

RURAL COMMUNICATIONS PROGRAM

INTERIM REPORT ON PROJECTS

JUNE 1979

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## RURAL COMMUNICATIONS PROGRAM

### Interim Report on Projects

June 1979

This Interim Report is being made available to interested parties to provide information on current results from the Rural Communications Program. The report describes the objectives, methodology used and results obtained in all projects initiated to-date under this Program. It is provided as a convenient and timely source of information. The views contained in this document should not be interpreted as necessarily representing the official policies, either expressed or implied, of the Department of Communications.

The Rural Communications Program was established by the Department of Communications during 1974, as a result of a growing concern, both within and outside government, of the apparently increasing disparity in the level of communication services available between urban and rural Canada. This concern resulted in studies being undertaken within DOC and under contract with universities and private industry, on topics that range from rural demography to satellite signal modulation methods. The majority of these in-house and contracted studies have been oriented toward the provisioning of conventional telephone and television services, with a much lesser effort devoted to studies on new home services such as alarms and Telidon. The number of contracts administered and the accompanying in-house research effort became substantial in 1976 and the latter has remained at about the 10-person-year level. The majority of the projects are complete, or nearly so.

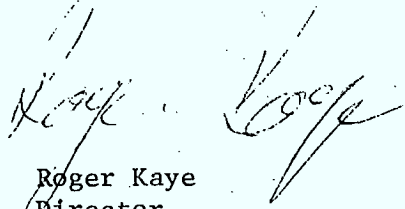
The projects described in this report generally fall into one of the following categories:

- i) Generation of a data base that defines the rural population and its current level of services,
- ii) Support for the development of products having potential for immediate application in rural areas and
- iii) Applications research on new technologies to evaluate the longer-term potential (e.g. fibre optics).

In order to make this information available quickly, this Interim Report is in the format of a compendium of summaries of the projects written by the responsible officers and with no value judgment on each project.

Members of the Rural Communications Program are available to answer any queries generated by this report.

Annex A contains a list of the projects and the B annexes contain the detailed descriptive information for each project.



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LIST OF PROJECTSANNEX A  
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<u>Project</u>	<u>Status</u>	<u>Reference</u>
Interbranch review of "The Status of Rural Communications in Canada"	Completed, July 76	Annex B1
Survey of "Equipment available for rural Communications"	Completed, Apr 76	Annex B2
Database on CATV Hardware Manufacturers	Completed, July 76	Annex B3
Survey of developments in CATV Hardware	Completed, Mar 77	Annex B4
Regional Demographic Studies	Completed, Nov 78	Annex B5
Economic Benefits of Improved Telecom Serv.	Completed, Jun 77	Annex B6
Demand for Rural Communications Services	Ongoing (Sept 79)	Annex B7
Household Distribution in Rural Canada	Completed, Mar 79	Annex B8
Financial Feasibility Study	Completed, June 79	Annex B9
Cost of Rural Telephone Service	Completed, Oct 78	Annex B10
System Engineering and Fabrication of an Experimental Transmit and Receive Unit for a Microwave Transmission System for Rural Application	Completed, Mar 79	Annex B11
Subscriber-Carrier Development	Ongoing (Nov 79)	Annex B12
Rural Interface Device LSI	Ongoing (July 79)	Annex B13
Rural Interface Device Field Trial	Ongoing (Mar 80)	Annex B14
Users Survey of Mobile Radio Services in Rural Areas of the Prairie Provinces	Completed, Aug 77	Annex B15
Technical Survey of Mobile Radio Systems for Rural Areas	Completed, May 78	Annex B16
Use of Radio for Fixed and Mobile Service in Rural Areas	Completed, Mar 79	Annex B17
Use of Satellites for Telephony in Rural Areas	Completed, Jul 78	Annex B18
Levels of Choice in Canadian Off-air TV Viewing	Completed, May 77	Annex B19
Rural Broadcasting; A Preliminary Study	Completed, May 77	Annex B20
ANIK C Potential for Rural Service	Ongoing (Dec 79)	Annex B21
DBS Impact Study	Ongoing (Dec 79)	Annex B22

Project	Status	Reference
Comparison of Rural/Urban TV Network coverage	Completed, Aug 78	Annex B23
Feasibility Study on Leaky Cables	Completed, Oct 77	Annex B24
Quality of Service Survey in Newfoundland	Completed, Nov 77	Annex B25
Feasibility of CATV Service in Newfoundland	Ongoing (Jul 79)	Annex B26
Multichannel TV Broadcasting Stations	Ongoing (Jul 79)	Annex B27
Evaluation of Modulation and Detection Techniques for TV Transmission by Satellite	Ongoing (Nov 79)	Annex B28
Integrated Services over Coaxial Cables	Completed, Mar 79	Annex B29
Integrated Services over Optical Cables	Ongoing (July 79)	Annex B30
Long-loop Telephone Field Assessment	Deferred Indefinitely	N/A
Power Systems for Remote Sites	Under consideration	N/A
Powerline Interference	Under consideration	N/A
Financial Options	Under consideration	N/A

Title: PRESENT STATUS OF RURAL COMMUNICATIONS IN CANADA

In-house report by a DOC inter-branch working group, Published in July 1976.

Objective:

The objective of this activity was to provide DOC management with an appreciation of telecommunications in rural Canada by describing the nature and magnitude of telecommunication problems in these areas.

Methodology:

All branches of DOC participated and contributed to this project. The working group reported on a regular basis to a Rural Steering Committee consisting of Directors General of most of the branches in DOC. The initial task was to define rural environment and then to quantify the rural telephone service, radio broadcasting, television broadcasting and cable television penetration existing in rural Canada. This activity was followed by estimating investments necessary to up-grade services to urban standards with current technology. The final activity was to assess the possible impact of some new technologies.

Results:

The following is a summary of the findings of the Working Group:

- The total population of rural Canada is 5,077,000 of which 1,154,000 live on the farm;
- There are some 94,000 households in rural Canada without telephone service out of a total number of 1,271,000 households. Some 54% of rural households are on multi-party service, that is, a shared line service with 4 or more parties on the same line;
- Only 4% of rural households have CATV service while only 4% are without television receivers;
- It is estimated that 2.1% of rural households are without any radio receiver;
- A very limited choice of television and radio service is available to rural Canadians;
- It is estimated that the cost of up-grading telephone service to urban standards would be in the \$2.3 to \$4.4 Billion range.

Consequences:

The report resulting from this activity was broadly distributed among the telephone companies, provincial governments and industry. This helped to focus attention on rural communications and largely due to this activity the Rural Communications Program got underway.



Title: A STUDY OF THE AVAILABLE PRODUCTS AND SYSTEMS FOR RURAL TELEPHONE COMMUNICATIONS

This study was contracted out and was completed in April 1976.

Objectives:

- 1) To identify manufacturers, suppliers and systems required in subscriber distribution networks.
- 2) To establish a data base on products and systems available in North America.
- 3) To review the products and systems suitable for use in rural telephone networks.
- 4) To determine the market penetration of available systems into rural telephone networks in Canada and U.S.A.
- 5) To determine the Canadian design and manufacturing content.
- 6) To analyze the cost performance of line transmission and radio techniques.
- 7) To project future systems and products.

Methodology:

The basic methodology used in this study was to survey the supply industry, to compile a comprehensive data base, then to develop typical rural transmission models. This activity was followed by a determination of sensitivity to cost, quality of service and flexibility. Based on this information and a complete assessment of the American telephone equipment manufacturing industry and its products, general observations were made as to how and in what areas of technology stimulation is required which would result in more effective systems for improvement of rural telephone service.

