4(1)(b) of the act, the minister may issue either radio licences or technical construction and operating certificates (TC&OCs), subject to such terms and conditions as he considers appropriate to ensure the orderly development and operation of radiocommunication in Canada. The wording of this paragraph makes an important distinction between radio licences and TC&OCs. Radio licences are issued "in respect of radio stations and radio apparatus to the extent that they are not broadcasting undertakings", while TC&OCs are issued "in respect of radio stations and radio apparatus to the extent that they are broadcasting undertakings". (Broadcasting undertaking means an organization licensed by the CRTC under the Broadcasting Act to provide a broadcasting service). Unless there is an exemption by statute or regulation, no radio apparatus may be operated without either a radio licence or a TC&OC.

Three types of radio apparatus are used in DBS systems: Transmit earth stations, which send uplink program signals to the satellite; the direct broadcast satellite, which receives the uplink signals, converts them to another frequency and retransmits them as broadcast signals; and receive-only earth stations, which receive the signals broadcast from the satellite and are sometimes referred to as DBS receivers.

If DBS content and carriage are licensed separately, the satellite carrier would likely own both the satellite and a network of transmit earth stations, to provide uplink service to licensed DBS broadcasters. In this case, both types of radio apparatus would need radio licences. A DBS broadcaster who had leased several channels might, however, decide it would be worth investing in earth stations, and might request the minister's permission to own this type of apparatus. In this case, a TC&OC would be needed.

If, on the other hand, DBS content and carriage are licensed together, the direct broadcast satellite would be owned by a broadcasting undertaking and would require a TC&OC. It would probably follow that transmit earth stations would be owned by the same undertaking; they would also have to be covered by the TC&OC.

DBS receivers will likely be sold as consumer articles and owned by individual purchasers. Subsection 3(3) of the Radio Act provides that a radio licence is not required for a radio receiver that is not part of a broadcasting receiving undertaking and that is only intended for the reception of broadcasting. In practical terms, this means that individuals would be able to purchase DBS receivers as they now buy AM/FM radios or TV sets, without applying for a radio licence.

DBS receivers would also be purchased by broadcasting undertakings such as cable companies who wish to distribute DBS signals to their subscribers. Since the DBS receiver would be part of a broadcasting undertaking, companies intending to acquire such a receiver would have to apply to the Minister of Communications for an amendment to their TC&OCs. (They would also have to apply for CRTC approval to distribute DBS services.)

Canadian content of satellite systems

Canada has acted to ensure that its domestic satellite system utilizes an appropriate level of Canadian designed and constructed components. Subsection 5(2) of the Telesat Canada Act provides that Telesat shall utilize, to the extent practicable and consistent with its commercial nature, Canadian research, design and industrial personnel, technology and facilities in research and development and in the design and construction of satellite systems. Under subsection 8(1) of the act, each request by Telesat for proposals from industry for the construction of a satellite or an earth station must be approved by the Minister of Communications so as to ensure that the request specifies a reasonable utilization of Canadian design and engineering skills and an appropriate proportion of Canadian components and materials. Should Telesat own and operate DBS systems, these provisions would ensure an appropriate level of Canadian components. There remains the question of what Canadian content requirements should apply if other parties own and operate DBS systems.

Common carrier regulation

Federally regulated carriers such as Bell Canada and Telesat Canada are required, pursuant to section 320 of the Railway Act, to file tariffs of tolls with the CRTC, and these are made subject to the approval of the commission. Under section 321, carriers are required to charge just and reasonable rates and are prohibited from unjustly discriminatory or unduly preferential practices. Section 320 further provides in paragraph 11 that all contracts, agreements and arrangements between carriers dealing with the management, working or operation of their respective systems are subject to the approval of the CRTC. The history of CRTC regulation of Telesat's rates and arrangements in regard to its fixed satellite services is summarized in Appendix 7.

The construction and launching of DBS systems in Canada would likely be preceded by discussions between the government, Telesat, broadcasters, common carriers and other interested parties to determine possible means of financing these systems. These discussions could lead to agreements between broadcasters and common carriers. Eventually, these agreements would be incorporated into a tariff which would be reviewed by the CRTC under the Railway Act.

Conclusions

The results of the 1983 RARC are not expected to place undue constraints on the planning of a Canadian DBS system. While Canada is free to organize and regulate DBS systems as it considers appropriate, it must do so within the basic technical parameters set out in the ITU Radio Regulations.

Federal jurisdiction over DBS is divided between the Minister of Communications and the CRTC. The minister has a broad mandate under the Department of Communications Act to foster the development of telecommunication services in Canada. The minister is also responsible under the Radio Act for technical and policy matters affecting the development and operation of radiocommunications. By establishing ownership criteria as a condition of Radio Act licensing for direct broadcast satellites, the minister may effectively determine if DBS content should be licensed separately from satellite carriage.

The CRTC regulates and supervises all aspects of the Canadian broadcasting system under the Broadcasting Act. In the usual course of events, the CRTC would hold an issue hearing to decide if broadcasting services delivered by DBS should be introduced into the Canadian broadcasting system, and if so, the regulatory guidelines applicable to DBS services. The chapter noted that the Broadcasting Strategy for Canada released March 1, 1983, indicates that the government will seek parliamentary approval of measures permitting Cabinet to issue broad policy directions to the CRTC, but for purposes of analysis, the chapter assumed that a policy direction on DBS had not been issued to the CRTC.

Planning of a Canadian approach to DBS could proceed without delay. Discussions could commence between interested parties on key issues such as separation of DBS content and satellite carriage, financing DBS systems and the respective roles to be played by different parties. The CRTC could hold a DBS issues hearing to examine the possibility of introducing DBS into the Canadian broadcasting system. If decisions are made to implement DBS, the existing regulatory framework may need some modification to accommodate a Canadian DBS system.

10

Models for institutional arrangements

DBS is a new mode of delivering broadcast programming and a dominant new application of satellite communications in this decade. Its introduction in Canada could, therefore, lead to changes in the roles and interrelationships of some of the institutions involved in broadcasting and satellite communications in Canada today.

This chapter describes and discusses four sets of institutional arrangements that could accommodate the implementation of a Canadian DBS system.[1] These models are by no means the only possibilities. They are presented simply as points of departure for public discussion which may lead to further refinement or to the identification of other approaches.

Factors affecting the models

While the basic service definition and many of the technical parameters of DBS are determined by international convention, a number of factors in the Canadian environment could affect institutional arrangements for implementing a DBS system in this country.

A major policy influence would be the federal government's recently announced Broadcasting Strategy. The strategy assigns a major role to cable television as the primary method of delivering the wider choice of Canadian programming expected to result from the creation of the Canadian Broadcast Program Development Fund. This fund will inject tens of millions of dollars over the next five years into the Canadian television production industry. Foreign satellite programming

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[1] This chapter draws on two reports prepared under the DBS Studies Program: *Regulatory and Policy Implications of a Direct Broadcast Satellite System*, by Francis Spiller Associates, Ottawa, March, 1982; and *Options for Institutional Arrangements for Direct Broadcast Satellites*, by Nordicity Group Ltd., Ottawa, March 1983.

would also be available on cable, for an extra charge. One goal of the strategy is to offer cable subscribers such attractive programming packages that they need not turn to direct reception of program signals carried by foreign satellites.

The role of cable would no doubt be an important consideration in the overall institutional arrangements for a DBS system. Most cable operators would probably arrange to distribute Canadian DBS signals and most Canadians would receive DBS programming via a cable system.

Regulatory practices would also affect institutional arrangements for implementing DBS. Options featuring common ownership of production, packaging and distribution activities, for example, would lead to a change in the current practice of separation of content and carriage which is followed with fixed satellite services. Such options would also run counter to the separation of distribution and program production functions established by the CRTC for pay-TV.

On the other hand, some options could bring about a clearer separation between content and carriage. This would have certain effects. It could, for instance, result in more competitive program services. It could also make it easier to alter exhibitor licences if this proved necessary to achieve Canadian broadcasting objectives. A third effect might be to make the DBS system available to a wider range of program suppliers than if it were controlled by a single entity. In other words, separation of content and carriage could provide greater access to the means of distribution for various cultural groups, public service agencies and independent producers.

The feasibility of various institutional arrangements would be affected by economic factors. Anik C is now being used for distribution of programming to cable head-ends and market forces are already defining possible future institutional arrangements. Decisions being made with respect to the major players' roles, carriage and content separation, and program supplier and packager separation could well influence the introduction of DBS.

Studies concerning direct-to-home television indicate the primary market to be anywhere between 900,000 and 1,900,000 households in remote and rural areas of Canada. This market could begin to develop gradually in 1983, as pay-TV and possibly other programming services become available on Anik C. The viability of these services, however, would be determined by the much larger Canadian cable market.

The small size of the market in Canada suggests that the broadcasting industry will be cautious in proposing DBS systems. The public broadcasters would have to examine the economics of the situation very carefully in considering whether to use DBS as a means of achieving their mandates to serve all Canadians in the case of the CBC or all residents of specific provinces in the case of educational television authorities. The CBC would have to examine various institutional issues related to its role. Should it, for instance, concentrate on national and regional programming at the expense of local programming? Should it also phase out in the long term its affiliate relationships and rely on DBS alone? For Telesat, commercial viability would be a key factor in a decision to implement a DBS system. Telesat has a profit requirement and would, therefore, need assurance that it would be permitted to recover capital costs and realize a specific profit rate. As long as Telesat remains the sole provider of space facilities, institutional arrangements developed with respect to DBS would also have to ensure that the rate structure was fair and equitable.

A desire by the private sector to participate in a dedicated DBS system would impact on how it is to be implemented. Evidence of a market base, such as might be developed through an interim DBS service on Anik C, could be a motivating factor. Without some motivation, the private sector would not likely put forward proposals for early dedicated DBS service, unless public initiatives or investments were forthcoming. This public involvement would in turn become an important factor in determining the institutional arrangements of the DBS system.

A final factor that could affect institutional arrangements is the timing of the introduction of Canadian services with respect to the availability of U.S. DBS services. In the absence of a Canadian system, U.S. services could appear desirable to a substantial part of the Canadian market. The Canadian broadcasting industry would be most affected in rural areas. While unscrambled services would be readily available to all, the unavailability of Canadian DBS subscription services could give rise to a demand for such services from U.S. DBS systems.

Four possible models

Four different possible institutional models are presented here. The methodology is one of fixing parameters of involvement by the parties which would be concerned with the implementation of DBS and discussing the implications of the resulting arrangements. The models have been particularly selected to provide a wide range of cases to stimulate beneficial public discussion. All of the models are based on the assumption that DBS would serve Canada's cultural and economic objectives, but probably to different degrees. They also include varying degrees of federal government funding or policy initiatives, which would influence both the nature of a Canadian DBS system and the speed of its development.

Institutional model 1: commercial evolution

In this model, the federal government would play a limited role in furthering the development of DBS in Canada, leaving the initiative to private industry.

A Canadian DBS system would come into being if and when the industry decided this would be commercially advantageous. Implementation would depend on the initiative of the private sector. Telesat would implement the space communications component of a DBS system when broadcasters were sufficiently interested to make the undertaking commercially viable. Broadcasters would start using the system when they judged that DBS was an economic alternative to existing modes of distribution.

Applications to the CRTC for DBS services would lead to public hearings and the establishment of a regulatory framework governing DBS. Unless this new frame-work altered present practices significantly, no changes to present institutional arrangements would be required.

Public and private broadcasters would wish to use DBS only if it were an economic alternative to existing distribution modes or if the potential revenue from the direct-to-home market were sufficiently attractive. In making decisions about the use of DBS technology, broadcasters could be expected to move in the manner least disruptive to their existing interests. To date, the broadcasting industry has taken few concrete initiatives in utilizing DBS technology to replace existing modes of television distribution.

In this model, present institutional arrangements would remain essentially intact, with the CRTC licensing new services or DBS delivery of existing services under a separation of content and carriage policy. Access to space facilities could continue to be governed by the "first-come, first-served" principle, with terms and conditions subject to CRTC approval.

If a Canadian DBS system did not develop at all or if it were implemented slowly (as this model implies), a number of potential benefits could be lost. A certain segment of the population would remain underserved while a great majority of Canadians would have access to a growing number of television services. Domestic broadcasters and program producers might lose an opportunity to originate more new programs for the home market and for export. Canadian industries would also lose significant opportunities to manufacture DBS equipment for domestic and export markets. Substantial possibilities to create jobs in DBS-related activities would go unrealized.

Slow development of a Canadian DBS system would leave Canada ill-equipped to respond to the challenge posed by the availability of American DBS unscrambled services in this country, beginning as early as 1984 with interim DBS services. While the federal government and the CRTC might prohibit the sale of U.S. subscription-based scrambled services in order to protect the Canadian broadcasting system, their efforts would be rendered particularly difficult in the absence of a domestic alternative. The government could, therefore, find itself unable to meet the policy objective of ensuring a healthy broadcasting system that reflects Canadian economic and cultural objectives.

Institutional model 2: government co-ordination

In the second institutional model, the federal government would, for public policy reasons, seek to foster the introduction of a DBS system by co-ordinating DBS planning activities among interested parties.

The government would establish a task force bringing together the Department of Communications, Telesat, the CBC and possibly other institutions to plan a DBS system that would reflect the needs of the country and the various sectors of the broadcasting system. It might assist Telesat by sponsoring the initial technical definition of a DBS system and perhaps also by funding subsequent satellite development. In concert, the CRTC might conduct a DBS issues hearing and establish licensing procedures for DBS.

Telesat would own and operate the DBS system. The CBC and possibly educational broadcasters would be expected to utilize DBS. Private stations and networks could lease DBS capacity when it became commercially attractive to do so. Cable operators and other retailers would likely enter into marketing and installation agreements with those providing subscription-based DBS services.

This option would depend on voluntary co-operation by the various institutions involved. In co-ordinating the development of a DBS system, the government would be acting in accordance with the objective set forth in section 3 of the Broadcasting Act. The involvement of the Department of Communications would be consistent with its mandate to ensure the orderly development of communications in Canada. Both the CBC and the CRTC would be acting in line with the mandates assigned to them by the Broadcasting Act. DBS would assist the CBC in achieving total coverage of the Canadian population, and the CRTC could be expected to take action in regard to DBS because of its concern for the extension of services.

The CRTC would likely hold an issues hearing, to be followed by a call for applications if it found DBS to be in the best interests of Canadian broadcasting policy. Given the postulated Telesat role, licensing procedures would probably be based on separation of program packaging and program production functions, and on separation of content and carriage. Carriage priorities would be determined by the CRTC under the Broadcasting Act and the cost of leasing satellite channels would be reviewed by the CRTC under the Railway Act. Canadian content requirements could be established by the CRTC as conditions of licence or as general regulations.

