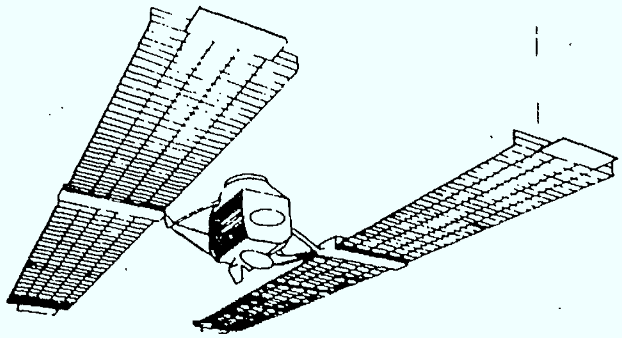
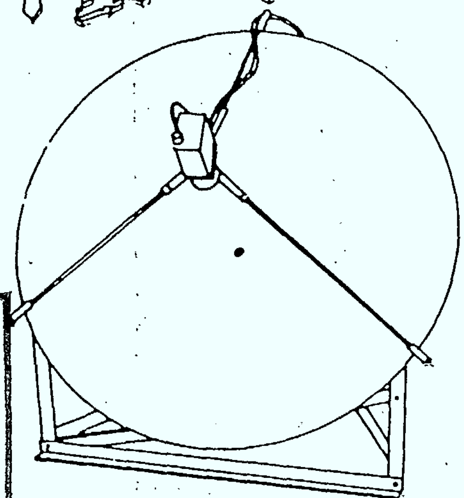


DIRECT BROADCASTING SATELLITE SERVICE IN CANADA



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DIRECT BROADCASTING SATELLITE SERVICE IN CANADA

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ABSTRACT

Successful field trials of direct broadcasting of television from a satellite have led to proposals for interim direct broadcasting satellite service in Canada using an ANIK-C satellite. Such service is expected to be provided beginning in 1983 well in advance of the launch of satellites dedicated to direct broadcasting which have been defined in system modelling planning studies and are described.

KEYWORDS

Direct broadcasting, satellite, planning.

INTRODUCTION

Direct broadcasting of television by satellite to individual home receivers has been underway in Canada on a field trial basis for three years. Since September, 1979, the modestly powered ANIK-B satellite has been used to transmit over 90 hours of programming weekly for the Ontario Educational Communications Authority and, since December, 1979, over 150 hours of programming weekly for the Canadian Broadcasting Corporation and British Columbia TV, Ltd. a commercial broadcaster. The field trials followed experiments and demonstrations carried out in Canada beginning in 1976 with the HERMES satellite, the forerunner of the high power direct broadcasting satellites which will be launched in the mid eighties.

The success of the field trials has demonstrated that a satisfactory service can be provided with satellites of modest e.i.r.p., if advantage is taken of receiver technology available today. As a result, commercial interests in both Canada and the U.S.A. have proposed that ANIK-C, which is similar to ANIK-B in e.i.r.p., be used to make a start on DBS service when capacity becomes available in 1983. In Canada, such interim service would meet market needs until a satellite system dedicated to direct broadcasting is launched.

DIRECT BROADCASTING SATELLITE EXPERIMENTS AND FIELD TRIALS

Tests with the Hermes satellite, capable of transmitting in the 12 GHz band with a boresight e.i.r.p. of up to 59.6 dBW, demonstrated that good quality reception could be achieved with high performance receivers at values much below the maximum power possible with satellite. With the rapid advances in receiver technology that paced the experiments with Hermes, it was possible to consider continuous and extended field trials of direct-to-home TV using the 12 GHz channels on the ANIK-B satellite, which has an e.i.r.p. ranging from 51 dBW to 46.5 dBW within the coverage area of each of its four beams. Table 1 shows the principal communications parameters of Hermes and ANIK-B.

A full description of the technical considerations and the system design for the field trials may be found in Ref. 1. In summary, satisfactory service was achieved for the duration of the field trial period within a contour of about 49 dBW with receivers using 1.2 m antennas and having a G/T of 13 dB/°K, when one TV signal was transmitted in a satellite channel. Outside of the 49 dBW contour or when two TV signals were transmitted in a satellite channel, similarly acceptable performance was experienced with receivers using 1.8 m antennas having a G/T of 16 dB/°K. Over two hundred receivers were deployed during the trials, which were carried out in the footprints of two of ANIK-B's beams. The field trials ended in September, 1982. Their success has resulted in the Ontario Educational Communications Authority and British Columbia's Knowledge Network of the West deciding to use ANIK-B, and later ANIK-C, for continuing service on an operational basis, albeit using them in the 1/2 channel per TV signal mode.