Results:

Seventy-seven suppliers of equipment and outside plant hardware for subscriber distribution systems were identified, of which 30 are subsidiaries of foreign companies, 13 in the Canadian owned category and the remainder either distributors for foreign suppliers or foreign companies that sell directly in Canada. Fifty-five companies consisting of manufacturers, distributors, etc. were contacted, 43 in Canada and 12 in the U.S.A.

The bulk of rural communications business in Canada consists of cables and wire for which there are three major suppliers: Northern Telecom, Phillips Cables and Canada Wire and Cable. Another line of products consists of outside plant hardware. This business segment is fragmented on a regional basis. The major suppliers are: Northern Telecom, Reliable, GTE Automatic Electric and Superior Continental. The third product line, electronic equipment that augments the cable is supplied principally by Northern Telecom, Transcom, Lorrain, GTE Lenkurt, Wescom, I.T. & T., Tele-Radio and Superior Continental.

The total rural market is estimated at \$150 million of which electronics represents some \$3 million, most of the electronic products being imported from the U.S. Most major manufacturers considered the rural market as insignificant and too highly fragmented.

Equipment and material costs show a wide spread depending on the type and length of outside plant cable (aerial or buried). The range is from \$500 to \$6,000 per subscriber.

New carrier systems and integrated electronic systems are being developed for mainly small town applications.

Consequences:

This survey provided DOC with a broad overview of the industry and technologies available for rural applications. As a direct consequence of this knowledge, the Rural Communications Program initiated numerous technical projects in industry to reduce the cost of provisioning rural services and also to identify market size.

Title: DATABASE ON CATV HARDWARE MANUFACTURERS

This study was completed in July 1976.

Objective:

- a) To determine the profile of CATV suppliers in Canada.
- b) To seek out products which could reduce the cost of systems for thinly populated areas of Canada.
- c) To estimate costs of rural CATV systems.

Methodology:

The preliminary database was conducted by mail survey of some 50 companies in U.S. and Canada. This was followed up with visits to a few companies.

Design objectives for rural CATV were postulated. The technical and cost data was used to examine simple system models for rural CATV, as a function of subscriber density. This was done for systems with 35, 12 and 5 channel loadings for high, medium and low density rural distribution. For each of these situations, technical feasibility was shown and installed capital costs were estimated.

Results:

The objectives were met and the following is a summary of findings:

The supply industry had just gone through a very bad financial year. The industry growth slid from 20% to 5% resulting in both Northern Telecom and Canada Wire stopping CATV coaxial cable manufacture and all cables are now imported. The U.S. market for CATV hardware was estimated to be \$127 million during 1975 and Canadian market approximately \$40 Million. Jerrold Electronics (owned by General Instruments) occupies a clear leadership position. The leading Canadian company is Delta-Benco-Cascade.

The rural CATV distribution system is technically feasible with current technology. Implementation of a direct tap distribution system is one design variation that appears feasible for low and medium density rural distribution. For 12 and 5 channel capacity rural CATV distribution, the use of the lowest possible frequency plan is recommended.

The cost of implementing rural CATV distribution ranges from \$490 per subscriber (high density and 5 video channels) to \$6,350 per subscriber (low density and 35 video channels).

Subscriber Density	Installed Capital Costs/Subscriber		
	35 Channels	12 Channels	5 Channels
High (5 subs./kft.)	\$ 560	\$ 530	\$ 490
Medium (1 sub./kft.)	\$1,550	\$1,320	\$1,140
Low (1 sub./5 kft.)	\$6,350	\$5,140	\$4,710

Consequences:

The report sheds some light on the high cost of providing CATV service to rural Canadians.

Title: IN-DEPTH SURVEY AND DEVELOPMENT OF CATV HARDWARE DATABASE

This study was completed in March 1977 as a follow-on to the project described in Annex B3.

Objective:

The objective of this study was to discuss findings of the previous study on CATV for rural applications with 13 leading CATV manufacturers and determine if they have any developments underway which would help to reduce costs of providing CATV services in rural areas.

Methodology:

A great deal of interest was shown by manufacturers in the proposed system. However, none of the manufacturers had any significant developments which could lead to a drastic price reduction.

In order to make CATV provisioning more economically attractive for medium density rural areas simultaneous cable installation for telephone and CATV was considered. The results showed that the saving could be 32%, for the case considered!

Consequences:

This study confirmed that the provisioning of coaxial CATV services alone is very expensive and that one possible way of extending CATV service into medium density areas will be by integration of telephone and CATV services onto a single network.

Title: REGIONAL DEMOGRAPHIC STUDIES.

Regional contracts with four universities were completed in November 1978.

Objective:

This project was designed to provide basic data on rural Canada and rural telephone service. Specific objectives were as follows:

- a) document where the rural population and settlement is, provide basic data that is of relevance to the provision of telecommunications services and to identify trends;
- b) determine the major factors associated with current levels of telephone service; and
- c) to identify a small number of typical areas which may be used for further technical, economic and social studies.

Data generated by this project is required for general characterisation of rural areas as well as for specific purposes related to technological studies and assessment of demand for services in rural areas.

Methodology:

Studies were conducted in four regions of Canada (B.C., Prairies, Ontario and Quebec, Atlantic) by a local university. Data was gathered for analysis from federal, provincial and telephone company sources. Reports from each region were summarized and presented in a Rural Communications Program Report.

Results:

The objectives were generally met although some gaps exist due to unavailability of data. New information which came to light included the following:

- a better working definition of "rural" (areas with population density between 1 and 1000 per sq. mile and communities up to 2500);
- the scope of rural Canada (17% of land area) and size of rural population (29% of total);
- socio-economic profile of the rural population;
- community data (9000 rural communities);
- rural business and economic data;
- telephone exchange (88% of the ~ 3,022 provincial exchanges are associated with rural service) and service data (54% of rural residential main stations are single party);

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- identification of factors affecting rural service (physiography and climate, population dispersion, community size and urban proximity, socio-economic conditions, serving company size, government and telephone company policies.)
- description of 38 areas which are typical of various regions of rural Canada.

This project has significantly enhanced our understanding of the characteristics of rural Canada and the level of telephone service provided to the rural population. Such basic information is relevant to every aspect of the Rural Communications Program and has proven to be of interest to provincial governments and other agencies.

#### Consequences:

This project has attempted to examine the dominant features of rural Canada and to determine the major factors that have influenced the penetration of telephone services in the rural areas. While the provision of telephone service to rural households may be considered to be virtually complete (but at a somewhat lower level of quality to that provided to their urban counterparts, telephone companies would seem to face two sets of related circumstances. On the one hand, there is the fact of increasing concentration of the population in urban centres which are efficient from a communications point of view since they lead to economies of scale and reduces unit costs. On the other hand, one consequence of urbanization is rural depopulation, which is inefficient from a communications point of view, leading to substantially higher unit costs for services to the remaining rural population.

The implications of this are far reaching. If, for example, a telephone company has a fixed sum for development it will have to trade-off service for a large number of urban subscribers against a smaller number of rural subscribers. On what basis is such a trade-off to be made? The cumulative effect of changes in the social and demographic character of the population is apparently reinforcing urban-rural differences, further concentrating demand in urban areas and making it more difficult to resolve this basic dilemma.

The development of rural telephone service has been closely linked with the dominant features and patterns of rural life, and while many of these factors cannot be quantified, it is safe to say that future service will be a product of the interaction between social and economic conditions and telephone company and government policies. Thus, the future would seem to be, at least in part, a matter of choice involving political decisions which influence the distribution or withholding of benefits to communities, areas, or regions.