Telesat would be responsible for obtaining financing for the DBS system, which it would own and operate. Uplink stations could be owned by Telesat or by licensed program packagers. Before making a commitment to implement DBS, Telesat would probably require a policy statement or hearing decision indicating the CRTC's willingness to license DBS services and to allow Telesat an adequate rate of return. Without this, Telesat might encounter difficulties in securing financing.

If adopted, this model could establish a Canadian DBS system within the existing broadcasting system and the legislative and regulatory frameworks which govern it, and provide services in approximately the same time frame as U.S. DBS systems. It could, by the clear separation of content and carriage, result in an important modification of the regulatory framework which would permit broadcasters to concentrate on programming without the responsibility for distribution facilities. This would lead to greater access to distribution facilities which could in turn result in improved program quality and diversity.

This option depends entirely on the voluntary co-operation of the institutions involved and initiatives taken in a timely fashion.

Institutional model 3: government funding assistance

In this model, the federal government would decide that DBS should be introduced in Canada and that its implementation must be timely. To ensure the establishment of a DBS system it would perform the same co-ordinating functions as in the second model. In addition, the CBC would produce and package programming for DBS and guarantee a long-term lease of several DBS channels from Telesat. Educational broadcasters might also participate if the provincial governments were to see DBS as a priority.

If necessary, the federal government could contribute financially to the development of a DBS system by paying non-recurring satellite costs. Telesat would, however, own and operate the system. Telesat would also plan the system but the design would be significantly influenced by the public sector broadcaster(s).

The CRTC would call for applications for new DBS services by holding an issues hearing which would lead to a DBS regulatory regime for service providers and establish access conditions and principles for establishing satellite rates.

Since public broadcaster(s) and possibly other culturally oriented institutions would be chosen as the primary instrument(s) for introducing DBS, this approach would ensure a high level of commitment to the social and cultural objectives envisaged by the Broadcasting Act. Private sector participation would be highly desirable, and the government or the CBC could pursue such involvement in DBS. Cable operators would likely enter into agreements with the program packagers to carry DBS programming.

As is the case for the previous model, the government would have to rely on the co-operation of the other institutions whose activities it would co-ordinate. Telesat would probably be prepared to participate if it were convinced of the commercial viability of a DBS system and if financing could be secured. Extension of services would be a strong motivating factor for the CBC. It could present a financial problem, however, and government financial support to the CBC could be necessary.

Between two and four channels of television programming could be provided by the CBC and other public broadcasters. Programming such as news and current affairs programs would likely be produced in-house, with a large part of drama and other programming acquired from independent producers. Subscription-based television packagers could utilize the remaining satellite capacity to distribute another four channels of programming during the first-generation DBS system.

As in the government co-ordination model, licensing could take place under a content and carriage separation approach. The public broadcasters and private sector program packagers would be licensed under the Broadcasting Act and the telecommunications carrier would own and operate the system, with tariff rates regulated under the Railway Act. Several program packagers could, therefore, have access to the distribution facility, thereby increasing the diversity of DBS programs available to the public. Since they would not own the satellite facilities, the CRTC could grant licences on a competitive basis, selecting the programming which would best achieve national broadcasting objectives. The CRTC could also readily refuse to renew their licences if their performance were judged inadequate. Canadian content regulations similar to those in effect for existing services would probably be applied to DBS programming.

With the CBC being a heavy DBS user, several consultants have suggested that eventually the CBC might decide to withdraw from its terrestrial distribution network and to broadcast exclusively via DBS. This would be unlikely to happen before the end of the century, however. The withdrawal of the CBC from the local television market could result in the disappearance of CBC-owned and -operated stations.[2] The survival of many of the CBC affiliates might also be in jeopardy. If it is decided that the provision of CBC local services must be maintained, the regulator would probably have to review its stances on concentration and cross-ownership.

The basic CBC television service (English and French) could be carried on two channels and could probably be advertiser-supported. Although the CBC could withdraw from advertising and pay for its operations entirely with public funds, this appears unlikely during current economic times. Two more channels could be devoted to supplementary CBC French and English programming; these could be subscription services. Finally, two channels could be kept for other special public services, provincial educational television services or private broadcasters.

2 The possibility was advanced by Raymond, Chabot, Martin, Paré et Cie in their report on *The Socio-economic Impact of Direct Broadcast Satellites on The Canadian TV Broadcasting Industry*, Montreal, November, 1982.

Financing of system implementation would be Telesat's responsibility. Although it is not known what guarantees it might require before it decided to implement a DBS system, it is highly probable that Telesat would make such a decision if the CBC guaranteed to lease four out of eight channels. The federal government could further assist the implementation of DBS by defraying the system development costs.

This model makes maximum use of existing institutions – the CBC, provincial broadcasters and Telesat – while giving primacy to the CBC in the overall system. Responsive to national broadcasting objectives, it would also result in the rapid implementation of services which could compete with U.S. DBS services. It gives ample scope for private sector initiatives and provides an opportunity to improve present programming services by increasing the number of program contributors and introducing competitive licensing. A high degree of separation of content and carriage would enable broadcasters to concentrate on program co-ordination leaving the distribution functions to the telecommunications carrier. While this option requires substantial federal funding for several years, the CBC might eventually reduce its present distribution costs while its revenues would remain the same or even increase.

Institutional model 4: accelerated commercial development
In the fourth model, the federal government would create a policy and regulatory environment that would motivate the private sector to rapidly finance and implement a DBS system.

This would require the CRTC to call for DBS applications. The private sector would form a consortium of existing or new broadcasters, pay-TV licensees and cable companies. Public broadcasters might also join the consortium.

Space facilities might be owned by the consortium. In this case, the consortium could contract Telesat to help plan the facility and to procure, launch and operate the system. On the other hand, Telesat could obtain approval to invest in the consortium itself.

Programming could be provided by a combination of the service packagers and broadcastsers who are members of the consortium. Some of the unused channels could be leased or sold to third parties licensed independently of the consortium.

This model would not burden the public treasury to any great extent but could require significant regulatory changes and possibly legislative changes as well, to create a regulatory environment that would induce the private sector to make a substantial capital investment. For example, various forms of cross ownership and vertical integration could be permitted.

The creation of a more deregulated environment would probably encourage one or more consortiums of different interests, such as broadcasters, pay-TV operators and cable companies, to apply to the CRTC to own and program a DBS system. In view of the small Canadian DBS market, it is highly unlikely that more than one DBS system would be viable in Canada.

The DBS consortium licensed by the CRTC could contract Telesat to assist in planning the spacecraft and to subsequently procure, launch and operate them. Uplinks could be owned by the consortium and individual service providers. Programming could be packaged by the members of the consortium. While some programs might be produced by the consortium, most would be acquired from producers. Programs could be packaged by the consortium under a single licence and by individually licensed parties, if there were any. Carriage priorities could be determined largely by market forces within the Canadian requirements established by the CRTC. This private sector initiative would not preclude provision of public services by the CBC and the provincial educational authorities.

Various forms of ownership could be explored to facilitate financing the system. For example, any individual channels not being used by the consortium could be leased or sold to other parties. Since the consortium would own the satellite facility, only individually leased channels would be regulated as to price.

One of the difficulties in implementing this option is the substantial time frame which could be required to introduce new legislation to make changes in the policy and regulatory environment.

Licensing arrangements could be those described in chapter 9 for a DBS hybrid (Licensing Option Three). The consortium would own the direct broadcast satellites, hold a broadcasting licence, and be responsible for programming some of the channels. DBS channel programmers would have to be licensed as broadcasting undertakings. The consortium would be subject to common carrier regulation for the channels it leased to other program packagers. Legislative amendments might be required to implement this approach.

If the consortium owned the satellites and used their entire capacity, licensing could be as described in chapter 9 for content and satellite carriage functions licensed together (Licensing Option Two). This option would probably lead to limited diversity of programming. Access by various program suppliers would be more limited than where separation of functions is maintained, particularly if the consortium programmed the entire satellite facility. Even if the consortium leased some of the satellite capacity to other packagers, competitive licensing would be difficult because of the high level of capital investment made by the consortium. While this model could require significant changes in CRTC policy, especially its policy on cross-ownership, it would result in a strong commitment by consortium members and result in services which would be competitive with U.S. DBS services.

The degree to which current CRTC policies on vertical integration would have to be modified would largely depend upon the composition of the consortium. The integration of program packaging and distribution functions within the consortium would make it a vertically integrated organization. The implication of vertical integration is that the DBS consortium, motivated by its desire to make a profit, would naturally design its programming services to attract a maximum number of subscribers and not necessarily to fulfill national broadcasting policy objectives.

Implications for the provision of local services would again depend upon the DBS consortium membership. However, CBC participation in this venture would not necessarily mean its withdrawal from its present terrestrial mode of distribution. The CBC might participate in the consortium by providing one channel of subscription-type services but not the basic services. The participation of private networks would, however, result in a negative impact upon their affiliates only if terrestrial distribution of programming were to cease.

In its study on options for institutional arrangements, Nordicity Group Ltd. has suggested that the undertaking might need to attract the financial participation of American broadcasters wishing to serve U.S. audiences. The Canadian DBS system could then be providing transborder service. While this might be financially desirable, it would not be in keeping with existing policies or with the spirit of the Broadcasting Act which promotes the development of a Canadian broadcasting system for Canadians. Nevertheless, since this model favors private initiative, these observations should not be ignored.

Nordicity Group Ltd. maintains that the financing of a DBS system far exceeds any equity commitments made by broadcasting interests to date. It would be necessary, therefore, to explore a range of forms of ownership, including the condominium concept. In other words, ownership of satellite transponders by individually licensed entities could permit each of them to obtain the financing required on the basis of its own assets, rather than those of the entire system. Financing would likely be a major problem under this option, and tax concessions or some public funding support might be required. Investors would have to be convinced of its economic viability, based on either the success of the interim DBS service on Anik C or the U.S. DBS services for statistics. If investors waited until U.S. statistics were available, a large portion of the Canadian market would probably have already been lost to the U.S. DBS systems.

Review of the models

All four models described in this chapter could result in the establishment of a DBS system for Canada but within different time frames, at different costs to the taxpayer, with objectives that would vary depending upon the owners and the participants. Table 20 provides highlights of the implications of the four models.

The first option would probably be least disruptive to existing institutional arrangements, but paradoxically it could weaken the Canadian broadcasting system and the government's ability to maintain a Canadian presence within that system. The second option (government co-ordination) would lead to the establishment of a Canadian DBS system more rapidly than the first if successful co-ordination could be achieved and financing arranged. Successful co-ordination is also essential to the third and fourth options. The third option (government funding assistance), entailing as it does a significant public expenditure, would be more likely to ensure the timely establishment of a DBS system in support of national broadcasting objectives. The final option presented in this chapter (accelerated commercial development) would see the establishment of a Canadian DBS system by private enterprise if financing could be secured but it would not necessarily serve national broadcasting objectives as well.

Table 20

Highlights of four possible institutional models for a Canadian DBS system

Models	Degrees of govt. involvement	Implications
1 **Commercial evolution**		
	• Minimal	• Lowest investment required
		• Least industry disruption
		• Slow implementation
		• May not result in service that will compete with U.S. DBS
2 **Government co-ordination**		
	• Co-ordination, Phase A support	• Separation of carriage and content
	• Possible funding of satellite development	• Service competitive with U.S. DBS
		• Depends on voluntary commitment of various organizations
		• Financing difficult due to risk and lack of investment return guarantee
3 **Government funding assistance**		
	• Provide funding for CBC commitment	• Rapid implementation of service competitive with U.S. DBS
	• Co-ordination, Phase A support	• Responsive to national broadcasting objectives
	• Possible funding of satellite development	• Significant cost to federal government
4 **Accelerated commercial development**		
	• Active promotion	• Commitment of consortium members
	• Major regulatory policy changes	• Service competitive with U.S. DBS
	• May require tax concessions or funding support	• Requires significant shift in CRTC policy
		• Tendency to monopoly
		• Least sensitive to government objectives

11

Summary and observations

The Broadcasting Strategy for Canada which was made public on March 1, 1983, renews commitment to the spirit of the broadcasting objectives set out in the 1968 Broadcasting Act. One of the three fundamental goals of the strategy is "to provide a significantly increased choice of programming of all kinds in both official languages in all parts of Canada."[1] In addition, the strategy proposes further policy initiatives for public discussion. Among these is a proposed equalization of services thrust, to "reinforce the national effort to equalize the level of broadcasting services throughout the country by employing all available distribution technologies – including microwave and satellites."[2] DBS would provide the opportunity to bring broadcast services to every part of Canada; it could also provide the opportunity to improve access to the means of distribution for Canadian programs and improved service diversity.

Need for a Canadian DBS system

Most Canadians are well served by television broadcasting, with terrestrial transmitters in virtually all urban centres and many rural areas. Canada is also well served by cable television. Some 80 per cent of the population has access to cable television systems, making this one of the most extensively wired countries in the world. In addition, television services are delivered to many urban and rural areas and some remote communities via the Anik fixed satellite systems. Yet there are still about one million Canadian households that cannot receive more than two or three television channels while their urban counterparts have access to twelve channels on

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[1] *Towards a New National Broadcasting Policy,* Government of Canada Department of Communications, March 1, 1983, p. 7.
[2] Ibid, p. 19.

the average and up to 20 or even 30 cable television channels in the larger systems. Eighty thousand households are unable to receive any television signals of acceptable quality.

Most of these underserved households are in rural and remote areas and small towns where population densities are insufficient for cable to be economical. While low-cost cable systems could conceivably be installed in towns with population densities of more than 500 persons per square mile (10.9 per cent of the remote and rural population), most of the underserved live in areas where the population is too dispersed to support cable or even community rebroadcast operations. Over 80 per cent of the remote and rural population (which numbered 6,287,079 in the 1976 Census) is unlikely to be served by additional terrestrial systems in the foreseeable future and is only likely to have services improved through direct broadcasting from satellites.

Financial viability of a Canadian DBS system

Information on the market for DBS in Canada was drawn from surveys carried out in the two major markets – the remote and rural market, and the urban market. Most of the remote and rural market would be served direct-to-home through individually owned or leased DBS receivers. While urban dwellers might also purchase home receivers, the majority would probably receive DBS programming through a cable system.

Based on the results of market surveys[3], the total direct-to-home market in Canada by 1996 is forecast to be up to 2.5 million households in the case of a higher-powered (54 or 57 dBW) satellite system using smaller less expensive dishes and 2.0 million households in the case of a lower-powered (50 dBW) system using slightly larger and more expensive dishes.