TABLE 1

HERMES AND ANIK-B AND C PARAMETERS

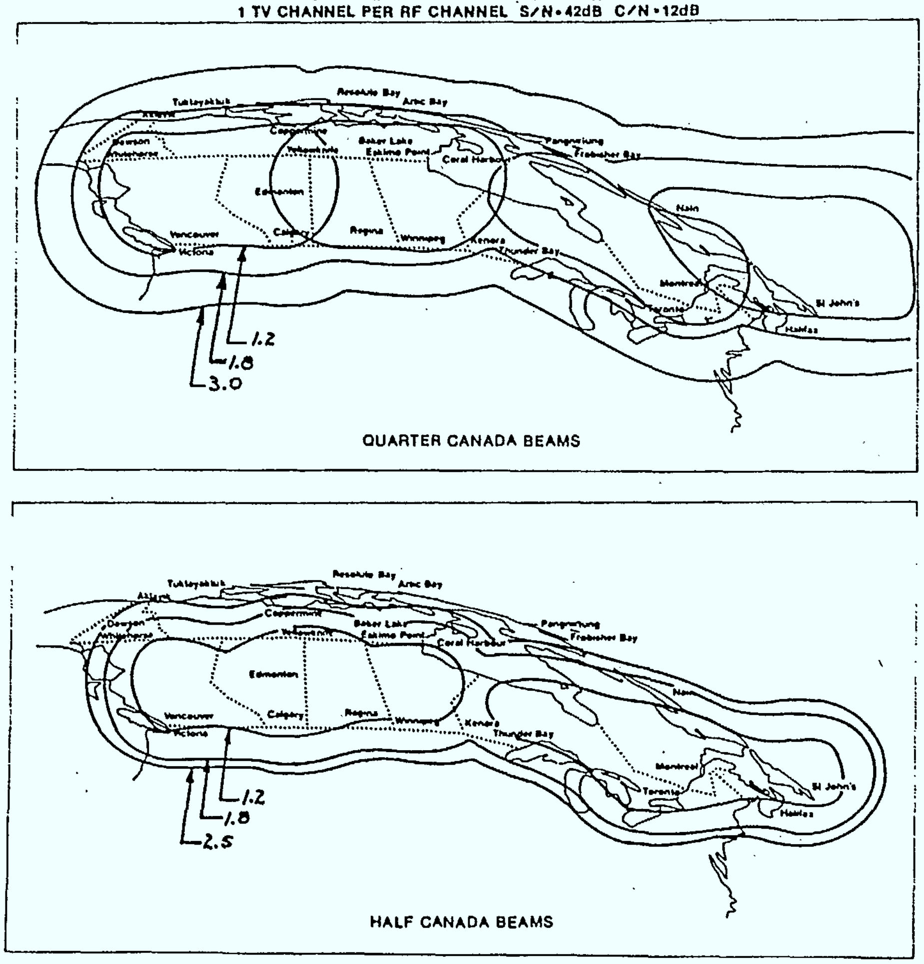
	HERMES	ANIK-B		ANIK-C
FREQUENCY BAND (GHz)	14/12	6/4	14/12	14/12
NUMBER OF TRANSPONDERS	2	12	4	16
CHANNEL BAND-WIDTH (MHz)	85	36	72	54
EIRP (dBW BEAM EDGE)	47 and 57	36	47	47
DOWNLINK BEAM	2-2½° Steerable Spot Beams	All Canada	4-2° Spot Beams	4-1°x2° Spot Beams
DESIGN LIFE (YEARS)	2	7		10

PROSPECTS FOR INTERIM DBS SERVICE USING ANIK-C

The first ANIK-C satellite is scheduled for launch by Telesat Canada in November, 1982, with a second to be launched in April, 1983. Table 1 shows that its e.i.r.p. characteristics are similar to ANIK-B. Through on-board switching its footprints can be configured to provide four beam coverage or two beam coverage of Canada. This is shown in Figure 1, where a 0.25° northward tilt of the antenna pattern is assumed, to improve coverage of northern Canada. 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. Channels can be directed into either four or two beam modes, as required.