The directions for research implied by the policy questions are numerous: What balance should be struck between urban and rural development? Can communications services be used as regulators to reduce rural-urban social and economic differences? What is the substitutability of communications technology; can it replace face-to-face communications in business, education and health care? What will be the effect of technological innovations? One way of investigating these topics is to create regional rural communications "laboratories" in small typical

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areas. These would be places which would provide opportunities for experimenting with and assessing the social and economic impacts of communications technology.

It has been suggested that the urbanization trend which has been a world wide phenomenon, cannot continue. The limiting factors are seen to be the inability of the rural areas to produce sufficiently large food surpluses, the disappearance of cheap energy sources needed to underwrite the urbanization process (and agricultural technology), and the impossibility of creating enough jobs in urban settings. The rapid urbanization characterizing so much of the world during the third quarter of this century occurred during an era of cheap energy which may be unique. The most effective efforts to ameliorate the problems facing cities may well be those to improve living conditions and productivity in the country side.

There is also the matter of the locational preferences of people. There are indications that many people are coming to prefer rural areas for living; the unplanned migration from rural to urban areas has created such unprecedented environmental, social and economic problems that the process may eventually reverse itself.

Finally, a word of caution. Various observers have suggested that rural life is special, distinct from urban and metropolitan ways of life. Yet the technological innovations that are the most familiar and exciting are urban-based - for example, the 'wired city'. The dilemma then is to avoid imposing urban values on rural communities. This is likely to require the invention of ideas which take account of the value decisions that have molded the historical development of small communities, reflect a concern with the overall quality of life, and are based on a scale appropriate to rural areas.



Title: THE ECONOMIC BENEFITS OF IMPROVED TELEPHONE SERVICES IN RURAL AREAS

A study completed in June 1977 by a university group working under contract.

Objective:

To develop a methodology by which the benefits of an improved telephone service on the economy of rural areas can be assessed and quantified.

Methodology:

A review of published work in the fields of telecommunications and regional development in order to:

- (i) identify and categorise potential benefits;
- (ii) develop a conceptual framework for measuring these benefits;
- and
- (iii) determine the data elements required to permit measurement.

Results:

The study reached a number of conclusions. These are:

- a) There is strong support in parts of the economic development literature for the hypothesis that telephone development (and more broadly, telecommunications) is important for national economic development. The meager evidence offered in support of this hypothesis does not, however, necessarily apply to the issue of telephone development and economic development in rural Canada.
- b) There is no consensus within the regional economics literature as to the impact of telephones on regional development. Most of the literature in this field does not even consider the role of communications. The mainstream adherence to the growth centre concept, agglomeration benefits, and general role of urban centres in area development as well as the export base and sector theories do not suggest a strong relationship. A few writers, however, have suggested that telephones may indeed compensate for distance and be a factor in location decisions.

- c) There is a growing awareness in the literature of the role of infra-structure on development. This appears to be the most profitable avenue for exploring the impact of improved telephone service on rural areas, as the telephone is part of the material infra-structure of a region.

Consequences:

It is recommended that an attempt to empirically verify the existence of an aggregate relationship between telephone development and rural economic development should proceed using economic theory in combination with appropriate statistical methods to develop a comprehensive set of indicators for measuring rural development. This set should include the availability of various components of social and material infrastructure of which telephones comprise one element. This would entail a considerable amount of work both in defining and constructing the relevant measures and in determining their inter-relationships. As a result, however, a detailed profile of the economic status of rural areas would emerge. This would be of immense value to telecommunications planners, especially insofar as pinpointing rural areas where priority should be given to the further improvement in telephone facilities and services. A considerable amount of the raw data for this exercise has already been collected by the demographic study. (See Annex B5).

There is a clear need to develop an adequate conceptual framework for predicting the likely economic impact and benefits of improved rural telephone service. Meaningful prediction of potential benefits can only proceed from a solid a priori base, which such a model would provide.

As a result of the findings of this study, and in view of the potential importance of this topic, this work has been broadened by the Economics Branch of DOC and the results have been submitted as contributions to GAS 5 (ITU).

Title: DEMAND FOR RURAL COMMUNICATIONS SERVICES

A study conducted under contract which has yet to be completed.

Objective:

To assess the demand of rural households and businesses for existing, improved, and new telecommunication services and to forecast short and long term demand for these services.

This analysis will provide information for all elements of the Rural Communications Program. In particular it will:

- determine the current level of satisfaction of the rural population with services and indicate the areas requiring improvement;
- provide an analysis of the short and long term demand for new and improved services by the residential and business segments of the rural population in terms of quantity and quality;
- indicate the level of revenues or the willingness to pay to support improved and additional services.

This information is required as an intelligent data source for narrow-band and broadband service studies in order to project market demand and revenues, and to make realistic assumptions in respect of service levels for the various technological options which will be examined and compared.

Methodology:

This project will be performed in two closely coupled segments. The first segment involves the development of appropriate demand models in which all of the demographic, economic and social factors are identified. This process involves reviews of prior work in this field and searches for primary and secondary data sources.

The second segment involves the generation of specific input data required by the demand models. This will be procured by means of a cross-Canada survey of rural households and businesses, involving personal interviews and written questionnaires. The output of this survey will, after suitable processing, be incorporated in the demand models to provide short and long term forecasts of demand for telephone and broadcasting services on a national and regional basis.

Results:

Progress to date has indicated that no exact precedents exist for forecasts of this type, and that very little is known of the importance and impact of communications in rural areas. In order to strengthen our understanding of how telecommunications relate to the rural "quality of life" and to identify variables which affect the diffusion of innovations among the rural population, a number of "focus groups" have been held in rural centres across Canada. When the information gathered by this method has been analysed it will be used to develop the survey questionnaire: as yet, however, no results are available.

Consequences:

The following issues will be clarified as a result of this project:

- What priority does the rural population put on communications services?
- Is there a problem with the current quality and quantity of rural services?
- What and where are the major areas of deficiency?
- Is the rural population prepared to pay the cost of the required improvements?
- What additional services are required and what revenues will they generate?
- Will improved/additional services contribute to the economic strength of rural areas?

Title: THE CLUSTERING OF HOUSEHOLDS IN RURAL CANADA

In-house report based on four university contracts.

Objective:

The objective was to obtain a set of maps that show the precise location of the households throughout portions of rural Canada and to determine scale-up factors that permit generalization of household location data to all of rural Canada; for use in modelling and systems applications studies.

Methodology:

Since it would be very costly to obtain a set of maps that show the precise location of the approximately 1.7 million households in rural Canada, an alternative procedure was adopted that consisted of choosing and mapping a number of areas that are typical of particular household settlement patterns. The extrapolation of cell-level data to large tract data (each tract being defined as having a settlement pattern that is represented by one of the typical cells) involves multiplication by scale-up factors. Thus, household clustering information pertinent to rural communications systems design can be obtained at various levels of compilation such as typical cell level, rural tract level; provincial level and national level.

Results:

The objective was met and two sets of typical cells and scale-up factors are presented. The first is the more accurate but involves considering 32 cells. The second will likely be used more extensively because of the lesser number of cells, six, but is nominally of lower accuracy. Should any user desire even greater scale-up accuracy than is obtainable with either the 32 or six-cell models, he can refer to the four reports submitted by the university professors and obtain, albeit with considerable effort, an even greater scale-up accuracy. The results provide us with the household location information that is essential data in any of our calculations of equipment requirements and/or costs for any new rural communication system proposal. For example, the optimal mix and total cost of a CATV/TVRO DBS ground segment can now be determined for rural Canada, subject only to assumptions regarding equipment cost.

Consequences:

The availability of household clustering data now makes it possible to complete certain application studies for improved rural service. It is expected that this data, never before available for Canada, may be useful in other federal departments, provincial governments, the CRTC, Telesat, the telcos and the CATV industry.