A financial analysis of the costs of four DBS system models (50 dBW or 54 dBW with four-beam or six-beam coverage of Canada) and the revenues required to render the operation commercially viable indicates that the cost of DBS television program delivery service would appear to be in a reasonable range. The analysis indicated that any of these four DBS systems could be considered for commercial operation. Furthermore, the analysis pointed to little difference in cost per user between the lower-powered and the higher-powered systems, primarily because the latter type would result in a larger market. The higher-powered system would, therefore, be of greater benefit to the consumer but would require a larger initial financial investment by the supplier.

In contrast to the United States where a number of companies are planning to implement DBS systems, Canada's relatively small market would likely support only one DBS system, at least initially. One system, shared by Canadian public and private broadcasters, would permit an economy of scale to be achieved, reducing channel costs to the benefit of all.

[3] *An Analysis of the Demand for Improved Residential Television Service in Rural Canada,* Demand Research Consultants Incorporated, and *The DBS Market in Canada,* Woods Gordon Management Consultants.

An appropriate environment for DBS

In addition to being affected by technological development and commercial marketing considerations, broadcasting systems are influenced by policy and regulatory processes and decisions. The effective implementation of a Canadian DBS system would require an appropriate policy and regulatory environment, taking into account a number of factors including the following:

- the role of DBS
- its financing (public or private)
- the institutional arrangements for the DBS system
- the programming to be provided by DBS
- the DBS market (communities or individuals or both)
- the impact of DBS on the existing broadcasting system and the nature of the evolving broadcasting environment at the time of implementation
- the impact of U.S. DBS systems on Canada

The position of the CRTC and the government with respect to a number of these key questions would need to be established and stated unambiguously, particularly in regard to institutional arrangements. Then the broadcasting industry would be able to proceed with analysis regarding DBS service to Canadians.

Discussions following the dissemination of this report and the results of the 1983 RARC will serve as two important inputs to the establishment of an environment which would permit consideration of the introduction of a Canadian DBS system.

System implementation

Although in the long term it is anticipated that 30 to 40 channels of television would be required in each of six service areas, it would be practical to adopt a phased approach to implementing a Canadian DBS system. The phase one system could be designed to serve four larger coverage areas as a way of minimizing initial costs, while market penetration is taking place. Greatest cost-effectiveness could be achieved using two operational dual-beam satellites, in two orbit locations. An in-orbit spare satellite would guarantee service availability, or if not needed as a spare, could be used to augment channel capacity in beams with high demand. A minimum of eight channels in each service area would be required at the beginning of the first phase, to take over from Anik C. When warranted by commercial demand, channel capacity could be augmented to 16 by doubling the number of operational satellites in each orbit location. To increase the number of channels per service area beyond about 16 would require that each service area be served from a separate orbit location for reasons of capacity of the allocated spectrum and if an acceptable carrier-to-interference ratio is to be maintained. This would be quite feasible financially when market penetration is approaching saturation. Phase two would see expansion of the system to use six orbit locations, serving six coverage areas with up to 40 channels of regular television and any accompanying radio and teletext services, or the equivalent in high definition TV channels. Table 21 outlines these system implementation phases, which could result in an operational DBS service for Canada in 1988, if a decision to proceed is made prior to 1985.

Table 21

System implementation phases

Phase 1A		
	Orbit locations	2
	Beams	4
	Satellites	3
	Channels per beam	8
Phase 1B		
	Orbit locations	2
	Beams	4
	Satellites	5
	Channels per beam	16
Phase 2		
	Orbit locations	6
	Beams	6
	Satellites	as needed
	Channels per beam	up to 40

It would appear beneficial to implement a system with an edge-of-coverage EIRP of 54 dBW, despite the fact that it would cost more and require more initial capital than a lower-powered system. A 54 dBW system would permit Canadians to use DBS receivers equivalent to those proposed worldwide for DBS. All indications are that this would maximize the market in Canada, and thus optimize economic and social benefits of a DBS service.

The impact on industry of implementing a DBS system would be substantial. Supply of DBS hardware – the satellites and the receivers needed for homes and cable distribution systems – would generate between two and three billion dollars of business over a 15-year period. Up to one billion dollars of revenues for program production might become available over the same period as a result of the extra markets served. More than five thousand high quality continuing technical and programming jobs would be created.

As the Broadcasting Strategy pointed out, new technologies are giving rise to new challenges and opportunities. They are increasing the reach and number of broadcast signals transmitted both within Canada and across the border.[4] Canadian broadcasting has always been progressive in its use of new technologies, with the early and widespread adoption of cable being an outstanding example. The use of Anik C both in Canada and in the United States represents the leading edge of the operational introduction of DBS technology. In 1984, the first dedicated direct broadcasting satellite will be launched by Japan, to be followed by France, Germany, the United States and Great Britain. By 1986, more than half a dozen systems will be in operation internationally, creating markets for millions of home receivers which will probably cost as little as $300 (1982 dollars). The Canadian broadcasting system can continue to be progressive by also adopting DBS technology. By staying in the forefront it can help in the preservation and further development of Canadian culture, as well as advancing Canadian technology, thereby enhancing opportunities and employment in the areas of both culture and technology.

[4] Ibid, p. 3.

Appendix 1

DBS studies

Many variables need to be taken into account in planning a DBS system. In April 1981, the Canadian government undertook a comprehensive program to address the most significant of these. Completed in March 1983, the multi-disciplinary program included studies of DBS requirements, socio-economic aspects, technical considerations, and policy and regulatory issues. This appendix summarizes all but the most technical of these studies. Copies of the studies are available for consultation at the department's regional offices and in the library at departmental headquarters in Ottawa. Addresses are listed below.

Headquarters
Department of Communications
300 Slater St.
Ottawa, Ontario
K1A 0C8

Atlantic Region
Department of Communications
7th Floor
Terminal Plaza Building
P.O. Box 5090
1222 Main Street
Moncton, N.B.
E1C 8R2

Quebec Region
Department of Communications
Rasco Hotel
295 St. Paul East
Montreal, Que.
H2Y 1H1

Ontario Region
Department of Communications
9th Floor
55 St. Clair Avenue East
Toronto, Ontario
M4T 1M2

Central Region
Department of Communications
Room 200
386 Broadway Avenue
Winnipeg, Manitoba
R3C 3Y9

Pacific Region
Department of Communications
325 Granville Street, Room 300
Vancouver, B.C.
V6C 1S5

DBS requirement studies

Statistics of Television Broadcasting Coverage in Rural and Remote Canada, Peter Anderson, Telecommunications Research Group, Simon Fraser University, Burnaby, British Columbia. January 1982.

This report provides statistical information concerning the availability of television services in remote and rural areas of Canada, according to population density and geographical location. Remote and rural areas are subdivided by population density into six categories: 1) remote; 2) dispersed rural; 3) rural settlements with population densities greater than or equal to 100 but less than 500 persons per square mile; 4) rural settlements with population densities greater than or equal to 500 but less than 1,000 persons per square mile; 5) rural fringe areas of census metropolitan areas; and 6) enumeration areas with unknown population densities. The statistics are presented in three forms: 1) general totals for Canada by province or territory and time zone; 2) totals for Canada by province or territory and 3) totals for Canada by time zone.

An Analysis of the Demand for Improved Residential Television Service in Rural Canada, Dr. Jacques C. Bourgeois and Dr. Renaud de Camprieu, Demand Research Consultants Incorporated, Ottawa, Ontario. March 1982.

This report is one of four which analyze the results of 2,667 interviews conducted among a sample of rural households representative of five Canadian regions (the Atlantic, Quebec, Ontario, the Prairies and British Columbia) concerning the need and demand for improved telecommunication services in rural Canada.

This report focuses on residential television services. It analyzes the needs of rural households for television service and indicates the relative priority they would attach to programs aimed at improving television service. It subsequently forecasts their short-term and long-term demands for improved television service given a range of associated costs.

A Study to Identify Requirements for New Services on a Direct Broadcast Satellite (DBS) System, A.I. Spolsky, Canadian Astronautics Limited, Ottawa, Ontario; and Tamec Inc., Verdun, Quebec. September 1981.

The report assesses the need for and requirements of potential new services that DBS could provide in Canada, in addition to entertainment programming. These possible new services are then translated into requirements for satellite channel capacity, uplink and receive terminals. The report also identifies financial and institutional issues and the possible implications of these new services.

The DBS Market in Canada, Colin Deane and John Moore, Woods Gordon Management Consultants, Toronto, Ontario. March 1983.

This report estimates the DBS market in urban areas of Canada and, drawing on information available in *An Analysis of the Demand for Improved Residential Television Service in Rural Canada,* projects the overall Canadian market for a DBS system over the 1983-2000 time period.

In urban areas the market for DBS receivers is divided into the following categories: households in non-cabled areas; households passed by cable but not subscribing; households passed by cable and subscribing.

Socio-economic studies

A Study of the Socio-Economic Impact of Direct Broadcast Satellites on the Canadian TV Broadcasting Industry, James Baer and Stuart Attwell, Raymond, Chabot, Martin, Paré et Cie, Montreal, Quebec. November 1982.

The report makes a preliminary assessment of the likely socio-economic impact of a DBS system in Canada. The potential impact on broadcasters, cable operators, producers, advertisers and carriers is based upon a scenario intended to expose the more serious potential impacts on the broadcasters and cable operators.

The report also provides an economic profile of the existing industry on which the impact assessment is based.

Potential Impact of U.S. DBS Services on Canada, Peter Lyman and Laurie Edwards, Nordicity Group Ltd., Ottawa and Toronto, Ontario. March 1983.

The report develops parallel scenarios, first to project the Canadian television environment to the late 1980s and second to project a likely American DBS development in the near and middle term (mid and late 1980s). Four scenarios are worked out for the United States ranging from the rapid and full development of competitive services to much slower development for both interim and dedicated DBS services. Each of the U.S. scenarios is then used as a basis for projecting the economic impact that American DBS services would have on the Canadian broadcasting environment.

A Feasibility Study for a Canadian DBS Program Package, Michel Lafontaine, Diane Marleau and Gil Daives-Barnoz, Tamec Inc., Verdun, Quebec. July 1981.

This report analyzes the economic feasibility of a range of television programs and other services which might be carried on a Canadian DBS system. The analysis takes a number of factors into account including the number of individual and community television receivers, the number of areas to be served and the number of beams required.

It develops and analyzes scenarios, including probable tariff ranges, which would produce a viable DBS service. The report formulates the most likely scenarios for a 15-year time-frame.

Cost Analysis of Alternative Arrangements for the Delivery of DBS Signals, Michel Lafontaine, Benoit Savard, Diane Marleau, Daniel Zann and Raymond Laforest, Tamec Inc. (and Douserv Telecom Inc.) Verdun, Quebec. July 1982.

The report compares the capital and operating costs of alternative methods of delivering television and radio services to all of Canada, using DBS as a basic technology. The alternative methods reviewed include individual home receivers, small low-cost cable systems, conventional cable systems and UHF/VHF transmitters. The report analyzes the impact which different DBS power levels would have on ground segment costs for two categories of potential DBS subscribers:

1) individual households which would be equipped with home satellite receivers.
2) small communities which could be serviced by a low-cost passive cable system, similar in design to MATV systems.

The Industrial Impact of a Program to Implement a Direct Broadcasting Satellite System in Canada, Colin Deane and Richard Blanchard, Woods Gordon Management Consultants, Toronto, Ontario. January 1983.

The report investigates the financial and employment impact that the development of a DBS system in Canada could create. The evaluation covers a period of 15 years from the implementation of a Canadian DBS. The report also investigates the impact which might stem from export business for DBS products and services.

Selected technical reports and studies

Direct Broadcasting Satellite System Modelling, Spar Aerospace Limited, Ste. Anne de Bellevue, Quebec. June 1981.

This study addresses system level considerations, such as frequency plans, beam plans and channel plans. A number of models are analyzed. Satellite block diagrams are derived and rough estimates made of spacecraft and launch costs.

Direct Broadcasting Satellite System Concepts, Spar Aerospace Limited, Ste. Anne de Bellevue, Quebec. November 1982.

This study builds on previous system level work. The most promising models are developed in the light of 1980s technology and the availability of buses and carriers. Spacecraft configurations are described in sufficient detail to enable credible cost estimates to be made.

State of the Art Techniques to Improve Sidelobe Characteristics of Small Earth Station Reflector Antennas, Office of Industrial Research, University of Manitoba, Winnipeg, Manitoba. May 1982.

This work reports on various options for reducing the sidelobes of low-cost earth terminal antennas.

Study of Digital Modulation and Multiplexing Techniques Appropriate to the Distribution of Radio Programs by Satellite, Miller Communications Ltd., Kanata, Ontario. January 1983.

This study examines two possible methods for distribution of digital radio signals by broadcasting satellite: using a dedicated transponder or sharing a transponder with a TV channel. A mathematical analysis of the various modulation options is included in the report.

Final Report of a Study of the Technical and Economic Consequences of Scrambled TV Services Offered by Direct Broadcast Satellites, K.E. Hancock, D.C. Coll, D. George and C.L. Balko, Philip A. Lapp Ltd., Ottawa, Ontario. February 1982.

Problems of Synchronization of DBS Scrambling Systems, Philip A. Lapp Ltd., Ottawa, Ontario. January 1983.

These reports summarize the findings of a study of scrambling techniques, their feasibility, practical implementation and relative merits.

Study of the Use of Anik C for Direct-to-home and Community Television Distribution Services, Telesat Canada, Ottawa, Ontario. September 1981.

This report summarizes the work carried out by Telesat in studying the feasibility and implications of the use of Anik C to provide an interim direct-to-home broadcasting service. Analyses are made of the market, and of economic and technical aspects. Social, political and regulatory implications are also considered, as are rates and service offerings.

Evaluation of the Anik B Communications Program: Phase I, DPA Consulting, Ottawa, Ontario. August 1982.

The Anik B Communications Program consisted of a series of pilot projects intended to explore potential applications of 14/12 GHz satellite technology. This report contains an evaluation of the program, and includes a brief description of each project, together with an assessment of the degree of success to which each one met the program goals.

Policy and regulatory studies

Regulatory and Policy Implications of a Direct Broadcast Satellite System, Frank Spiller, Francis Spiller Associates, Ottawa, Ontario. March 1982.

The report identifies and analyzes regulatory issues relevant to the introduction of a DBS system in Canada which arise from existing legislative instruments and regulatory practices. The report discusses policy and regulatory options that would facilitate the introduction of DBS services.