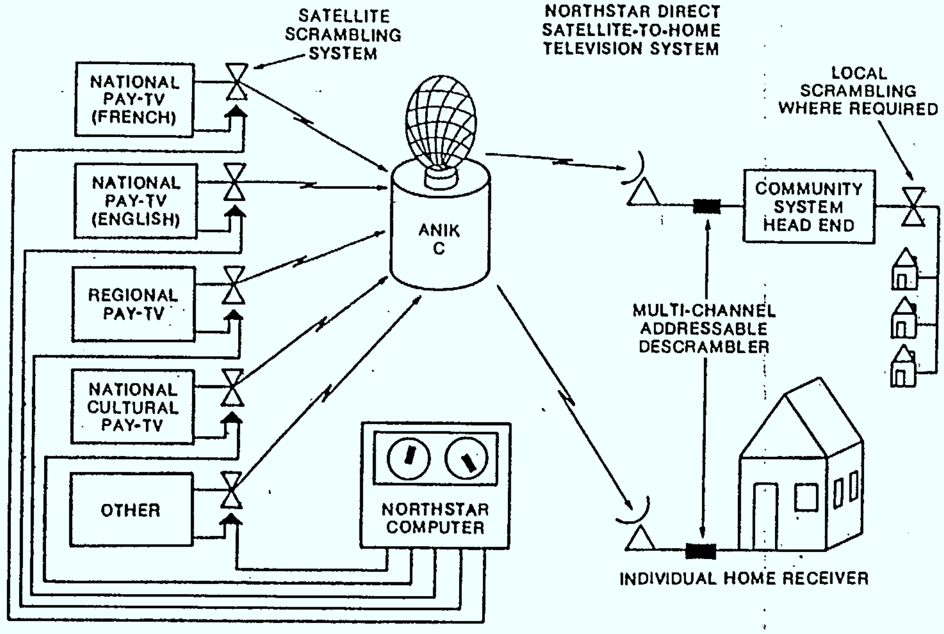
Fig.1

ANIK C TERMINAL SIZE IN METRES 0.25° NORTHERN TILT
1 TV CHANNEL PER RF CHANNEL S/N=42dB C/N=12dB



One of the largest applications of ANIK-C will be to distribute Pay TV. To date, two national and three regional network licenses have been granted to companies that intend to use ANIK-C to distribute their programming to vendors who in turn will market and distribute the programming to consumers. At least two more regional licenses are expected to be granted. Thus Pay TV will be receivable with 1.2 m or 1.8 m home receivers with performance very similar to that experienced in the ANIK-B field trials. One entrepreneurial company from the commercial broadcasting industry in Canada, Northstar Home Theatre, Inc., has proposed to the Pay TV licensees to market their programming via direct home terminals in those areas not served by cable distribution systems. The Northstar direct satellite-to-home television system is shown in Figure 2.

Fig.2

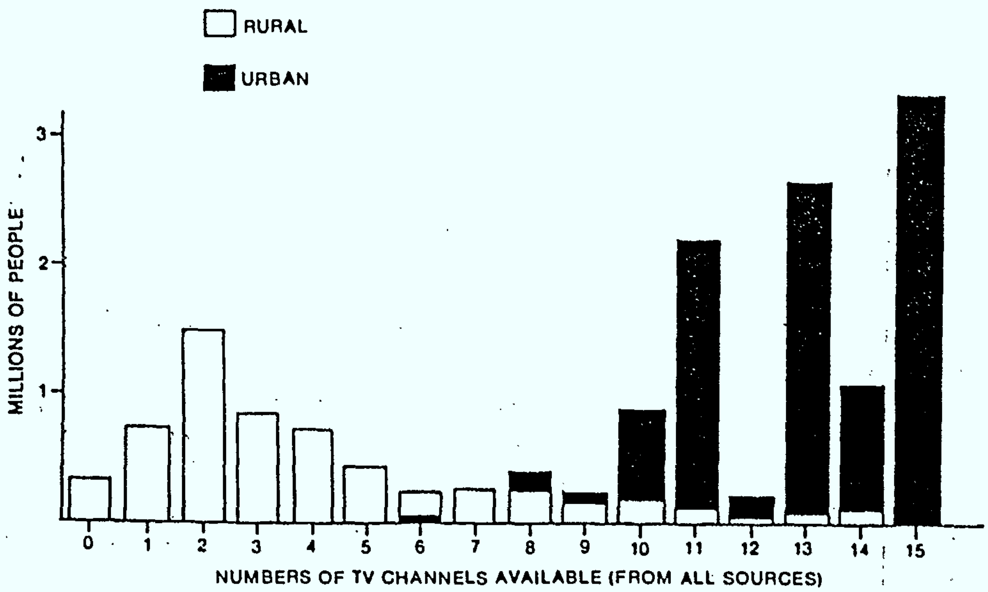


In addition to the pay TV and the educational TV channels, several regionally oriented TV channels will be distributed via ANIK-C. Other commercial as well as Canadian Broadcasting Corporation channels may be added. While intended principally for cable head-ends and subsequent distribution to households via cable systems, receivers with antennas small enough to be considered for individual home installation will extend the service to those areas not served by cable. Thus direct broadcasting from a satellite to small home receivers is expected to become an operational service in Canada in early 1983, even though ANIK-C was not designed to be a direct broadcasting satellite.