Title: FINANCIAL FEASIBILITY STUDY

This project was completed in June 1979 upon submission by the contractor of a final report.

Objective:

To develop a methodology for determining the optimum ways whereby the Federal Government could create financial incentives for Telcos to invest in rural service upgrading programs.

Methodology:

A methodology was developed to quantify (in terms of revenue and capital requirements) the economic impact of a rural improvement program upon a company. A number of financial incentive schemes were examined, using the above method, so as to assess the influence each would have on the calculated revenue and capital requirements. These included:

- a) Low-cost loans from a "Canada Communications Bank";
- b) Accelerated depreciation of rural communications hardware;
- c) Subsidies;
- d) Subscriber purchase of stocks;
- e) Removal of Federal Sales Tax on rural communications hardware.

The methodology developed was based on two telephone companies, one being a provincial crown corporation and the other, a privately held company.

In order to arrive at a realistic financing scheme, rural rates and costs were determined. The crown corporation rates ranged from \$3.10/month for multi-party service to \$3.65/month for individual single party service. The privately held company rates were \$7.65/month for single party to \$4.95/month for multiparty. In addition to the above, the private company has a mileage charge for subscribers located outside the Base Rate Area. The long term debt of the crown corporation comprises Provincial Government advances and debentures issued by the telco which are fully guaranteed by the province. The privately held company is financed by long-term debt (47.5%) and equity capital (52.5%). Being a public corporation, the private company is subject to both provincial and federal profit taxes.

Results:

The report describes a methodology and the results of the testing of that methodology on the two telephone companies, as well as providing a preliminary appreciation of the pros and cons of various incentive schemes as they could apply to four categories of telephone company:

- (i) Large, financially strong telcos and their subsidiaries;
- (ii) Small, independent telcos;

(iii) Rural cooperatives;

(iv) Provincial crown telcos.

The following table compares the impact of four schemes on the two telcos tested. Along with the preliminary assessment of the impacts on four categories of telco, it is clear that the influence of each scheme varies from telco to telco.

SUMMARY OF RESULTS FOR ECONOMIC EVALUATION  
COMPARISON OF RESULTS 5-YEAR CONVERSION

Incentive	None	FST 9% removed	CCA 100%	CCA 16%	ITC 50%	Cost of debt -5%
cost est.	1	2	3	4	5	6
COMPANY "A" shortfall	\$11,113.	\$10,658.	NA	NA	NA	\$ 7,915
Revenue Reqts Per Yr/tot. Subsc	\$ 202.	\$ 194	-	-	-	\$ 144
Impact of Incentive (cf. 1)	-	- 4%	-	-	-	-29%
Revenue Reqts Per Yr/Upgd subs	\$ 229	\$ 219				\$ 163.
Impact of Incentive (cf. 1)	-	- 4%				-29%

COMPANY "B" shortfall	\$ 3,567.	\$ 3,328	\$ 1,880.	\$ 2,959.	-\$1,389	\$ 3,004.
Revenue Reqts Per Yr/Tot. Subsc	\$ 100.	\$ 92.	\$ 52.	\$ 83.	-\$ 39.	\$ 84
Impact of Incentive (cf. 1)	-	- 8%	-47%	- 17%		- 16%
Revenue Reqts Per Yr/Upgd subs.	\$ 113.	\$ 106.	\$ 60.	\$ 94	-\$ 44	\$ 95
Impact of Incentive (cf.1)	-	- 8%	-47%	- 17%	-	- 16%

Company A: Provincial Crown Corporation

Company B: Privately owned

FST: Federal sales tax

CCA: Capital Cost Allowance

ITC: Investment Tax Credit

Consequence:

The proposed methodology would have to be applied to all the major telephone companies in Canada to get a better appreciation of its inherent validity, and in order to assess the impact of each scheme on the nation as a whole.



Title: COST OF RURAL TELEPHONE SERVICE

In-house study.

Objective:

This report describes the major factors which influence the costs of providing rural telephone service, and shows by means of specific examples what range of costs may, in practice, be expected. These examples have been computed for a cross-section of Canadian telephone companies, taking account of local design and construction techniques, so that we may have a picture of how geographic influences affect costs. These practical examples will be used as reference points when newer distribution technologies are being evaluated for cost effectiveness.

Methodology:

A computer program for designing cable routes capable of serving various numbers and distributions of subscribers was developed. Cost and route design input data was derived by examining the loop practices and broad gauge unit cost data of a number of Canadian telephone companies.

Results:

Data for a range of routes representative of the rural situation were derived and a very large spread of costs for providing service discovered. Costs per subscriber increase rapidly with distance from the central office. Depending on the construction method, first costs per subscriber can vary between \$3,000 to \$10,000 for routes up to 100 Kft in length.

Factors influencing costs are seen to be:

- surface geography
- climate
- subscriber density, distribution, and growth
- economies of scale

Consequences:

Data from this study was used (together with telephone service statistics) to compute the cost of upgrading service in rural areas to various levels. For instance it was estimated that \$1½B would be required to provide all rural subscribers with single party service, or \$2½B to provide 4-party service or better. The telephone industry is currently spending close to \$1B to upgrade rural service to 4-party or better by expanding and improving their existing cable plant.

Title: SYSTEM ENGINEERING STUDY AND FABRICATION OF AN EXPERIMENTAL TRANSMIT AND RECEIVE UNIT FOR A MICROWAVE TRANSMISSION SYSTEM FOR RURAL APPLICATIONS.

This project was contracted out and was completed on 31 March 1979.

Objective:

RE: An 18 GHz trunk and feeder microwave system:

- 1) To conduct an engineering study in order to identify the requirements and trade-offs of the overall system in order to provide a practical and cost effective design in co-operation with Canadian telephone companies.
- 2) To assemble and test a rural microwave radio transmitter and receiver in order to demonstrate the viability of the concept.

Methodology:

The system model for the rural microwave radio was developed from an examination of needs of the rural telecommunications network and demographic data. Two basic applications were identified: A feeder route and trunk route. Basic system parameters were defined and on that basis the exploratory development began. As cost and other practical factors started emerging, a system application study was initiated in Alberta and Bell Canada networks. The excellent results obtained during testing of the experimental system proved that the system is technically feasible. The findings of the application studies were that the system would be economical, if widely adopted.

Results:

Five route evaluations were conducted. The rural microwave radio was cheaper (on a projected-cost basis) than either new cable or an equivalent 2 GHz radio system.

On long trunk systems (50-100 km.), radio systems are usually much cheaper than equivalent capacity cable systems. Comparing the use of 18 GHz and 2 GHz radios on these long routes, there are always trade offs to be made of cost vs availability. If all factors were to be included in the comparison, however, the much greater flexibility of the 18 GHz system should usually prevail.

A design cost goal of \$12,000 (1978) per two way repeater, inclusive of all costs, would be the break-even cost for the system. At this cost level, which includes self-contained remote powering, system route planning becomes almost independent of geographic constraints and the rural microwave radio should prove as easy to plan and install as conventional systems.

Consequences:

This trunk or feeder system could complement fibre optics local distribution systems in the future. Potentially, it could carry a large number of TV channels. However, for the present we have demonstrated that this microwave system is technically feasible and that it might contribute significantly to a cost reduction in rural telephone services.

Implementation of this system could only proceed after further studies were completed. Such studies would have to be concerned with spectrum allocation, cost, reliability, market size (and attendant problems of spare part stocking, instruction of personnel, etc.) also the effects of population changes in the areas serviced with this type of system.