Options for Institutional Arrangements for Direct Broadcast Satellites, Peter Lyman and Timothy Denton, Nordicity Group Ltd., Ottawa, Ontario. March 1983.

The report identifies a range of institutional options for implementing a Canadian DBS system. Advantages and disadvantages of each option are analyzed, indicating the regulatory and legislative changes which they may require. Possible financial arrangements are also discussed. The report concludes with an assessment of the overall feasibility and implications of each option.

Appendix 2

Excerpts from relevant acts

The Broadcasting Act

Broadcasting Policy for Canada

3. It is hereby declared that

   (a) broadcasting undertakings in Canada make use of radio frequencies that are public property and such undertakings constitute a single system, herein referred to as the Canadian broadcasting system, comprising public and private elements;

   (b) the Canadian broadcasting system should be effectively owned and controlled by Canadians so as to safeguard, enrich and strengthen the cultural, political, social and economic fabric of Canada;

   (c) all persons licensed to carry on broadcasting undertakings have a responsibility for programs they broadcast but the right to freedom of expression and the right of persons to receive programs, subject only to generally applicable statutes and regulations, is unquestioned;

   (d) the programming provided by the Canadian broadcasting system should be varied and comprehensive and should provide reasonable, balanced opportunity for the expression of differing views on matters of public concern, and the programming provided by each broadcaster should be of high standard, using predominantly Canadian creative and other resources;

   (e) all Canadians are entitled to broadcasting service in English and French as public funds become available;

   (f) there should be provided, through a corporation established by Parliament for the purpose, a national broadcasting service that is predominantly Canadian in content and character;

(g) the national broadcasting service should

(i) be a balanced service of information, enlightenment and entertainment for people of different ages, interests and tastes covering the whole range of programming in fair proportion,

(ii) be extended to all parts of Canada, as public funds become available,

(iii) be in English and French, serving the special needs of geographic regions, and actively contributing to the flow and exchange of cultural and regional information and entertainment, and

(iv) contribute to the development of national unity and provide for a continuing expression of Canadian identity:

(h) where any conflict arises between the objectives of the national broadcasting service and the interests of the private element of the Canadian broadcasting system, it shall be resolved in the public interest but paramount consideration shall be given to the objectives of the national broadcasting service;

(i) facilities should be provided within the Canadian broadcasting system for educational broadcasting; and

(j) the regulation and supervision of the Canadian broadcasting system should be flexible and readily adaptable to scientific and technical advances;

and that the objectives of the broadcasting policy for Canada enunciated in this section can best be achieved by providing for the regulation and supervision of the Canadian broadcasting system by a single independent public authority.
1967-68, c. 25, s. 3.

Objects of the Commission

15. Subject to this Act and the *Radio Act* and any directions to the Commission issued from time to time by the Governor in Council under the authority of this Act. the Commission shall regulate and supervise all aspects of the Canadian broadcasting system with a view to implementing the broadcasting policy enunciated in section 3 of this Act. 1967-68, c. 25, s.15.

The Canadian Radio-television and Telecommunications Commission Act

Objects, Powers, Duties and Functions of the Commission

14.(1) The objects and powers of the Commission and the Executive Committee in relation to broadcasting are as set forth in the *Broadcasting Act*.

(2) The Executive Committee and Chairman shall exercise the powers and perform the duties and functions in relation to telecommunication, other than broadcasting, vested by the *Railway Act*, the *National Transportation Act* or any other Act of Parliament in the Canadian Transport Commission and the President thereof, respectively, and references in any such Act to the Commission or to the President or Vice-President thereof to the extent that such references relate to any matter, the powers, duties and functions in relation to which are by this section vested in the Executive Committee and Chairman, respectively, shall be deemed to be references to the Executive Committee established by this Act or to the Chairman, as the case may be.

(3) For greater certainty but without limiting the generality of subsection (2), sections 17 to 19 and 43 to 82 of the *National Transportation Act* apply, with such modifications as the circumstances require, in the case of every inquiry, complaint, application or other proceeding to or before the Executive Committee of the Canadian Radio-television and Telecommunications Commission under the *Railway Act* or any other Act of Parliament other than the *Broadcasting Act* and, in the event of any conflict between those sections of the *National Transportation Act* and the provisions of the *Railway Act* or any other such Act in relation to any such inquiry, complaint, application or other proceeding to or before the Executive Committee of the Canadian Radio-television and Telecommunications Commission, those sections of the *National Transportation Act* prevail.
1974-75, c. 49, s. 14.

The Railway Act

321 (1) All tolls shall be just and reasonable and shall always, under substantially similar circumstances and conditions with respect to all traffic of the same description carried over the same route, be charged equally to all persons at the same rate.

(2) A company shall not in respect of tolls or any services or facilities provided by the company as a telegraph or telephone company:

(a) make any unjust discrimination against any person or company;

(b) make or give any undue or unreasonable preference or advantage to or in favour of any particular person or company or any particular description of traffic in any respect whatever; or,

(c) subject any particular person or company or any particular description of traffic to any undue or unreasonable prejudice or disadvantage, in any respect whatever;

and where it is shown that the company makes any discrimination or gives any preference or advantage, the burden of proving that the discrimination is not unjust or that the preference is not undue or unreasonable lies upon the company.

R.S., c. 234, s. 321, as amended by R.S., c. 35 (1st Supp.), s. 3.

Appendix 3

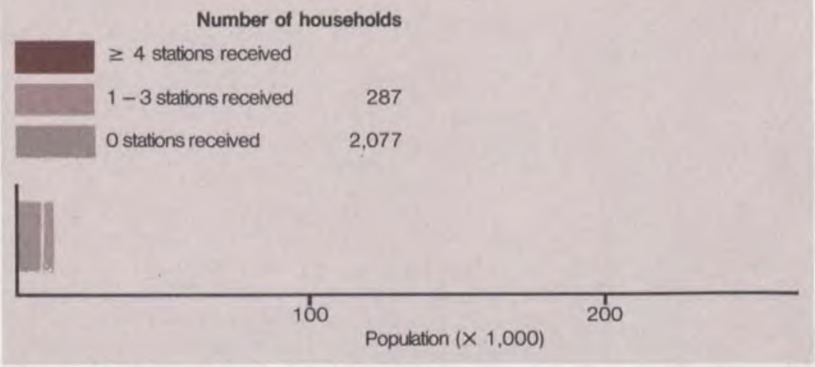
Television service in rural and remote areas, by province or territory, 1980

The charts following summarize some of the data in *Statistics of Television Broadcasting Coverage in Rural and Remote Canada,* Telecommunications Research Group, Simon Fraser University. Rural and remote Canada is defined as those areas and settlements having a population density of less than 1,000 per square mile, but with settlement size not exceeding 2,500 persons, and rural fringe areas whose population densities exceed 1,000 per square mile which are located near or adjacent to urban centres. Population density for a small number of people classified by Census Canada as being rural could not be calculated because land area size information was not available. For over-the-air television reception, location within the Grade "B" coverage contour of a transmitter was taken as the criterion for reception. Cable service was available in some settlements and was included.

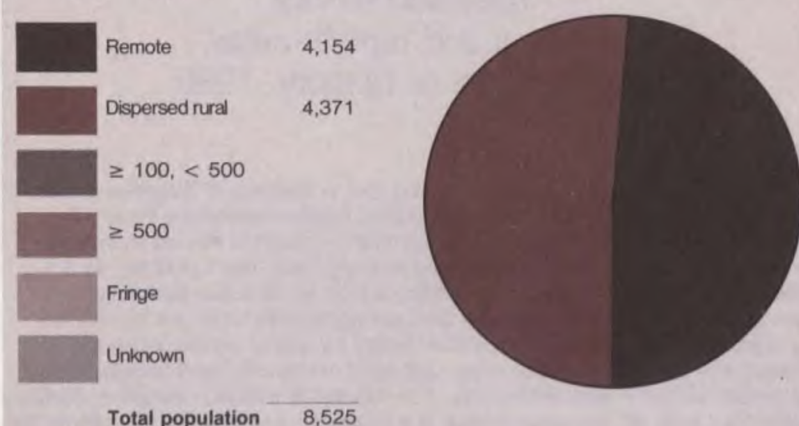
The first chart for each province or territory shows the number of television stations received from all sources by the rural population. The second chart shows the number of people receiving three or less channels by population density. The third chart shows the number of television stations broadcasting Canadian English, Canadian French, and American programming received by the population.

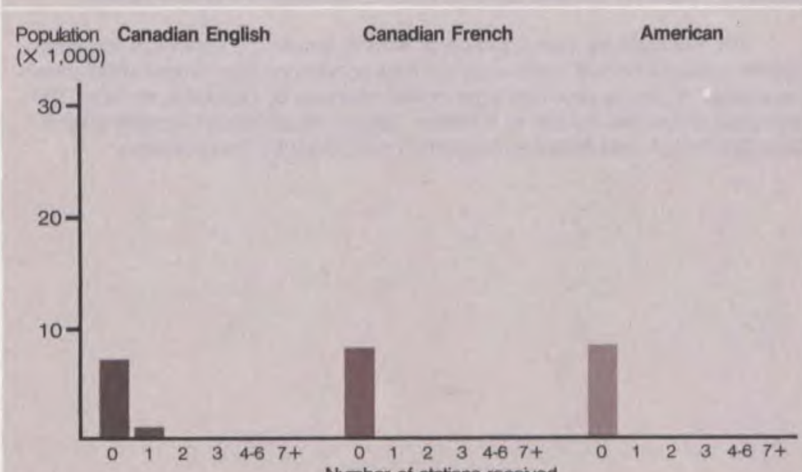
Television service in rural and remote areas

Yukon



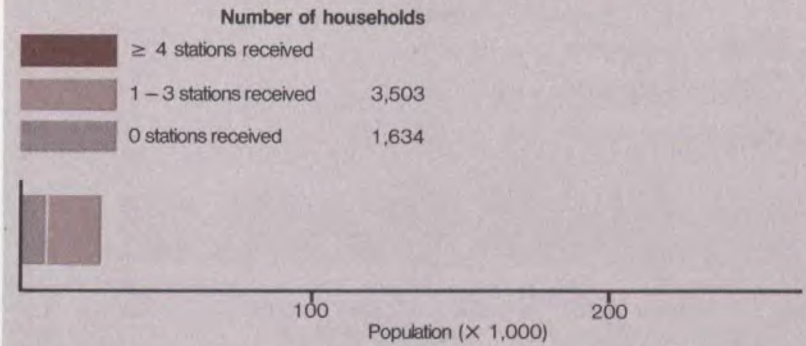
Distribution by density of population for ≤ 3 stations received



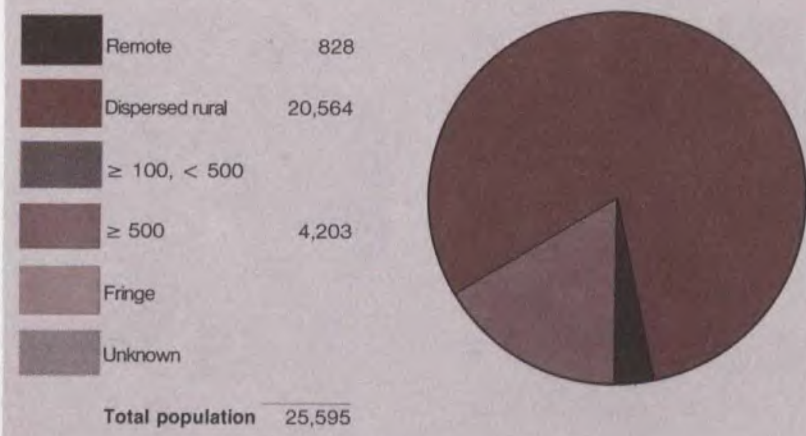


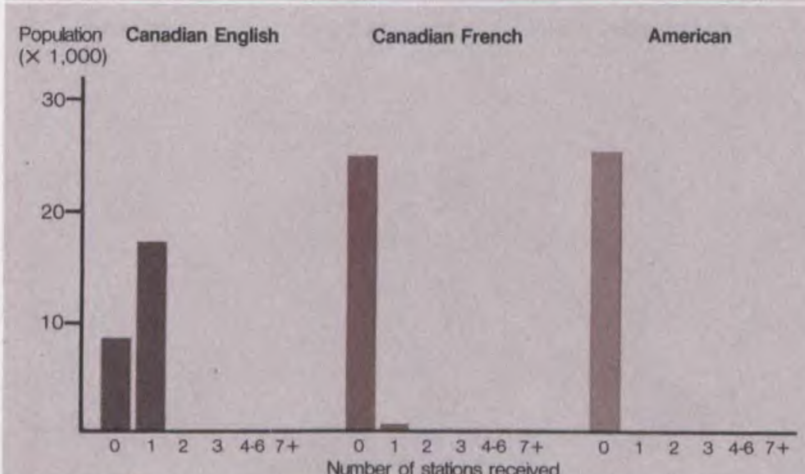
Television service in rural and remote areas

Northwest Territories



Distribution by density of population for ≤ 3 stations received



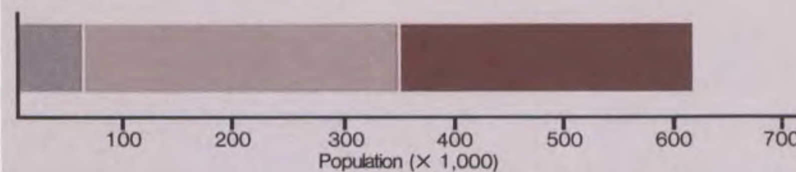


Television service in rural and remote areas

British Columbia

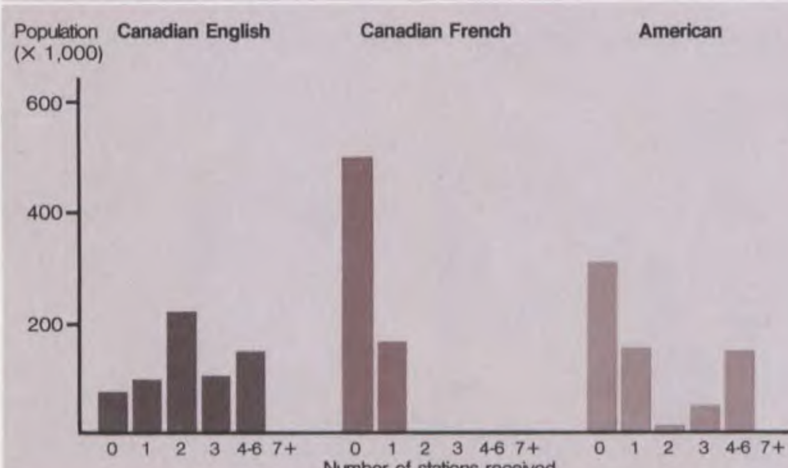
Number of households

≥ 4 stations received	82,248
1 – 3 stations received	85,908
0 stations received	19,723