Across Canada, the largest potential market for DBS services is in rural areas which are presently underserved, as indicated in Figure 3 which shows the disparity between urban and rural television services. There are over one and a half million households in this category, which are too dispersed to be served with cable distribution systems as are the 78% of urban households. Figure 4 shows the results of a market survey carried out among rural residents. Some 2,700 households, enough to give a 95% confidence level in the results, were interviewed to determine when they would be prepared to buy, and the price they would be willing to pay for a DBS home receiver if it enabled the reception of 6 channels of television. A remarkable result of the survey was indication of the

Fig.3

AVAILABILITY OF TELEVISION IN CANADA



rapid acceptance of DBS technology. More than half of the market could be expected to be penetrated within the first three years, at any price level from $400 to $1,200 per unit. At $400 over ninety percent of all rural householders could be expected to purchase a receiver. Even at $1,200, sixty percent of all rural households could be expected to buy a receiver. Of course, Pay TV would also require a monthly fee, but even a conservative rate of subscription to the service would yield a substantial clientele. Initially, receivers are expected to sell at the higher price ranges, but are expected to drop in price to the lower prices relatively quickly.

Fig. 4

LONG TERM MARKET DEMAND vs PRICE FOR DBS HOME RECEIVERS IN RURAL CANADA

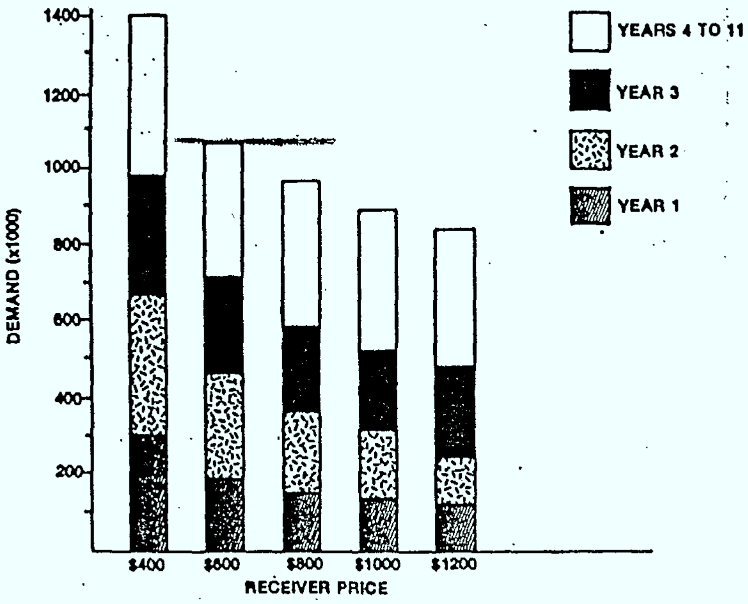


TABLE 2

SYSTEM PARAMETERS - 4 BEAM AND 6 BEAM MODEL ALTERNATIVES

PHASE		4 Beams	6 Beams
1	Satellites Channels/Beam	3 8	4 8
2	Satellites Channels/Beam	5 16	8 16
1 & 2	Orbit Locations System Reliability C/I	2 0.7 - 7 yrs (14 Ch/Beam) 30 dB	3 0.7 - 7 yrs (16 Ch/Beam) 30 dB
3	Orbit Locations Satellites Channels/Beam		6 As Req'd Up to 36

In considering beam arrangements and channel capacity requirements, the geographical and the political nature of Canada must be taken into account. Channel capacity requirements are large because of Canada's two official languages; much of the television service must be provided in both French and English, considerably increasing the number of channels required. The area to be covered is very large, and to keep travelling wave tube power requirements at a reasonable level, at least four antenna beams are required. These would almost meet requirements from a time zone coverage standpoint, since there are five and a half time zones in Canada. However, from a political standpoint, four beams are not adequate over the long term. The quarter Canada beam covering eastern Canada would cover five provinces, Quebec which is predominantly French speaking, and the Atlantic provinces which have an English speaking majority. Thus a shortage of channels would develop in this beam before this condition was reached in the beams covering the rest of Canada, which is predominantly English speaking. This situation would be alleviated, and service possibilities equalized across Canada by use of a six beam coverage scheme. To be able to cover the alternatives from a technical and cost point of view, both were modelled.