Title: A SYSTEM STUDY AND EXPLORATORY DEVELOPMENT OF A SUBSCRIBER CARRIER SYSTEM TO SERVE LOW DENSITY RURAL AREAS

A three-phase contract consisting of:

Phase I - Technical systems concepts and preliminary market assessment,  
Phase II - Technical feasibility and hardware development and Phase III -  
Market assessment based on firm system specification.

Objective:

The objective is (a) to determine if a digital subscriber carrier system capable of providing improved grade of telephone service to the low density rural areas of Canada is feasible at a competitive cost, and (b) to determine the market potential of such a system in Canada, the U.S. and offshore in order to encourage Canadian industry to continue to develop and manufacture the system with its own resources.

Methodology:

The necessary hardware will be developed and assembled into a working breadboard version of the system to demonstrate operation. All new system concepts will be implemented in order to prove the technical feasibility of the system. The assessment of the market will be done by preparing a suitable information package questionnaire for distribution to 15 Canadian and U.S. telcos and REA. The distribution of the questionnaire will be followed by visits and telephone calls to the respective telcos. The work is monitored periodically during scheduled project reviews and continuously on a less formal basis.

Results:

Phase I of the contract has been completed. It appears that a cost competitive digital subscriber carrier system for low density rural communication may be feasible. Drawings identifying the functional blocks of the remote unit circuit and the central office unit circuit have been generated. The system in this study has been shown to be more cost-effective than any current system and was shown to approach the \$300 per subscriber cost target. The most significant market area for the system lies in upgrading of rural multi-party lines and four-party lines. The first interim report has been prepared and distributed by the contractor.

Consequences:

The availability of a low cost, low capacity subscriber system could provide an economical method for the telephone carriers to upgrade existing rural service. The resulting market would stimulate the Canadian electronics industry to manufacture this or similar systems and thus open up new employment opportunities. The department would fulfill two primary objectives, namely to determine a cost effective way to improve telecommunications services in rural Canada and to identify an opportunity to industry for development.

Title: DEVELOPMENT OF A CUSTOM LSI CIRCUIT FOR A RURAL INTERFACE DEVICE (RID) UNIT

This contract is a shared-funding response to an unsolicited proposal to develop a Large Scale Integration (LSI) Circuit for a Rural Interface Device (RID). The RID is an electronic system situated at the subscriber's end of a multi-party telephone line. The RID provides the user with nearly all of the advantages of single party service without incurring the cost of laying a dedicated line to the nearest switching center. It is anticipated that the cost of the RID will be appreciably less than the cost of a dedicated line.

Objective:

The objective is to develop the LSI chip in order to reduce the size and cost of the RID unit. The RID unit manufactured in discrete component technology does not represent an economic alternative.

Methodology:

Eight work activities are being completed: functional design, circuit layout and computer simulation, test program generation, mask preparation, processing wafer batches, evaluation of prototype and process, processing second iteration and characterization and documentation. Interim reports and project reviews are used to provide the DOC project officer the opportunity to monitor the progress of the project and assess the results.

Results:

Prototype chips have been fabricated. However, a sufficient quantity of chips has not been produced as yet to initiate a field trial study.

Consequences:

The RID unit could provide the telecommunications carriers and telcos with a low-cost alternative to upgrading rural lines to private line service using massive and costly plant extension programs. The magnitude of the blocking problems that may ensue on RID-equipped lines has yet to be determined. The RID unit may provide a viable temporary alternative until more permanent solutions such as subscriber carrier and fibre optics become available in rural areas.

Title: FIELD TRIAL OF A RID/PANI CIRCUIT

This project involves a contract to assist a telephone company in a field trial of the Rural Interface Device/Party Automatic Number Identification (RID/PANI) circuit recently developed (see also Annex B13).

Objectives:

The objective is to verify the technical performance of the RID/PANI circuit and to evaluate customer reaction to the features offered by the unit.

Results:

The trial has not started due to unavailability of the LSI chips.

Consequences:

A field trial to verify the performance of the RID/PANI unit will determine the extent of the acceptance of its service features by the customer. This will greatly enhance the probability of a successful introduction of the unit by other telcos. Its successful introduction is important because the RID can provide multi-party subscribers with a level of service approaching that of single-line service at a much lower cost to the telcos.

Title: "MAN ON THE MOVE" - A USERS' SURVEY OF MOBILE RADIO SERVICES IN RURAL AREAS OF THE PRAIRIE PROVINCES.

This study was contracted out to a university and was completed in August 1977.

Objectives:

- 1) To identify the socio-economic-geographic characteristics of users.
- 2) To identify user complaints and preferences.
- 3) To analyze communications patterns of users.
- 4) To estimate future needs.

Users include General Radio Service (GRS), Private Mobile, General Land Mobile Radio Service (GLMRS), Restricted Common Carrier Mobile Radio Service (RCCMRS) and paging licensees.

Methodology:

A questionnaire was developed and sent to some 3,633 radio users in the Prairie Provinces. Some 43% responded; the data was analyzed and a report was prepared.

Results:

1. Socio-economic-geographic characteristics of users:

GRS licensee density correlated strongly with agricultural activities. The frequency of GRS calls varied with characteristics associated with urban environments and the percentage of calls for business purposes varied inversely with population. All categories (GRS, Private, etc.) of licensee displayed high correlations with the younger farm operators.

Estimated Penetration:

	Work Force 1971	Penetration (Mobiles/1,000 work force)		
		GRS	Private	GLMRS
Alberta				
Urban	494,605	20.8	29.9	12.4
Rural	262,060	31.9	11.3	8.7
Saskatchewan				
Urban	184,080	24.9	11.2	2.3
Rural	225,990	41.5	4.2	1.1
Manitoba				
Urban	309,620	12.2	12.4	1.1
Rural	149,300	24.3	10.6	0.5

2. User Complaints, Preferences and Plaudits:

Two-thirds of GRS respondents had a negative attitude towards the service. Abuse, inadequate range and skip problems. Inadequate range was cited as a problem with GRS, Private and RCCMRS. Delays due to congestion were cited by all users.

RCCMRS, Private, GLMRS, Paging and GRS licensees stated a degree of necessity for their sets that ranged respectively from "absolutely necessary" to "important". Very few people considered their sets as luxury.

Respondents liked the time and money savings.

3. Communications Patterns:

75% of GRS respondents stated that their GRS use was business oriented and of course business calls predominated for GLMRS and Private. The duration of the majority of calls were: GRS, 3 mins; GLMRS, 1 - 2 mins; Private, 1 min; RCCMRS, 1 min. The most common base station sites were: GRS, rural farm; Private, rural farm; GLMRS, urban with 1,000 to 5,000 population. The average number of modules in a system were: GRS, 2.8; Private, 5.2; GLMRS, 1.7; RCCMRS, 5.8; Paging, 5.2.

4. Future Needs:

GRS: Better area coverage, higher quality equipment, more privacy, telephone system connection, much less congestion.

Private: Better range, more modules, telephone connection and lower cost.

GLMRS: Better area coverage, less congestion and lower cost.

Large portions of all users expected an improved service within five years and were planning to change their service in the near future.

Consequences:

For the first time we have quantitative information on rural mobile radio users. This information will be a useful input in the development of Network and Spectrum Policy.

Specifically, future proposals for mobile communications should take into account:

- rural needs, which may be greater than that which has heretofore been assumed;
- the need for something better than GRS;
- the need for something less expensive than currently available public mobile systems.

The findings of this study were utilized in follow-on studies described in Annexes B16 and B17.



Title: A STUDY OF RURAL MOBILE RADIO IN THE PRAIRIE PROVINCES -  
A TECHNICAL SURVEY

This study was contracted out and the project was completed in May 1978.