Distribution by density of population for ≤ 3 stations received

Remote	37,560
Dispersed rural	187,293
≥ 100, < 500	57,151
≥ 500	25,798
Fringe	15,183
Unknown	24,604
Total population	347,589

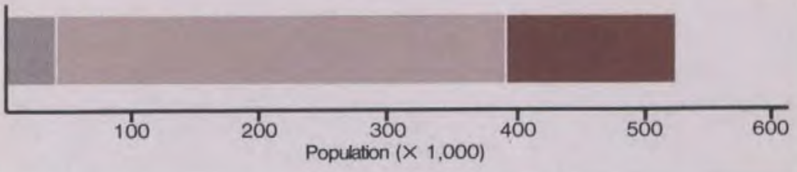


Television service in rural and remote areas

Alberta

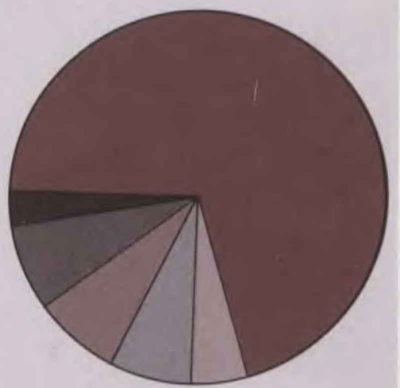
Number of households

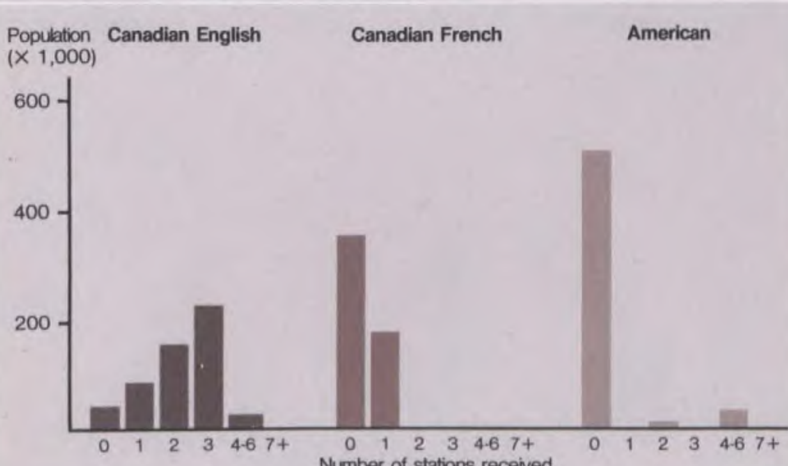
≥ 4 stations received	36,785
1 – 3 stations received	100,118
0 stations received	10,385



Distribution by density of population for ≤ 3 stations received

Remote	18,176
Dispersed rural	275,400
≥ 100, < 500	11,104
≥ 500	30,398
Fringe	29,323
Unknown	27,958
Total population	392,359



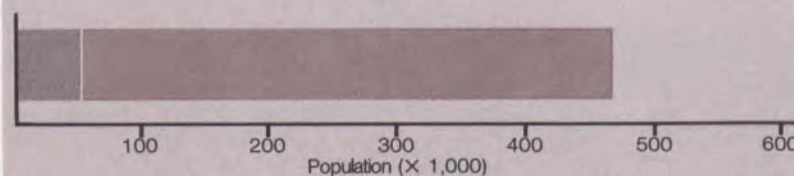


Television service in rural and remote areas

Saskatchewan

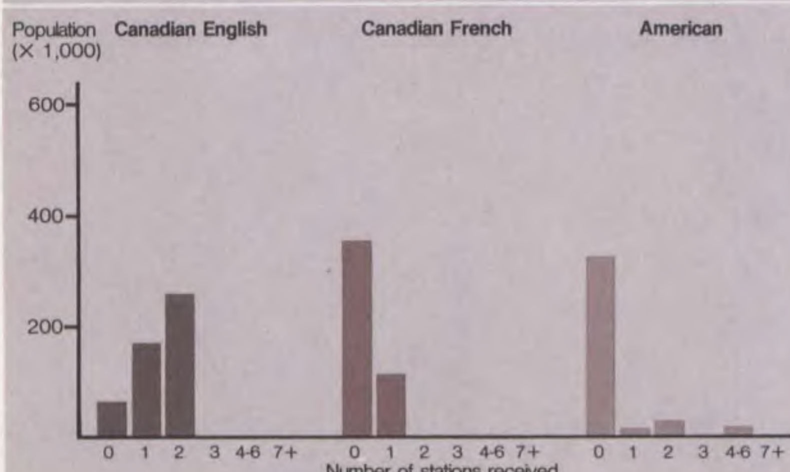
Number of households

≥ 4 stations received	
1 – 3 stations received	124,044
0 stations received	15,645



Distribution by density of population for ≤ 3 stations received

Remote	11,322
Dispersed rural	271,186
≥ 100, < 500	33,485
≥ 500	70,176
Fringe	44,707
Unknown	31,683
Total population	462,559

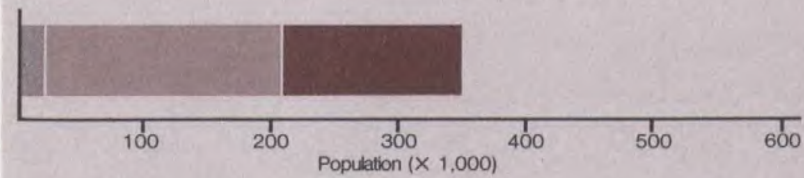


Television service in rural and remote areas

Manitoba

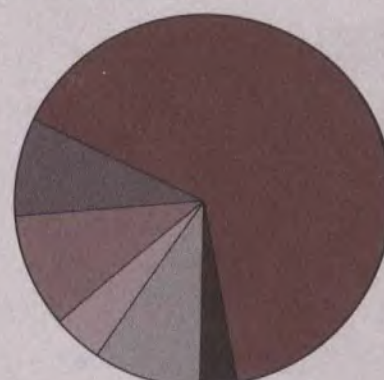
Number of households

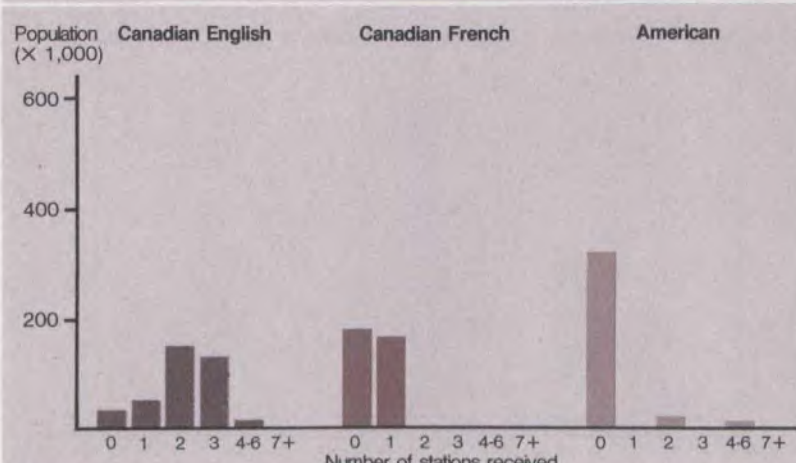
≥ 4 stations received	38,786
1 – 3 stations received	51,410
0 stations received	6,558



Distribution by density of population for ≤ 3 stations received

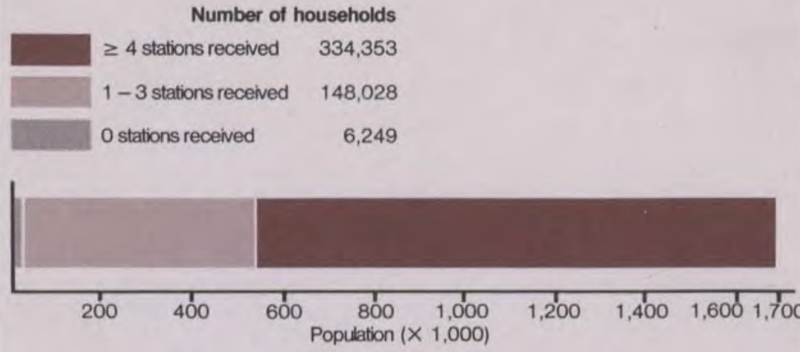
Remote	6,252
Dispersed rural	132,223
≥ 100, < 500	17,138
≥ 500	20,426
Fringe	8,780
Unknown	19,352
Total population	204,171





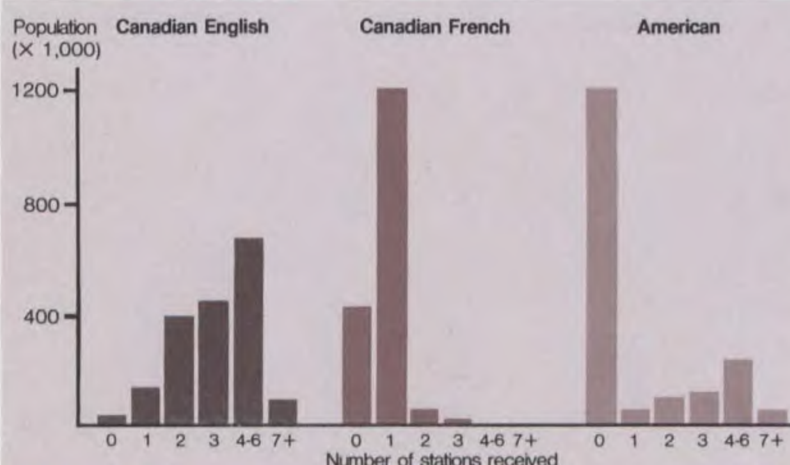
Television service in rural and remote areas

Ontario



Distribution by density of population for ≤ 3 stations received

Remote	12,935
Dispersed rural	367,603
≥ 100, < 500	59,756
≥ 500	47,573
Fringe	10,496
Unknown	29,677
Total population	528,040

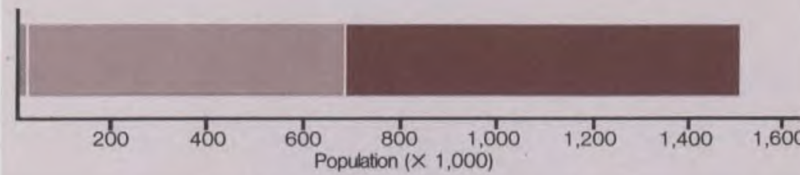


Television service in rural and remote areas

Quebec

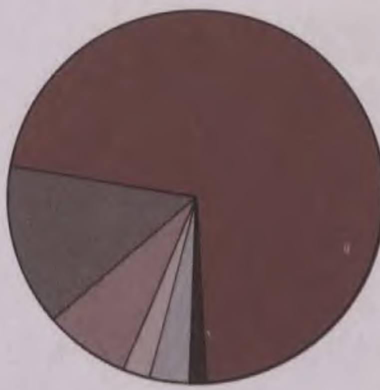
Number of households

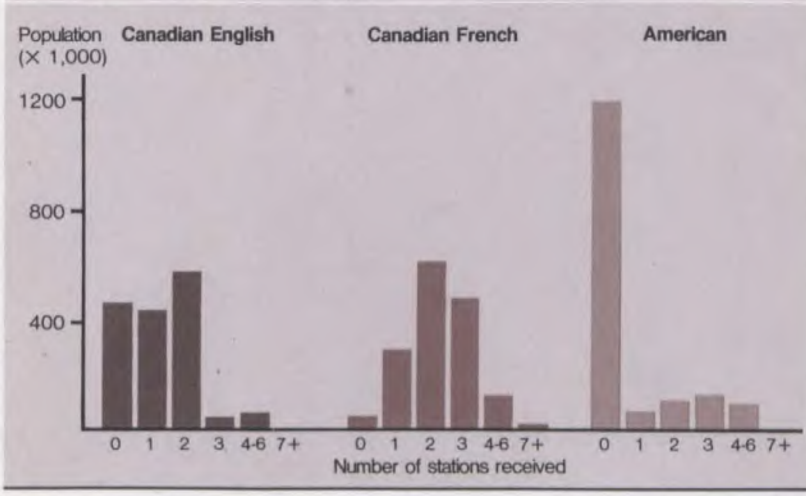
≥ 4 stations received	214,381
1 – 3 stations received	171,692
0 stations received	5,695



Distribution by density of population for ≤ 3 stations received

Remote	8,276
Dispersed rural	477,459
≥ 100, < 500	93,707
≥ 500	49,419
Fringe	15,473
Unknown	23,547
Total population	667,881



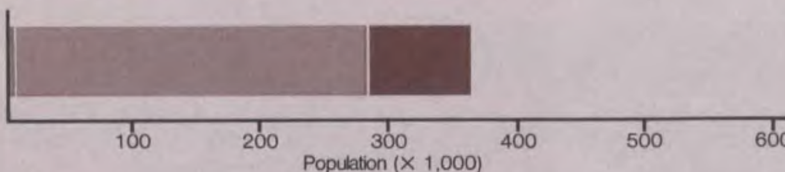


Television service in rural and remote areas

New Brunswick

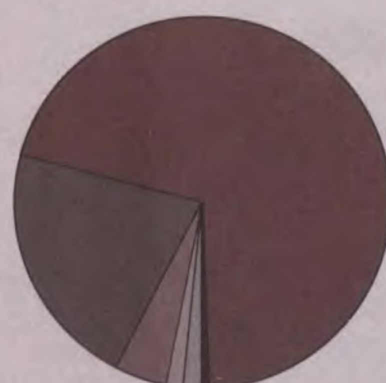
Number of households

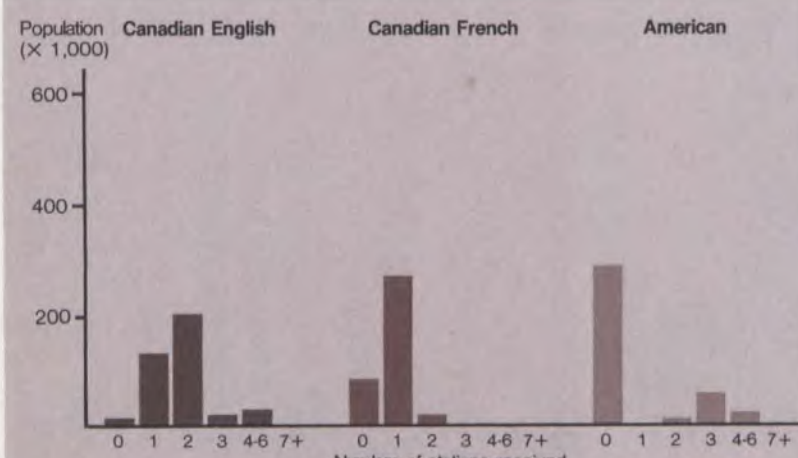
≥ 4 stations received	19,523
1 – 3 stations received	74,828
0 stations received	333