Table 3 gives the top level parameters of the satellites which would meet the system requirements. Being dual beamed satellites, each would have 16 operating travelling wave tube amplifiers, plus 4 spare amplifiers in a ring redundancy configuration. A channel bandwidth of 18 MHz was assumed, although 21 MHz is also possible, and would still permit up to 36 channels in a 500 MHz allocation of spectrum. Buses assumed in the satellite modelling were the ESA L-SAT bus for the 54 dBW satellites, and the RCA Astroelectronics Division bus for the 50 dBW satellites. In both cases the payloads approach the upper limits of the bus capacities, and result in reasonably efficient aplications of them. Versions of the Ariane 4 vehicle could be used to launch the satellites, or the STS in combination with the IUS or PAM A as the perigee stage.

TABLE 3

SATELLITE PARAMETERS

	6 BEAM MODEL		4 BEAM MODEL	
EIRP (Edge of coverage)	54 dBW	50 dBW	54 dBW	50 dBW
TWT ouput power	126 W	50 W	166 W	66 W
Total Satellite power	6 kW	2.3 kW	7.4 kW	2.9 kW
Bus type	L-SAT	RCA	L-SAT	RCA
Transfer orbit weight		2162 kg	3145 kg	2336 kg
Launch Vehicle	STS/IUS or Ariane 4	STS/PAM A Ariane 4	STS/IUS Ariane 4	STS/PAM A Ariane 4
Beams/Satellite	2		2	
Polarization	Dual Circular		Dual Circular	
Channels/Beams	8		8	
Channel Bandwidth	18 MHz		18 MHz	
Payload Redundancy	16/20		16/20	
Satellite Design Life	7 years		7 years	

The estimated costs of implementing a DBS system for Canada using the satellites described in Table 3 are given in Table 4. One in-orbit spare satellite is assumed in either the four or six beam cases in phase 1. However, in phase 2, two spare satellites are required for the six beam case, to meet a probability of 0.7 that 16 channels would be available after 7 years, while only one spare would almost meet the same criterion in the four beam case.

TABLE 4

ESTIMATED SATELLITE SYSTEM COST

	50 dBW (EOC)		54 dBW (EOC)	
	4 Beams	6 Beams	4 Beams	6 Beams
Phase 1 8 Channels per service area	$410M (3 S/C)	$520M (4 S/C)	$520M (3 S/C)	$670M (4 S/C)
Phase 2 16 Channels per service area	$620M (5 S/C)	$950M (8 S/C)	$810M (5 S/C)	$1280M (8 S/C)

Economic and policy studies have been caried out in parallel with the technical modelling studies. The economic studies have indicated that a DBS system should be used for the dual purpose of program distribution to cable subscribers as well as to the individual home market, to expand the audience for commercially supported and subscription television. A DBS system would also be the most cost effective way of making new programming, such as educational television, universally available. The impact of a new, DBS delivered service is expected to be most felt by the small, commercial broadcaster, providing locally oriented service. To maintain local service, opportunities may need to be provided for commercial broadcasters to adapt to a new broadcasting environment. A particularly important impact will be felt from spillover from DBS systems providing service in the United States. At least 95% of the Canadian population will be capable of receiving television from the U.S. systems. A major economic impact will also be experienced by the manufacturing industry, as a new market is established for more than a billion dollars in satellite and receiver hardware. A DBS system would also provide a new outlet for the program production industry.

Policy, regulatory, and institutional studies have concentrated on the legislative instruments and regulations which govern broadcasting and telecommunications in Canada. Some changes are indicated: for example, permitting the widespread ownership of satellite receivers, allowing for greater participation in the financing of a very capital intensive DBS system, and resolving copyright issues. A study of the legal aspects of a broadcasting service delivered by satellite is also in progress.

The planning for DBS service in Canada will culminate with a general report, to be issued early in 1983, covering the full range of results of the studies carried out. Information from the studies, consultation with the broadcasting and related industries, and the outcome of the 1983 Regional Adminstrative Radio Conference should permit an informed decision regarding the implementation of a full-fledged direct broadcasting system for Canada.

CONCLUSIONS

Direct broadcasting satellite service in Canada has developed in a classical, evolutionary manner. Beginning with experiments using the Hermes satellite in 1976, and field trials using the modestly powered ANIK-B satellite from 1979 to 1982, operational direct to home service is expected to begin in 1983 with ANIK-C. Because of ANIK-C's modest power, however, this can be considered as interim DBS service only. Planning for a higher powered, full-fledged DBS system is reaching culmination, and the 1983 RARC will provide the final information necessary for completing plans. If an implementation decision can be reached in 1983, a system to replace ANIK-C interim service could be placed into operation by 1988.

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