Objective:

To study the technical, cost and service aspects of rural mobile radio in the Prairie Provinces and to assess the systems conceived to solve the needs of these rural residents.

Methodology:

The project was split into two phases, namely: fact finding/assessment and conceptual model development. During the first phase, contacts were established with suppliers of mobile radio equipment to develop a data file on existing equipment and to establish the nature of new and projected technological developments. The second phase activity consisted of a conceptual development of a shared, multi-channel system.

Some 160 companies were sent a letter requesting technical information and about 50% replied. This mail survey was followed by meetings with Motorola, Canadian General Electric, International Systcoms, Canadian Marconi and Pye Electronics which together supply about 95% of the Canadian market.

Results:

Technological trends in evidence are:

- Continuing development of reliable, "secure" communications systems for public safety, building security, and special control.
- Continuing trend towards "digitization": digital frequency synthesis, microprocessor switching and control.
- Evidence of increasing "modularization", providing the system designer with more options.
- A continuing trend towards miniaturization and reduced power consumption.

A general characteristic is that equipment from different suppliers is not interchangeable, resulting in high cost and poor spectrum utilization. The study suggests that spectrum near 220MHz would be desirable for rural radio service.

Consequences:

The findings of this study were utilized in follow-on studies in mobile radio (annex B17).

Title: A FEASIBILITY STUDY OF RURAL RADIO COMMUNICATIONS.

Study contracted out to industry and completed in March 1979

Objectives:

The objective of this study was to examine the "Feasibility of Radio Facilities in Rural Parts of Canada" by

- a) Undertaking general studies related to the application of radio technologies to rural communications;
- b) Devising and coordinating a plan for feasibility for selected areas;
- c) Organizing a pilot project at a selected location to demonstrate feasibility and acceptability by the public.

Methodology:

The first phase of this project consisted of a review of presently available radio systems and their suitability to improve communications in Canada. The findings of this phase were presented to telephone companies to verify accuracy. This activity was followed by a review of advanced basic technologies from which new systems could be configured. A broad framework of mobile and fixed services was developed and used in the process of establishing a new radio approach for rural areas of Canada.

Results:

The review of presently available radio systems such as Subscriber Radio, both VHF and Microwave, and Mobile radio showed that these systems are not suitable for high penetration in rural areas of Canada, in order to alleviate the low quality of communications services presently provided to residents of rural areas. The main reasons for the low penetration of radio in rural Canada are high cost and lack of suitability of the system for providing an acceptable standard of service. The private networks are to a large extent customized resulting in a patchwork of systems and a highly fragmented market. The present market for two-way radio in Canada is estimated at \$129 million annually, supplied mainly by subsidiaries of U.S. and British companies. The growth of two-way radio service is now inhibited by a shortage of frequency spectrum. This problem is likely to be resolved with allocation of more spectrum to two-way radio. Policy proposals from all interested countries will be presented for consideration at the 1979 World Administration Radio Conference, and it is virtually certain that the conference will agree that additional spectrum should be allocated to two-way mobile radio.

The study concludes that the basic advanced technology in terms of components and sub-systems exists presently that would allow a development of a national Rural Radio System for both fixed and mobile applications. The main obstacle is the development of a consensus and establishing standards among Canadian providers of mobile service. If this problem can be overcome the Canadian domestic market would be more than adequate to develop a healthy Canadian industry with a significant export potential. The main technical challenge to the development of this system is to create a system concept which will result in low-cost mobile transceivers. This can be accomplished by taking most of the complexity out of the mobile unit and placing it in the base stations where the high cost technological elements would be shared by many users.

Consequences:

A major opportunity for advancement of Canadian high technology industry has been identified. Exploitation of this opportunity will result in a very significant improvement of telecommunications services to rural households as well as to the man on the move.

Title: A FEASIBILITY STUDY OF A 12/14 GHz SCPC SATELLITE COMMUNICATIONS SYSTEM TO MEET TELEPHONY REQUIREMENTS IN RURAL AREAS

This study was completed in January 1979.

Objective:

To investigate the feasibility of providing a) telephone service to individual homes and b) telephone trunking to communities via a 12/14 GHz satellite.

Methodology:

Models were designed, taking into account network constraints and satellite system capabilities, and the costs of the different components were estimated. Single Channel Per Carrier (SCPC) using voice activation, demand assignment and up-link power control were studied in detail.

Results:

The potential for reaching a high level of efficiency, leading to low space segment costs per circuit, was demonstrated. However, cost of earth station equipment is still prohibitively high. This cost might be brought down by design effort.

Title: TELEVISION COVERAGE IN RURAL AND REMOTE AREAS OF CANADA

Two reports "Levels of Choice in Canadian Off-Air Television Viewing" and "Areas and Communities in Canada Without Off-Air Television Reception - A Survey" were provided in May 1977 upon completion of a contract.

Objectives:

1. To determine the levels of choice and the geographical extent of Canadian off-air TV coverage in rural and remote Canada.
2. To identify and characterize those Canadian communities which do not receive off-air television service other than by communications satellite.

Methodology:

The contractors mapped the portions of the country that were, as of Sept. 1976, within the "B contours" of zero, one, two, etc. French language off-air TV stations. They repeated the process for English language Canadian TV stations. They then identified all communities receiving no off-air TV and compiled data on each, such as population, number of dwellings, area and shape, languages spoken, etc.

Results:

1. Maps are provided for each province that show the area that is within the B contours of zero, one, two, etc. channels of Canadian off-air TV, for each of the two major languages. The good coverage close to the cities is evident as also is the vast area that has poor coverage. The majority of the area within the ten provinces is out of the range of even one TV station.
2. 771 communities are identified as having no off-air TV service.

Consequences:

The large area of non-coverage plus the rapidly diminishing areas having one, two, etc. channels of off-air TV is suggestive of a satellite-type distribution system as being a possible method to quickly and massively increase the number of TV channels available to rural and remote Canadians. This possibility is described in the follow-up report on "Rural Broadcasting - A Preliminary Analysis" (Annex B20).

The Large area of non-coverage may correspond to very lightly inhabited portions of the country. The follow-up "TV Penetration Study" (Annex B23) has provided this population vs TV availability data as compared to the area vs TV availability information given in the two reports described above.

Title: RURAL BROADCASTING - A PRELIMINARY ANALYSIS AND REVIEW OF THE ISSUES AND CONSIDERATIONS OF SOME FUTURE OPTIONS

In-house, May 1977, report.

Objective:

This report, as the first on the subject of broadcasting to come out of the Rural Communications Program, is in essence a discussion paper on some of the broadcasting issues to be addressed by the Rural Program.

Methodology:

The preliminary contract described in Annex B19 provided the two reports "Levels of Choice in Canadian Off-Air Television Viewing" and "Areas and Communities in Canada Without Off-Air Television Reception - A Survey". The pertinent results from these reports were integrated with information on the growth and financing of TV stations in Canada and certain demographic data to make recommendations on possible methods to improve TV services in rural Canada.

Results:

1. Maps showing the area provided with zero, one, two, etc. channels of English or French TV reveal that area coverage is small.
2. A satellite delivered package to community receivers is the major theme and recommendation of this report.
3. Only the satellite delivery system can decisively close the gap in TV services that presently exists between the cities and rural Canada.
4. The cost burden to rural dwellers will be comparable to that borne now by CATV subscribers in the cities.

Consequences:

Follow-up work was deemed desirable to determine the number of TV channels available in rural Canada on a population basis, rather than on the area basis used in this report. This follow-up work is described in Annex B23 under the heading "TV Penetration Study".