Distribution by density of population for ≤ 3 stations received

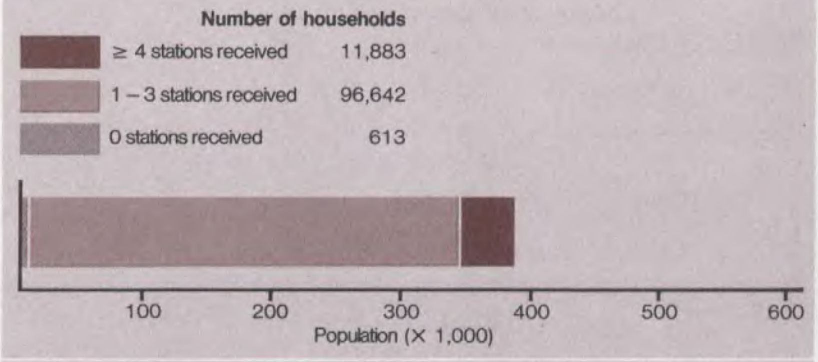
Remote	1,176
Dispersed rural	198,456
≥ 100, < 500	61,718
≥ 500	13,207
Fringe	4,183
Unknown	4,931
Total population	283,671



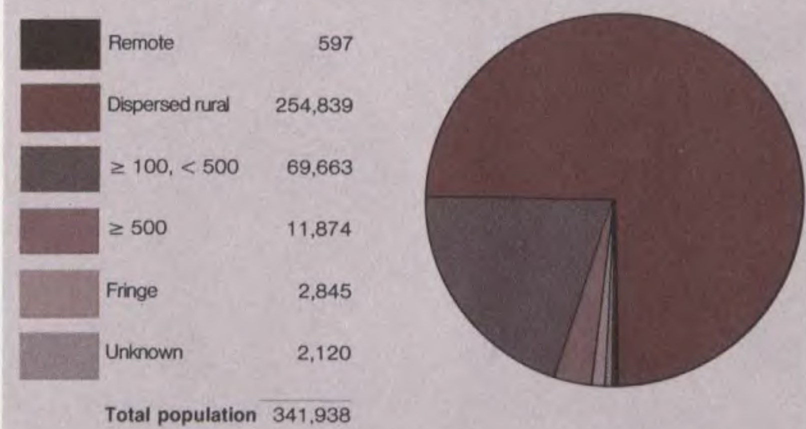


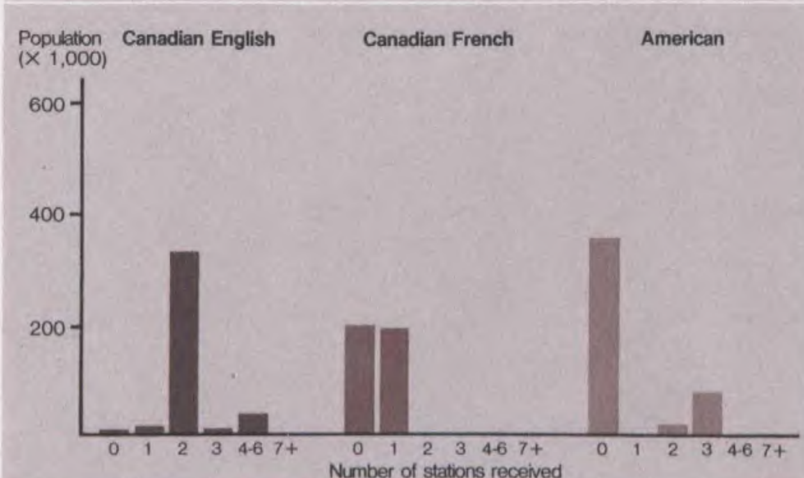
Television service in rural and remote areas

Nova Scotia



Distribution by density of population for ≤ 3 stations received



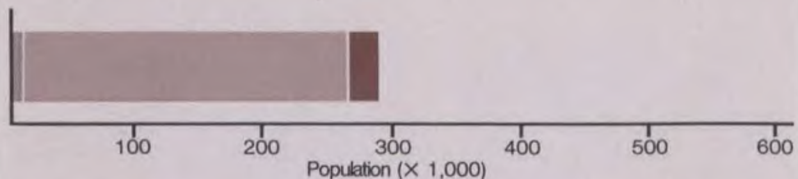


Television service in rural and remote areas

Newfoundland

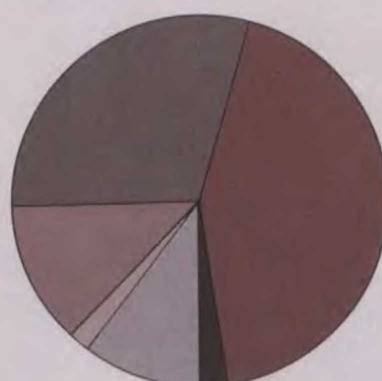
Number of households

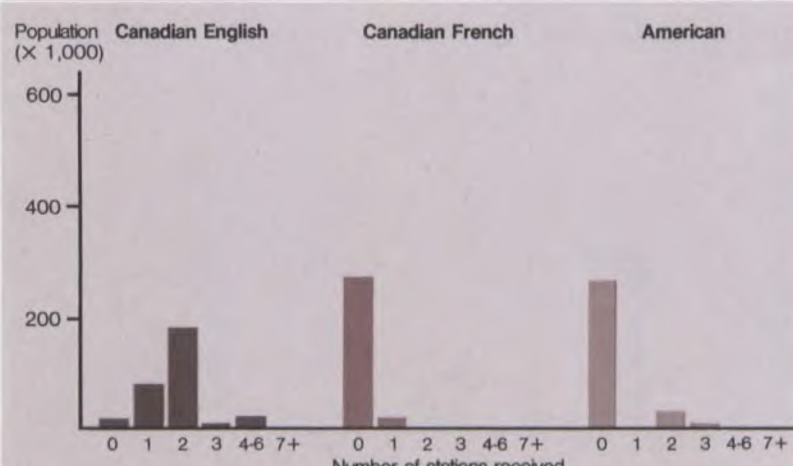
≥ 4 stations received	4,878
1 – 3 stations received	56,023
0 stations received	3,070



Distribution by density of population for ≤ 3 stations received

Remote	5,314
Dispersed rural	109,877
≥ 100, < 500	73,830
≥ 500	32,076
Fringe	4,360
Unknown	26,115
Total population	251,572



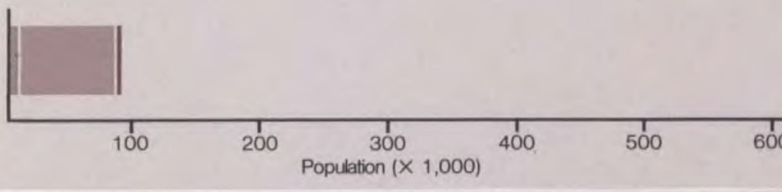


Television service in rural and remote areas

Prince Edward Island

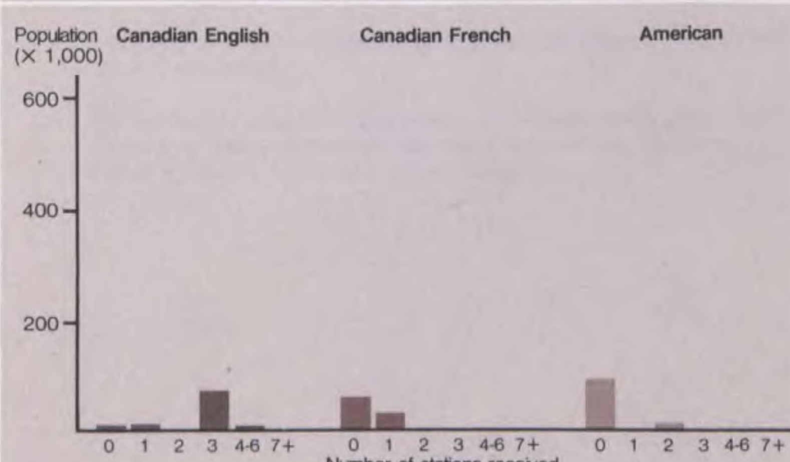
Number of households

≥ 4 stations received	785
1 – 3 stations received	21,143
0 stations received	1,557



Distribution by density of population for ≤ 3 stations received

Remote	
Dispersed rural	55,155
≥ 100, < 500	7,907
≥ 500	11,310
Fringe	3,515
Unknown	305
Total population	78,192



Comparison of satellite costs

It is of interest to compare the dry weight of direct broadcast satellites with that of other communications satellites. This is done in table 4-1. Some points to note are:

- The unit cost of the low-EIRP spacecraft, which includes a high non-recurring element, is below that of Brasilsat, which has a low non-recurring cost associated with the serial production of the Hughes Aircraft HS376 spacecraft bus.

- The unit cost of the high-EIRP DBS spacecraft is dramatically lower than that of MSAT estimates even though the same L-SAT bus is used. This is due primarily to the complex and experimental nature of the MSAT program.

- Incentive payments have been included in the calculation of costs for Anik D, Brasilsat and Intelsat V.

- The unit cost of a low-EIRP spacecraft program with non-recurring costs spread over a larger production run should approach the unit cost of the Intelsat V, which is in the same weight category.

Table 4-1

Comparision of spacecraft costs

Spacecraft	Number of space-craft	Launch vehicle	Spacecraft dry weight	Spacecraft cost (× 1,000,000)	Cost per kg of spacecraft dry weight (× 1,000)
Anik D	2	Delta 3920	513 kg	$47	$92
Brasilsat	2	Ariane SYLDA or STS and PAM D	513 kg	$58	$112
Intelsat V	15	Atlas Centaur or Ariane	809 kg	$64	$79
Low-EIRP DBS (RCA) *	3	Ariane 4 SPELDA or STS and PAM A	980 kg	$99	$101
High-EIRP DBS (L-SAT) *	3	Ariane 4 or STS and IUS	1,534 kg	$96	$63
MSAT *	2	Ariane 3	1,160 kg	$193	$166

* Estimates

Note: Costs are given in 1982 Canadian dollars.

Source: *Direct Broadcasting Satellite System Concepts,* Spar Aerospace Limited.

Table 4-2 gives estimates of launch costs per unit of spacecraft dry weight for a range of candidate launches. For comparison, a PAM D launch from STS is included, although all of the spacecraft considered in this report for a Canadian DBS system are beyond its capability. Points to note are:

- launch costs are similar per unit weight
- launch costs based on STS and Ariane are similar per unit of weight.

Table 4-2

Comparison of launch cost

Launch vehicle	Dry mass	Cost (× 1,000,000)	Cost (× 1,000)
STS and PAM A	810 kg	$37.6	$46.4
STS and IUS	1,534 kg	$73.6	$47.9
Ariane 4 (40)	850 kg	$47.36	$49.9
Ariane 4 (44 P)	1,534 kg	$74.5	$42.5
STS and PAM D II	660 kg	$28.1	$42.5

Note: Costs are given in 1982 dollars.

Source: *Direct Broadcasting Satellite System Concepts* Spar Aerospace Limited.

Appendix 5

Study of the impact of DBS on the Canadian television broadcasting industry

Raymond, Chabot, Martin, Paré et Cie carried out a study of the impact of DBS which is reported in "A Study of the Socio-Economic Impact of Direct Broadcasting Satellites on the Canadian TV Broadcasting Industry". The methodology used was to develop a hypothetical scenario to serve as the basis for analysis. To expose a maximum possible impact, the scenario assumed that fairly drastic changes could take place because of the introduction of DBS. The possible impacts of lesser changes were not felt to be sufficiently significant to be easily quantified through this methodology.

The scenario included assumptions about system configuration, programming, participation by various elements of the broadcasting and telecommunications industry, and sources of revenues. The basic principles guiding its development were that it should favor the attainment of national broadcasting objectives, take into account the unique characteristics of DBS, and recognize that the advent of DBS could present opportunities for changes by participating organizations.

For example, the scenario assumed the gradual withdrawal of public broadcasters from conventional over-the-air broadcasting, as their signals become universally available through cable and DBS. It permitted the assessment of the likely maximum degree of impact on the CBC's affiliates, since it implies CBC withdrawal from the local television broadcasting market. However, to moderate the financial impact on its affiliates, the CBC may choose other approaches to the adoption of DBS. It could, for instance, maintain its present network and participate in a DBS system by producing specialized programming for one or more DBS channels. As another option, it could replace its distribution network including its low-power repeaters with DBS but maintain its transmitters in large centres, and carry on or even increase programming oriented toward local audiences. Undoubtedly other options exist. These will be developed as the CBC and other broadcasters consider how best to use DBS technology in their operations.

Study scenario

The scenario postulated a two-phased development of DBS in Canada: (1) an interim DBS service utilizing one Anik C satellite with 16 channels, employing two to four beams and requiring a 1.2 to 1.8 m antenna for reception in most parts of the country; and (2) five years later a dedicated DBS service utilizing three satellites, employing six beams with up to 20 channels in each, and requiring an antenna 1.0 m in diameter (or even smaller) for high-quality reception throughout Canada.

The programming assumed for interim DBS service would have up to eight television channels available in each coverage area: the CBC English and French networks, educational television, pay-TV and two advertiser-supported television services. All these services would be transferred to the dedicated DBS system when it became available. The dedicated system could carry an additional 12 advertiser-supported, special interest, public service and narrowcasting channels, for a total of 20 channels.

The longer-term scenario assumed that the CBC would use DBS as its primary means of transmission and that it would withdraw partially from the local over-the-air broadcasting, in recognition of the regional coverage potential of DBS, leaving a greater local role to private stations and networks. The CBC would stop selling local air-time to advertisers and might also reduce the amount of national advertising sold if this proved necessary to assist the private sector in coping with market fragmentation due to increased competition.[1]

It was estimated in the study that the probable market for DBS would be 2.2 million households or 29 per cent of Canadian households. Among the households in this market, 59 per cent would be cable subscribers and 41 per cent would be households using home receivers.[2] Table 5-1 describes this postulated market.

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1 It should be noted that this is not CBC policy.