Title: ANIK-C POTENTIAL

In-house study related to the projects described in annexes B22 and B28.

Objective:

To assess the technical and economic merits of using ANIK-C as a Direct Broadcasting Satellite (DBS) for distribution of TV in rural areas.

Methodology:

The approach has been: 1) to develop a preliminary position paper entitled "Today's Satellite Technology and Resources; an Option to improve Broadcast Services in Rural Canada" to stimulate internal discussions; 2) to develop a dialogue on the merits and market potentials of the proposal with TCTS and Telesat; 3) to carry out sufficient research within and outside government (Annex B28) to substantiate the economic and technical viability of the ANIK-C option.

Results:

A preliminary economic and technical analysis has shown that ANIK-C may be cost-competitive with other approaches. ANIK-C could play the dual role of trunking signals to small cable systems in rural communities and to provide Direct Broadcasting to isolated homes individually. The study described in Annex B28 on SCPDM/PIWM which is scheduled for completion in November 1979, and the Department's DBS experiments with ANIK-B (12 GHz) will, if positive, greatly enhance the technical potential of ANIK-C for rural service. The issuing of a final report must await completion of the SCPDM study (Annex B28).

Title: DIRECT BROADCAST SATELLITE (DBS) IMPACT STUDY

An in-house assessment of the projected impact of DBS technology, regarding application, time frame and competitiveness with other approaches.

Objective:

To define the role and opportunities that DBS could have in improving broadcast services in rural areas.

Methodology:

The approach has been to develop the most likely scenarios for DBS, to study various technical and economic alternatives and to discuss these proposals within the department. Various DBS proposals/scenarios originating from personnel in the Space Sector of DOC are analyzed and commented upon with the specific purpose of accommodating rural requirements whenever possible and practical to do so.

Results:

Issuing of a final report must await completion of the SCPDM study (Annex B28), however analyses undertaken to date indicate:

- (i) that a medium-size, high-power DBS could potentially double the average number of TV channels currently available in rural areas;
- (ii) that a high-powered DBS system is not necessarily the most economical and efficient approach. Various economic analyses show that, in fact, an integrated service package for DBS and CATV distribution on Anik C would be much more economical and provide adequate service;
- (iii) Moreover, experiments with Hermes and Anik B will define the quality of TV reception considered appropriate for direct-to-home service. Also, the contract described in Annex B28 on modulation/detection techniques will provide information on the potential of SCPDM for Anik C operation and a valuable comparison of modulation/detection techniques for video transmission via satellite.



Title: TELEVISION NETWORK COVERAGE IN RURAL CANADA COMPARED WITH THAT  
IN THE CENSUS METROPOLITAN AREAS

Contract followed by in-house analysis.

Objective:

To compare existing TV availability in rural areas with that in metropolitan areas, in order to quantify the need for improvement.

Methodology:

The number of rural Canadians living within the "B" contours of television stations and those living within areas served by cable television systems were determined using 1976 census population data. The data was compiled separately for language of station (E or F) and for nationality of station (Canadian or U.S.). This data for rural Canada was then compared with similar information for the larger cities.

Results:

The 6 million people in rural Canada have access to an average of 3.85 TV channels of distinctly different programming, whereas 12 million people in metropolitan areas enjoy 12.6 channels. Only 10% of rural Canadians have access to CATV. The rural/city TV availability ratio is: a) American networks 0.7/4.4, b) English Canadian 2.2/5.8, and c) French Canadian 0.9/2.5. The percentage of rural people having access to no television is 3.3%, to one channel is 12.8%, to two channels: 26.5%, three channels: 14.7%, four channels: 12.9% and to five channels: 7.7%. Furthermore, the rural coverage is far from uniform with the best coverage being in southern Ontario and B.C. and the worst being in the east and on the Prairies.

Title: RADIATING CABLE FOR RURAL COMMUNICATIONS

A report "Feasibility Study of Using Leaky Coaxial Cable (LCX) for Rural Communications" was submitted in September 1977 upon completion of a contract and a follow-up, in-house analysis titled "The Role of Radiating Cable in Rural Communications" was issued on 22 March 1978.

Objective:

To ascertain the usefulness of radiating cable techniques in rural applications.

Methodology:

The contractor completed basic research projects on LCX that he considered to be relevant to the above objective. The in-house analysis used the results from this research and also published information on LCX to arrive at conclusions regarding specific rural applications.

Results:

No near-future significant usage of the radiating cable method for signal distribution in rural Canada is envisaged.

Consequences:

Further work on this project was not recommended.

Title: QUALITY OF TELEPHONE SERVICE IN NEWFOUNDLAND

Joint study conducted by staff of the Federal Department of Communications and the Department of Transportation and Communications of the Government of Newfoundland.

Objectives:

- 1) To identify the quality of telephone service provided in the Province of Newfoundland.
- 2) To objectively compare service indices based on data provided by the Newfoundland Telephone Company and Canadian National Telecommunications in similar areas.

Methodology:

The approach to the determination of the quality of telephone service was as follows:

- 1) During the summer of 1976 a subscriber opinion survey of over 1200 householders in more than 300 communities was conducted by interview.
- 2) Commencing in October 1976, collections of quantitative data were provided on a regular basis by the carriers.
- 3) Field visits were made by members of the study team to representative parts of the province to inspect first-hand the telephone facilities in place.

Results:

The subscriber opinion survey and the quantitative observations augmented by the visits of the study team provided a good indication of the quality of telephone service being provided in the non-urban areas of the province of Newfoundland.

In general, the study indicated that both CNT and NTC provide reasonably good service under sometimes extremely difficult conditions in the non-urban areas of the province. A correlation of the responses to the subscriber opinion poll indicated that a larger proportion of NTC subscribers are satisfied with its service. This fact is supported to some degree in the quantitative study based on data provided by both companies.

The study identified that the principal problem areas are service interruptions, difficulty in reaching the operator, and difficulty in obtaining individual telephone service. The problems are emphasized in many cases by such accompanying difficulties as lack of roads, inclement weather and rugged terrain.

Consequences:

There is agreement within the study confirming the difficulties of serving rural versus urban areas. This is not a novel observation as much effort has already been expended in examining various means of more adequately serving the rural population of Newfoundland and other locations in Canada. It is recognized that the rugged geography and weather conditions experienced in the coastal areas of Newfoundland and Labrador contribute to the high cost and relative difficulty of serving the sparsely populated areas.

CNT serves a larger, relatively poorer geographic area on the island itself, with fewer business telephones and a lesser degree of service penetration than does NTC. In this respect it is noted among other factors, that the number of subscribers served by party lines is greater, and those with access to direct distance dialing is lower in CNT operating territory. These factors are reflected in the overall performance of the companies.

It is significant to note that within the adjacent communities of Wabush and Labrador City, (served by NTC and Labrador Telephone respectively) where the serving areas are limited and fairly concentrated, there are relatively few problems. Any that do arise are repaired quickly. However, as one examines the northeast coast of Labrador, or the south coast of the island, problems of extensive sea or air travel and water corrosion of telephone plant give rise to more numerous repair problems and the inability to carry out prompt repair action.

One of the most frequently raised points was the desire on the part of the public for individual line service. The matter of the public desire for private lines has been identified in other reports (e.g. the 1976 DOC Inter-Branch Working Group on Rural Communications) as a major problem in rural telecommunications across Canada. The rural areas of Newfoundland are for the most part no exception. It is interesting to note however, that the standard grades of service available from NTC are individual and two-party service. Multi-party service has been virtually eliminated.

Title: FEASIBILITY OF CABLE TELEVISION SERVICE IN NEWFOUNDLAND

This study is being done by a contractor and will be completed in July 1979. It is accompanied by related in-house technological and economic analysis.