2 Results from the market studies carried out in the course of the DBS Studies Program were not available when this study was started. The total market estimated here is in the range suggested by market studies which are described in chapter 6, although it differs in detail.

Table 5-1

Probable market for DBS assumed for study of impact on broadcasting industry

	Households	
Market segment	**Total number**	**Probable DBS users**
Dispersed households	1,278,000	325,000
Small rural communities	1,013,191	253,000
Cable systems	4,300,000	1,300,000
Off-air broadcast in large cities	1,128,200	338,400
Total	7,719,391	2,216,400

Findings of the study

For a detailed analysis of the economic impact of DBS, consult *A Study of the Socio-Economic Impact of Direct Broadcast Satellites on the Canadian TV Broadcasting Industry*. A brief description of the study findings follows.

The study scenario acknowledges that the CBC would be a key element in a Canadian DBS system. It postulates that not only would the CBC sponsor a significant portion of the programming, but that it would use the opportunity presented by DBS to change its operations to place an even greater emphasis on programming. In the scenario DBS becomes the CBC's primary means of transmission, its local broadcasting is diminished or eliminated, and its advertising revenues are greatly reduced.

The study concludes that the sharp decrease in advertising revenues of the CBC would be offset by decreased distribution costs because its costly terrestrial communications system would be replaced by DBS, and local station operations would be reduced in scale. In fact, Raymond, Chabot, Martin, Paré et Cie estimate a possible small net saving of $3.7 million annually for the CBC under the scenario.

The impact of the scenario on CBC affiliates was found to be severe. If the CBC were to stop selling advertising on a network basis, affiliates would lose about $11 million in associated transfers from the corporation, in addition to losing the free CBC program service.

If, in addition, the CBC were to withdraw entirely from selling local advertising on the stations it owns and operates, more than $42 million of potential advertising would be released to remaining local broadcasters, but the CBC affiliates would be the least able to attract these funds because they do not now compete with CBC owned and operated stations. The study concluded that only with the CBC withdrawing from advertising sales altogether – and so releasing a further $50 million – would sufficient revenues be available to the CBC's affiliates to offset the losses in network payments.

On the other hand, CTV and TVA affiliates would benefit substantially under the scenario. Of the $50-100 million in advertising sales released to private broadcasters as a result of the assumed reduction or even elimination of CBC advertising sales, the study postulated that a major portion would be captured by the CTV and TVA affiliates.

Independent broadcasters also would stand to gain under the study scenario, although less than the affiliates of CTV and TVA. They are usually located in larger urban centres where the competition for advertising dollars would not decrease following the CBC's withdrawal from commercial sales as much as it would in smaller communities. Those independent stations becoming DBS superstations are likely to see a considerable growth in advertising revenue.

The cable television industry would be affected in two ways under the study scenario: (1) the effect on direct costs of equipment and (2) the extent to which DBS would offer serious competition to cable companies.

The scenario assumed that all cable companies seeking to receive DBS services would invest $2,500 per year for ten years for all necessary reception equipment. The smallest systems would require increased revenues to cover these costs, and on average approximately $6 per year per subscriber would be sufficient to cover the investment. Systems with more than 1,000 subscribers each would be able to cover costs with income of just $0.19 per subscriber per year on average.

The study concludes that DBS could pose a competitive threat to Canada's smaller cable systems. Small community groups or apartment buildings might be able to undercut the cable licensee's monthly charge, thereby causing some competitive losses. The study suggests that certain groups of cable companies not now offering sufficiently attractive television services could be subject to a moderate risk (5 per cent revenue loss), a higher risk (10 per cent) or an extreme risk (15 per cent).

Summary

The specificity of the scenario necessarily limits the generality of the conclusions of the study. In fact, the economic impact on the broadcasting industry of this scenario seems to be determined more by the assumed CBC withdrawal from advertising markets than by DBS. Nevertheless, certain general points emerge from the analysis: the entry of DBS services into Canadian broadcasting markets can be expected to have some impact on existing broadcasting licensees. DBS would compound the audience fragmentation already caused by pay-TV and likely to be caused in future by expansion of satellite-to-cable services; in addition, DBS advertiser-supported superstations can be expected to reduce the advertising revenues of established broadcasters.

DBS services do not appear likely to affect the cable television industry adversely. Rather, they might add to the range of options cable companies are able to offer their subscribers. Although the study suggests that smaller cable systems could be subject to some competitive pressure caused by home reception of DBS services, comparative costs have not been analyzed closely. However, the study found that satellite-to-cable delivery would cost substantially less per subscriber than satellite-to-home delivery, giving it a cost advantage. Other factors, such as quality of service, would be the cause of any migration from cable to individual home receivers.

Appendix 6

Study of the impact of a Canadian DBS system on the program production and manufacturing industries

The impact of a Canadian DBS system on the hardware and program production industries was analyzed in a study by Woods Gordon Management Consultants, *The Industrial Impact of a Program to Implement a Direct Broadcasting Satellite System in Canada.* The methodology used in the study and the principal results, are summarized here.

Program production industry

The programming which the study assumed would be carried by a Canadian DBS system is shown in Table 6-1 for three successive phases over a 15-year period. Many of the programming possibilities in this scenario are services that are already in existence, such as the CBC, educational channels, advertiser-supported channels and the newly available pay-TV services. Some new programming could come into being, but this would be only if services not now available, such as programming for native peoples and religious programming, were fully developed.

The major impact of DBS on programming would be due to the larger market made available for pay-TV. To estimate the revenues available for DBS pay-TV programming, the study assumed that the non-cabled Canadian market, comprising a minimum of 1.8 million households, would subscribe to a DBS pay-TV service with penetration rates of 30, 40 or 50 per cent. In addition, subscribers taking two pay-TV services were assumed to be 20 per cent (low estimate) or 50 per cent (high estimate) of the pay-TV subscribers. Assumed cost to subscribers was $15 a month for one pay-TV service and $25 a month for two. The amount of revenue assumed to be available for program acquisition by the pay-TV enterprises was $6.40 per single-channel subscriber and $12.80 for the two-channel subscriber. (The remaining portion of revenue was assumed to be devoted to distribution, billing and other overhead expenses.)

Table 6-1

Assumed DBS programming scenario over fifteen years

Phase 1	
The basic program package is assumed to be carried on Anik C as an interim DBS service and to be available for transfer to a dedicated DBS.	
CBC (English)	
CBC (French)	
Educational (English or French)	
Pay-TV (English or French) national	
Pay-TV (English or French) regional	
Pay-TV (English or French) cultural and specialized	
Public interest or House of Commons	
Phase 2	
This phase builds upon Phase 1 by giving expression to policy and public service objectives and by including elements to improve market penetration.	
CBC 2 (English or French)	
Advertiser-supported station(s) (English or French)	
Multilingual advertiser-supported channel	
Native peoples channel (supported by government grants)	
Religious channel	
U.S. networks	– NBC
	– CBS
	– ABC
	– PBS
Phase 3	
The last phase caters to likely increasing discrimination and specialized interests of established DBS audiences.	
Specialized pay-TV	– children's programming
	– sports
	– movies
	– foreign programming
Other services (such as FM superstations and specialized video and audio)	

Source: Woods Gordon Management Consultants.

Based on these assumptions, and taking only the more conservative, low estimate (20 per cent) for two-channel subscribers, funds available for acquisition of DBS pay-TV programming in a single year solely from non-cabled markets were estimated to range from $49.8 million to $82.9 million, as shown in table 6-2. For the 15-year period covered by the study, the cumulative total would be in the range of $697 million to $1.16 billion, allowing for a three-year build-up.

Table 6-2

Estimated revenues available from non-cabled markets for program acquisition by DBS pay-TV

Market penetration	Estimated revenues (millions of 1982 dollars)	
	One year	Fifteen years*
30%	$49.8	$ 697
40%	$66.4	$ 930
50%	$82.9	$1,160

* Allows a three-year build-up

Note: Estimates are based on 20 per cent of pay-TV subscribers taking two services.

Source: Woods Gordon Management Consultants.

By examining the estimates supplied by successful pay-TV applicants in their submissions to the CRTC, the researchers derived an assumption that expenditures on Canadian programming would be 61 per cent of total estimated revenues available for program acquisition. As shown in table 6-3, this assumption would lead to a 15-year expenditure on Canadian programming of between $425 million and $708 million in 1982 dollars.

Table 6-3

Estimated expenditures by DBS pay-TV on Canadian programming over fifteen years

Market penetration	Estimated expenditures (millions of 1982 dollars)
30%	$425
40%	$567
50%	$708

Note: Estimates are based on 20 per cent of pay-TV subscribers taking two services.

Source: Woods Gordon Management Consultants.

The Woods Gordon study also estimated the job-years likely to be created by programming expenditures of DBS pay-TV. Using the assumptions that one million 1982 dollars spent on Canadian program production would generate 30.5 job-years of direct employment, that an employment multiplier of 1.45 would lead to an additional 13.7 job-years per million dollars, and that about 9.3 per cent of the dollar value of program content would be imported, the study concluded that employment creation over 15 years due to pay-TV transmitted by DBS would be at least 18,800 job-years. This is illustrated in table 6-4.

Table 6-4

Estimated employment created through Canadian programming expenditures of DBS pay-TV over fifteen years

Market penetration	Estimated employment created (job-years)
30%	18,800
40%	25,100
50%	31,300

Note: Estimates are based on 20 per cent of pay-TV subscribers taking two services.

Source: Woods Gordon Management Consultants.

The study assumed that only two channels of new special-interest programming, such as native or religious programming, would develop over the next 15-year period. These were assumed to be independent of market size; they might, for example, be funded by institutions or by grants. The estimated expenditures on such production are shown in table 6-5, along with number of the job-years expected to be created. Expenditures over 15 years on Canadian programming would total $84 million, while some 2,000 person-years of employment would be created.

Table 6-5

Employment and financial impact of two special-interest DBS channels over fifteen years

	Estimated expenditures on programming (millions of 1982 dollars)	Estimated employment created (job-years)
Canadian programs	$36	1,200
Imported programs	$84	2,000
Total	$120	3,200

Source: Woods Gordon Management Consultants.

Table 6-6

Major physical elements of a DBS system

Space segment	
	Satellites
	Launches
	Telemetry, tracking and control (TT&C)
	Insurance
Earth segment	
	Uplink stations
	Capital costs
	Operations and maintenance
	Broadcasting operations
	Capital costs
	Operations and maintenance
	Downlinks: direct-to-community
	Head-end terminals
	Installation
	Household decoders
	Service and maintenance
	Downlinks: direct-to-home
	TVRO antennas
	Outdoor electronics
	Indoor electronics
	Cable
	Installation
	Monitoring and billing
	Service and maintenance
	New TV equipment (e.g. HDTV)

Hardware manufacturing industry

The physical elements of a DBS system are listed in table 6-6. The study projects expenditures for them over a 15-year period (1984-1998), and the number of new jobs likely to be created as a result of these expenditures.

It was assumed for purposes of the study that interim DBS service would be provided on Anik C from 1984 until 1988 when service would continue under one of the following systems models:

System model 1

The first model assumes continuation of the interim service using an Anik C replacement and one in-orbit spare. Service would continue at this level for the balance of the 15-year period.

System model 2

In the second model, interim service would be replaced in 1988 with a full DBS service providing eight channels per beam in four beams. This would be increased in 1992 to 16 channels per beam in four beams.

System model 3

In the third model, interim service would be replaced in 1988 with a full DBS service providing ten channels per beam in six beams. In 1992, this would be increased to 20 channels per beam in six beams.

These models represent three system options, each of which has its own specific requirements for satellites, launches and uplinks. Estimates of equipment required for both community and home reception are dictated by assumptions about the market for DBS services. Three scenarios were developed based on market size – low, medium and high. The hardware quantities for the space and earth segments were derived from these scenarios; they are shown in table 6-7. As many as 12 satellites, served by 136 uplink stations and 6 operations centres, serving as many as 2,500 community receivers and 1,666,000 home receivers, may be required under the high market scenario.

Table 6-7

Hardware for three DBS System Models Assumed to be required between 1984 and 1998

	System model		
Space segment	**#1**	**#2**	**#3**
Satellites	4	8	12
Launches	4	8	12
Earth segment			
Uplink stations	32	80	136
Broadcasting operations centres	0	6	6
Direct-to-community receiving stations			
Low market	600	600	600
Medium market	1,300	1,300	1,300
High market	2,500	2,500	2,500
Direct-to-home receivers			
Low market	796,000	796,000	796,000
Medium market	1,247,000	1,247,000	1,247,000
High market	1,666,000	1,666,000	1,666,000

For each element of capital expenditure associated with the construction, launch, operation of the system and distribution of services, assumptions were made regarding costs, percentage of capital goods likely to be produced in Canada, servicing requirements and direct and indirect employment generated.

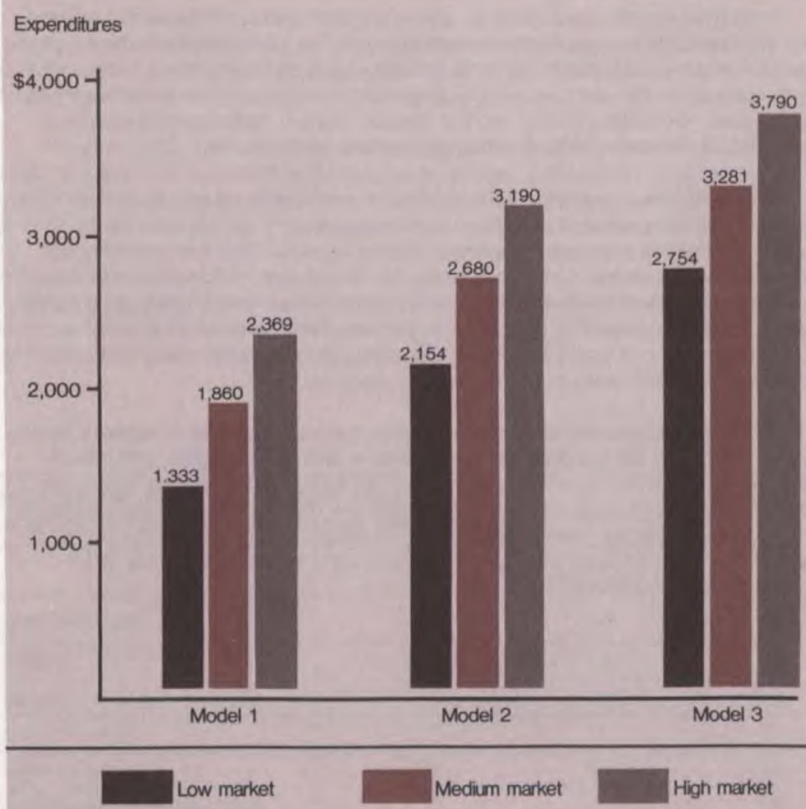
Estimated total expenditure for space segment and earth segment hardware for the three DBS system models ranges from $1.3 to $3.8 billion over the 15-year period considered by the study, as indicated in figure 6-1. In general, predicted expenditures for the earth segment were greater than those for the space segment. In the case of system model 2 and the medium market, earth-segment spending amounted to 58 per cent of the total expenditure on hardware.