Objective

The reasons for undertaking this study are: 1) to develop a representative data base of typical cable design layouts in rural communities; 2) and, to assist the Newfoundland Government in assessing the commercial viability of extending cable service to small settlements. Based on conventional CATV technology, the consultant is to develop the most cost-effective design and operation for each community. In-house application studies will expand these findings to further reduce service costs using new improved technologies.

Methodology

A demographic study was done by the Newfoundland Dept. of Communications to identify potential communities for cable service (based on populations  $\geq$  500 and household distributions of  $\geq$  25 per mile). The consultant is to study the feasibility of CATV undertakings in some 115 communities, using mathematical cable distribution cost formulas based on detail engineering of various urban, semi-urban and linear communities.

The head-end and back-haul trunking costs will be determined for each community and group of communities. Based on the best technical and economic design alternatives, the overall costs for the cable system undertakings will be developed. Then, an economic and financial analysis based on the capital outlays, operation and maintenance costs, marketing and rating projections will determine the commercial viability of extending cable service to specific groups of communities.

Results:

Not yet available.

Title: MULTICHANNEL TELEVISION REBROADCAST STATIONS

A study has been contracted out and will be completed in July 1979.

Objective:

To assess the potential and economics of multichannel television rebroadcast stations for improving broadcast services in rural areas.

Methodology:

The approach used by the consultant to develop the appropriate station models for a wide spectrum of rural applications, is to:

- 1) develop 4 models corresponding to selected design, operational, maintenance and channel-capacity requirements;
- 2) assess the technical viability of each model;
- 3) estimate the capital costs of implementing each model;
- 4) develop the overall "service costs" (capital, operation and maintenance costs) of each model;
- 5) provide application guidelines and recommendations for the operation of multi-channel stations.

The in-house application study will utilize the appropriate models and various demographic and household distribution information to assess the potential and competitiveness of multi-channel rebroadcast stations undertakings in the Canadian environment vis-à-vis other approaches.

Results:

The results of this study will permit us to determine whether rebroadcasting is, in general, an approach worth considering and, if so, under what conditions and in which configurations. Subsequent application studies will determine the competitiveness of this approach vis-à-vis others, the extent of the potential market, the possible economies of scale and opportunities for Canadian industry.

Title: EVALUATION OF THE SCPDM<sup>(1)</sup> TECHNIQUE FOR VIDEO TRANSMISSION AND THE COMPARISON OF VARIOUS MODULATION AND DETECTION TECHNIQUES FOR BROADCAST SATELLITE APPLICATIONS.

This study is being done under contract and is to be completed in November 1979.

Objective:

The potential of SCPDM and PIWM<sup>(2)</sup> for video transmission has never been fully examined and developed. This study will evaluate the above modulation schemes and investigate the performance relative to other modulation and detection techniques, the objective being the selection of the optimal system design.

Methodology:

Taking into account the availability of components, cost, performance and the overall transmission system design, a computer simulation of the various stages of a SCPDM or PIWM modem will be carried out, including the satellite transponder with its up/down links. Various video signals and waveforms will be used to assess the transmission performance of these modulation techniques. A survey of various modulation and detection techniques from open technical literature will be done to obtain a data base necessary to compare various approaches and identify the one best suited for a cost-effective Broadcasting Satellite system.

Results:

The findings of this study should provide significant clarification in the area of optimum modulation and detection technique for low-cost satellite system application. The results will be introduced into the satellite systems scenarios which will be compared with other technical options so as to determine the most suitable approach to be followed for upgrading broadband services in rural Canada. However, the definitive results of the study will only be available in 6 to 8 months.

- 
- (1) Suppressed Clock Pulse Duration Modulation
  - (2) Pulse Interval Width Modulation

Title: COAXIAL CABLE INTEGRATED DISTRIBUTION

This is an in-house study that has produced the report entitled "Integrated Distribution of Broadband and Narrowband Communications Services in Rural Areas using Coaxial Cables".

Objective:

The objective of the study is to assess the technical, operational and economic feasibilities and the advantages of using coaxial cable integrated systems for the provision of CATV, telephony and other services in rural areas.

Methodology:

System designs suitable for the simultaneous transmission of CATV, telephony and other services were examined and the most attractive designs selected. A simplified cost model was established, which permits the total system cost to be estimated from simple line costs and per-subscriber costs. The cost of integrated systems and conventional separate systems were then compared for various route lengths and subscriber densities. Finally, addition of new services, system flexibility and reliability, operational and administrative considerations, hardware availability, privacy and introduction strategy are examined.

Results:

The study indicates that, generally, an integrated system using coaxial cable can lead to a cost saving in the range of 25-50% over separate systems for telephony and CATV. The viability of such an integrated system must however be viewed in the context of the situation in which it might be introduced:

- a) In relatively high density rural areas (e.g. 5 to 50 subscribers per km), such a system could prove viable as a new or replacement system,
- b) In areas where an adequate telephone or CATV system already exists and where upgrading or reinforcement cannot yet be justified, it would not generally be economical to put a new integrated system in place, and
- c) In the very low density areas (less than 5 subscribers per km), no line system, whether integrated or separate, can be economically viable. In this case, the use of DBS and radio should be considered.

In summary, it can be generally concluded that except for very high density rural areas (towns and villages), the separate provision of telephone and CATV is simply not viable, and integration would make the provision of these services a good commercial proposition. However, such cases may not be too numerous and, viewing the results of this study together with those of the parallel study on fibre optics, it should be noted that within the relatively near future (say 1985), the cost of fibre based systems may be so much less than that of coaxial systems that, unless there is some urgency in providing service, the potential advantage of using fibre optic integrated systems should not be ignored.



Title: FIBRE OPTIC INTEGRATED DISTRIBUTION

This is an in-house study expected to be completed by the end of July 1979.

Objective:

This study is to assess the technical, operational and economic feasibilities and advantages of using fibre optic integrated distribution systems for the provision of CATV, telephony and other services in rural areas.

Methodology:

Previous studies on fibre optic integrated distribution were reviewed. Based on the current technical capabilities and constraints, an optimum network configuration was determined and a design model formulated. System component costs were projected. A simplified cost model will be established, and the system costs estimated. A comparison of the costs of fibre optic integrated systems with those of conventional separate systems will then be made for various subscriber densities

Results:

Preliminary results indicate that a star-structured configuration, or slight variations thereof, is most technically and operationally attractive for an integrated fibre optic system. Such a network structure overcomes the channel capacity limitations imposed by the current light sources. It offers the flexibility for the addition of new services. Further, it minimizes the quantity of electronics required in the field, thus rendering the system more reliable.

Preliminary cost analysis indicates that, with the projected component costs for the mid-1980's, integrated fibre optic systems will become significantly less costly than combined separate systems. A cost savings of up to 40% for an average rural area has been derived. Integrated distribution would also offer cost savings in operation, maintenance and administration.

In addition to telephony and CATV, an integrated fibre optic system can also readily provide a wide range of new, broadband and two-way services. Telidon and Pay-TV are two examples.

In summary, both the study on coaxial cable integrated distribution and the present study on fibre optic integrated distribution have strongly indicated that integrated distribution is indeed a very attractive solution to the rural communication problems. Through an integrated system, both the provision of CATV and other new services and the upgrading of multi-party to single party telephony in many rural areas of Canada can be accomplished at the same time.

Due to the rapidly decreasing costs of fibre optic components, it is anticipated that in the relatively near future (say 1985), the cost of an integrated fibre system will be less than that of an integrated coaxial system. This factor should, therefore, be taken into account in the planning of the implementation of an integrated system.