The Woods Gordon Study found that the earth segment also had much higher Canadian content; it was 79 per cent compared to 35 per cent for the space segment in the model 2, medium market scenario. The low percentage of Canadian content in the space segment is due to the cost of launches which are performed outside Canada and the need to import components, which account for about half of the satellites' costs. Of the earth-segment costs, more than 45 per cent were attributed to the installation and maintenance of home receivers and to operations of uplink stations and community receivers.

The manpower requirements to produce the earth and space segment hardware, to operate the satellites and uplink stations, and market, install, and maintain community and home receivers are shown in figure 6-2. The total job years over the 15-year period range from 31,700 for the low market, Anik C system scenario to 73,200 for the high market large system scenario. In general the study projected four times as many jobs concerned with earth segment hardware as for space segment hardware.

Figure 6-1

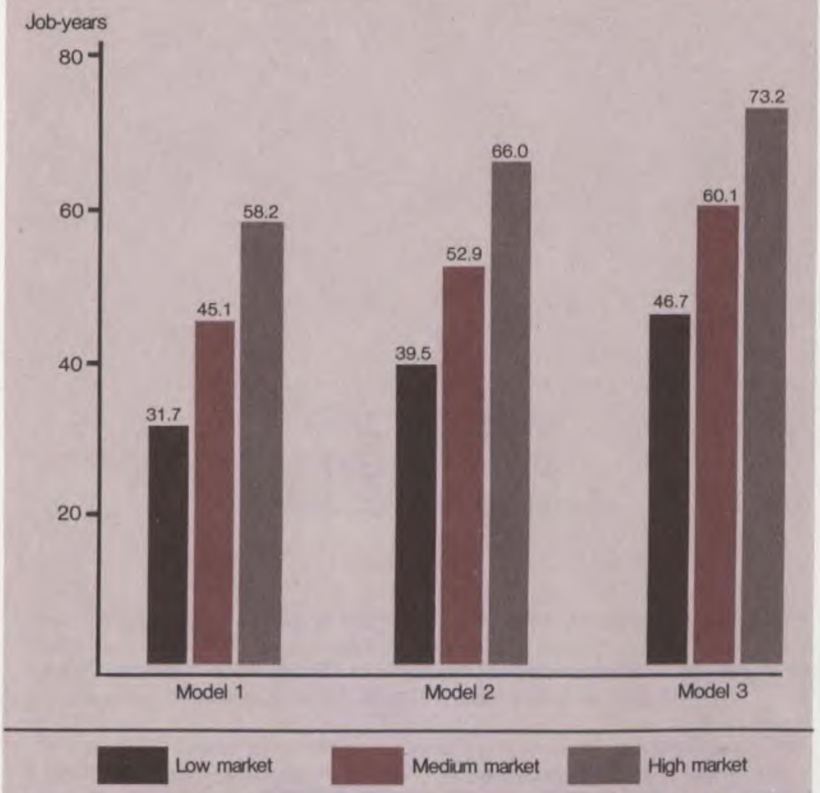
Estimated expenditures on hardware for three DBS system models (in millions of 1982 dollars)



Source: Woods Gordon, *The Industrial Impact of a Program to Implement a Direct Broadcasting Satellite System in Canada.*

Figure 6-2

Estimated job-years created through expenditures on hardware for three DBS system models (in thousands)



Source: Woods Gordon, *The Industrial Impact of a Program to Implement a Direct Broadcasting Satellite System in Canada.*

Appendix 7

CRTC regulation of Telesat Canada's fixed satellite services

Since the inception of Telesat in 1969, the government has held the view that Telesat is a complement to and not a competitor with existing telecommunication carriers, and that a close association with these carriers must exist if efficient, effective integration of fixed satellite and terrestrial facilities is to be ensured.

In 1976, Telesat entered into a connecting agreement with members of the TransCanada Telephone System (TCTS). The connecting agreement was subsequently reviewed by the CRTC. In Telecom Decision CRTC 77-10, the CRTC concluded that approval of the connecting agreement would not be in the public interest. One of the principal grounds for the decision was the commission's conclusion that approval of the connecting agreement would raise a substantial likelihood of Telesat's giving undue preference to TCTS, contrary to section 321 of the Railway Act, and would significantly prejudice the capacity of the commission to adjudicate complaints of unjust discrimination under the Railway Act.

On November 3, 1977, Telecom Decision 77-10 was varied by the Governor in Council pursuant to subsection 64(1) of the National Transportation Act so as to provide for approval of the connecting agreement. In a statement issued on the same date, then Minister of Communications Jeanne Sauvé emphasized that a particular and urgent concern of the government was the future of Canada's domestic satellite services, and that in the absence of the increased utilization envisaged under the connecting agreement, and the revenues arising therefrom, those services would become much more costly. The connecting agreement involved commitments by both parties: Telesat committed itself to the construction of a new series of fixed satellites, and TCTS undertook to provide financial and utilization guarantees to Telesat.

On July 7, 1981, the CRTC issued Telecom Decision 81-13 related to applications by Bell Canada, British Columbia Telephone Company and Telesat Canada dealing with services and facilities furnished on a Canada-wide basis by members of TCTS including fixed satellite services. Telecom Decision 81-13, among other things, ordered Telesat to refile its general tariff so as to comply with two new requirements: one, to deal direct with end-users; two, to lease partial satellite channels to common carriers and to the public. The connecting agreement between Telesat and TCTS required Telesat to lease only full satellite channels to approved carriers such as CNCP, TCTS members and certain non-TCTS members such as Québec-Téléphone. The CRTC found this marketing practice to be unlawful under the Railway Act and, in effect, ruled in Telecom Decision 81-13 that Telesat should be both wholesaler and retailer of satellite services, leasing without differentiation in price both whole and partial satellite channels to carriers on a wholesale basis, and also dealing directly with end-users on a retail basis.

On December 10, 1981, Telecom Decision 81-13 was varied by the Governor in Council pursuant to subsection 64(1) of the National Transportation Act so as to (1) require Telesat to file with the CRTC a revised tariff which allowed (a) whole satellite channels to be leased by broadcasting undertakings and approved common carriers and (b) partial satellite channels to be leased only by approved common carriers, and (2) require Bell Canada and B.C. Telephone to file with the CRTC standard items in their general tariff for private-line services provided by partial satellite channels and rate schedules for these services that are insensitive to distance and number of locations served. In a statement issued on the same date, Minister of Communications Francis Fox noted that the Governor in Council gave particular attention to the concerns expressed by broadcasters and potential business users that Telesat's marketing practices limited the availability of satellite services. The minister further noted that the Governor in Council decision would enable broadcasters to lease whole channels from Telesat and business users to lease services from approved common carriers based on partial satellite channels. At the same time, the Governor in Council decision would support the arrangements that Telesat had negotiated with TCTS in the connecting agreement which provide for the financing and utilization of Telesat's new series of fixed satellites.

Glossary

AFC: automatic frequency control.

Ariane: satellite launch vehicle developed by the European Space Agency.

Baseband: the basic signal (audio, video, etc) used to modulate a radio frequency carrier.

Beam: term referring to the directional pattern of an antenna. At frequencies used for satellite communications, the beams can be very narrow, only a few degrees wide.

BPSK: binary phase shift keying, a digital modulation method where one phase of a radio frequency signal is used to represent one binary state, and a second phase, (usually 180° apart) is used for the second binary state.

BSS: broadcasting satellite service (ITU definition).

Bus: the portion of a satellite required to support the payload. The bus includes the structure, power sources (solar array, batteries), attitude control and station keeping devices, temperature control devices, telemetry equipment, etc.

Cable head-end: central hub of a cable distribution system, where television signals are received for onward transmission.

Carrier: a radio frequency signal which is modulated (am, fm, etc) to transmit program information (video, audio).

CBC-2: proposed second television network by the Canadian Broadcasting Corporation

CCIR: International Radio Consultative Committee, a permanent division of the ITU which formulates international standards for radio communication.

Community reception: reception of a satellite television signal with a community antenna and receiver, and distribution within the community by terrestrial transmitter or cable.

Companding: a technique to provide a subjective improvement in audio signals by compressing the transmitted volume range and restoring the range at the receiver.

dB: decibel, a ratio expressed logarithmically.

DBS: direct broadcasting satellite.

dBW: decibel power of a signal over a 1 watt reference.

Demodulator: the device which recovers the modulating signal from the radio frequency carrier.

Digital multiplexing: a technique of combining several digital signals prior to transmission.

Downlink: the space-to-earth transmission from a satellite.

Dry weight: the weight of a satellite without the station-keeping propellant which is added prior to launch.

EIRP: effective isotropic radiated power.

ESA: European Space Agency.

Feeder link: transmission link from earth-to-space providing signals to a direct broadcasting satellite; sometimes called uplink.

Footprint: the area on the earth's surface covered by a satellite antenna beam.

Frequency band: a segment of frequency spectrum, generally used for a specific application.

FSS: fixed satellite service (ITU definition).

Geostationary orbit: the circular orbit about 36 000 km above the equator where satellites have an orbital period of 24 hours and therefore appear stationary from any point on the earth.

GHz: gigahertz, a unit of frequency in the radio spectrum, equivalent to one billion (10^9) hertz.

G/T: a figure of merit for a satellite receiver, defined as the ratio of the antenna gain to the system noise temperature. The higher the figure, the better the receiver.

HDTV: high definition television.

Intermodulation: interaction among radio signals.

Inuktitut: language of the Inuit.

ITU: International Telecommunications Union.

IUS: inertial upper stage, a rocket system for transporting satellites from the orbit of the space shuttle to geostationary orbit.

Low noise amplifier: a high quality radio frequency amplifier which contributes very little internally generated electronic noise to the signal being amplified.

L-SAT: large satellite bus under development by the European Space Agency.

MAC: acronym for multiplexed analogue component system, a television signal format especially suitable for frequency modulation of a radio frequency carrier.

Margin (signal): the extra signal level allocated to compensate for losses due to antenna mispointing, attenuation by rain, wet snow accumulation of the antenna, etc.

MATV: master antenna system for television reception in apartment buildings, hotels, etc.

MHz: megahertz, a unit of frequency in the radio spectrum, equivalent to one million (10^6) hertz.

Mid-band: supplementary channels used by cable systems in the frequency band 120-174 MHz not used in over-the-air broadcasting by TV and fm radio stations.

Modulation: the technique of superimposing a baseband signal on a radio frequency carrier signal.

MSAT: satellite system under definition by the Department of Communications for providing telecommunications services to mobiles.

MSK: minimum shift keying, a digital modulation technique using frequency shifting of a radio frequency carrier to represent binary states.

Multiplexing: the technique of combining baseband signals for subsequently modulating a radio frequency carrier.

NTSC: National Television System Committee.

Orbital Positions: positions in the geostationary orbit assigned to specific satellites.

Over-the-air: broadcast signals transmitted for widespread reception by television and radio receivers in common use.

PAM A, D: payload assist module, a rocket system for boosting satellites from the orbit of the space shuttle to a highly elliptical transfer orbit, from which the satellite can be injected into geostationary orbit.

Payload: the electronic equipment onboard a satellite for performing the satellite's primary function.

PCM: pulse code modulation, a digital encoding technique.

Perigee stage rocket: stage of a launch vehicle which places a satellite into a highly elliptical orbit from which the satellite can be transferred to geostationary orbit.

Polarization (linear/circular): term referring to the electric field of an electromagnetic wave. If the electric field lies wholly in one plane, the wave is linearly polarized. If the electric vector rotates and is constant, the wave is circularly polarized. The design of the antenna feed must be appropriate for the polarization of the signal received.

QPSK: quadrature phase shift keying, a digital modulation technique.

RARC: Regional Administrative Radio Conference.

RGB inputs: refers to the circuits driving the red, green, and blue electron guns in a color television tube.

Satellite channel: the radio frequency channel of a satellite driven by one amplifier, usually a travelling wave tube amplifier. The bandwidth of satellite channels varies from system to system as required for the principal application.

S/C: spacecraft.

SCPC: single channel per carrier, usually referring to voice or sound channels.

Scrambled (descrambled): technique for preventing unauthorized reception of a signal by electronically altering it so that it cannot be received without the use of a descrambler which restores the signal to its original form for display by a standard television receiver.

SHF: super high frequency band, from 3 to 30 GHz.

Signal-to-noice ratio: ratio of the wanted signal to the unwanted background noise.

Solar array: array containing many thousands of solar cells for generating electric power that is used by the satellite.

Solar cells: semiconductor devices that generate electric current when illuminated by sunlight.

Space segment: the satellite portion of a satellite communications system.

Spectrum: refers to the electromagnetic wave spectrum which comprises the range of radio frequencies used for telecommunications and broadcasting.

Spillover: satellite signal coverage pattern beyond intended primary coverage area.

STS: space transportation system, more commonly known as the space shuttle.

Sub-carrier: a carrier subsidiary to the main carrier, carrying additional information; for example, the sound portion of a television signal.

Super-band: supplementary channels used by cable systems in the frequency band 216-300 MHz which is not used in over-the-air broadcasting by TV and fm radio stations.

Superstation: term coined for a television station which extends its coverage far beyond the normal terrestrial coverage of a broadcasting station by using satellite or other means of transmission.

TDM: time division multiplexing, a technique for combining signals on a time division basis.

Telemetry: status and condition data transmitted to a monitoring station.

Teletext: alphanumeric and graphic information broadcast for video display.

Transponder: satellite payload which receives an uplink signal, converts it to the downlink frequency, amplifies it, and transmits it back to earth as a downlink signal.

TVRO: Television-receive-only, acronym for a satellite TV receiver consisting of an antenna, low noise amplifier and one or more channel receivers.

TWTA: travelling wave tube amplifier.

UHF: Ultra high frequency, the band between 300 and 3000 MHz.

Uplink: the earth-to-space transmission to a satellite.

VHF: very high frequency, the band between 30 and 300 MHz.

Videotex: an interactive communications system for displaying alphanumeric and graphic information on a video screen. Telidon is an example of videotex.

WARC: World Administrative Radio Conference.

Canada