DEPARTMENT OF COMMUNICATIONS

MSAT PHASE B

THE IMPACT OF MSAT ON THE RADIO COMMON CARRIER INDUSTRY

JANUARY 1985

VOLUME II - METHODOLOGY & ATTACHMENTS

FINAL REPORT

APRIL 1985

KVA

KVA Communications and Electronics Co.

Radio Communications System Specialists

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IN COLLABORATION WITH: WARD MALLETTE CHARTERED ACCOUNTANTS

Government of Canada
Department of Communications
300 Slater Street
Ottawa, Ontario
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Gouvernement du Canada
Ministère des Communications

Your file Votre référence

Our file Notre référence
6977-6-11

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DEPARTMENT OF COMMUNICATIONS - OTTAWA - CANADA

SPACE PROGRAM

TITLE: Study to Assess the Impact of MSAT on Radio Common Carriers

AUTHOR(S): Sheila Flynn
Mike Kedar

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Mike Kedar
January 1985

MSAT/RCC Impact Study

Volume II

Table of Contents

Volume II - Introduction

Volume II includes all the background data used in the RCC MSAT Impact Study. Specifically, each Section is described below.

Section 10.0 includes a copy of the industry survey questionnaire sent to 200 of the 600 RCCs. The questionnaire was designed to review the current RCC industry in terms of services provided and financial data, as well as to collect information on future trends within the industry.

Section 11.0 includes a copy of the aggregated results obtained. Of the 200 questionnaires sent, 80 responses were received.

Section 12.0 describes in detail, the methodology used to survey the RCC industry and to collect all the data required to assess the impact of MSAT. The in-depth interviews were based on this methodology.

Section 13.0 includes a copy of the in-depth questionnaires. Approximately 30 of the 80 initial respondents were interviewed in person and the questionnaire was completed at this time.

Section 14.0 includes a copy of the economic model. The data derived from the in-depth interviews was aggregated to represent the entire RCC population and provided many of the inputs to the economic model. The economic model includes all the equations necessary to calculate the impact of MSAT on the RCCs as determined from the net present value (NPV) of the project.

Section 15.0 describes the methodology used to aggregate the sample data collected from the in-depth RCC interviews to include the entire RCC population.

Section 16.0 includes a copy of the "Socio-Economic Input Study Assumptions", published by DOC. The study assumptions were derived based on input from DOC, Telesat, KVA, Telcos etc. This document provides inputs used in RCC study, as well as the overall socio-economic study.

Section 17.0 describes the future technologies and services as discussed in the Market Opportunities and Trends, Section 3.4, Volume I.

Section 18.0 provides a detailed discussion of MSAT services and the competitive environment in which they could potentially be offered. This document was presented to the RCCs prior to the in-depth interviews to provide background information and an introduction to MSAT.

Section 19.0 provides a summary of the RCCs Canadian distribution, both provincially and regionally. The data is based on information collected in the industry survey questionnaire and based on DOC licencing data, Dec 1982.

Section 20.0 presents the RCC MSAT data collected, including forecasts and financial figures, on a provincial basis.

SECTION 10.0

BASELINE QUESTIONNAIRE

MSAT/RCCA IMPACT STUDY
PART A - PARTICIPANT ORGANIZATION & GENERAL QUESTIONS

Company name.....

Address .....

Phone # .....

Study Contact .....

Phone # .....

---

1. Is Government interest in RCC operators as national providers of services such as Cellular, MSAT, and paging a welcome trend? YES [ ] NO [ ]

2. Do you consider the present RCC position within the Canadian Common Carrier Telecommunications Industry adequately defined in light of proposed nation wide services such as MSAT and Cellular. YES [ ] NO [ ]

3. Are you willing to participate in an in-depth evaluation in light of nation wide services such as MSAT? YES [ ] NO [ ]

THE FOLLOWING QUESTIONS ARE NEEDED TO PREPARE A PROFILE OF THE RCC INDUSTRY.

4. How many employees do you have in total? [ ]

5. What were your gross revenues for the most recent 12 month period reported? [000.]

6. What is the total estimated investment cost in your operating equipment (excluding real estate)? [000.]

7. Provide (to the nearest whole number) percentage of gross revenues and investment involved in each of the following categories:

	Gross Revenues (Q.5 above)	Investment (Q.6 above)
a) Radio Paging Service	% [ ]	[ ]
b) Mobile Radio Service	% [ ]	[ ]
c) Mobile Telephone Service	% [ ]	[ ]
d) Radio Equipment Sales	% [ ]	[ ]
e) Maintenance & Installation	% [ ]	[ ]
f) Others	% [ ]	[ ]
% TOTAL	100	100

8. If you have specified others in question 7, provide the following information.

Type of Service or Activity	Percentage of Gross Revenue for this Category
Telephone Answering Service	[ ]
Microwave Equipment Sales	[ ]
Other: (Specify).....	[ ]
.....	[ ]
.....	[ ]
TOTAL	100%

9.a) Do you compete with regulated* common carriers such as Telcos, CNCP, etc? YES [ ] NO [ ]

b) Would it help if you were regulated? YES [ ] NO [ ]

10. With regard to establishing and maintaining industry service standards should there be:

- an internal RCC industry committee? [ ]

or - a joint industry/government committee? [ ]

or - no standards at all? [ ]

11. What do you consider will be the effect of the creation of large nationwide RCCs through acquisitions, or licencing, on the RCC industry as a whole?

Positive [ ]

Adverse [ ]

12. Are you willing to accept new RCC applicants as customers on your channels until they have established a large enough base to be licenced for their own channels?

YES [ ]

NO [ ]

* **Regulation** and **Regulated** refer to the process, administered by government, to select and control public service providers. Regulation does **not** imply monopoly. There could be many regulated common carriers serving the same market. Regulation does mean meeting certain standards of service, and possibly filing tariffs and rates with the regulator.

PART B - CURRENT SYSTEMS & SERVICES

In this part we are addressing the different services and systems that make up your enterprise. These are divided into:

I Radio Paging Service
II Mobile Radio Service
III Mobile Telephone Service
IV Mobile Radio Equipment Sales
V Maintenance and Installation
VI Data Services, Radio Links, Personal Radio Communications Systems.

Please answer the sections that apply to your business. It shouldn't take longer than 40 minutes even if you answer all sections.

I **Radio Paging Service**

Do you provide this service? YES [ ] NO [ ]

IF NO, go to Section II

A. Existing

1. Year service began? [19]

2. Number of units? [ ]

3. Number of customer owned units? [ ]

4. What percentage of units are: Display % [ ]
   Tone % [ ]
   Tone & Voice % [ ]
   Total % 100

5. Number of radio paging channels? [ ]

6.a) List the locations (City, Town or Village) where you have hub transmitters and indicate whether system coverage from that location is predominantly urban [1] or rural [2]. Indicate the coverage in Km. from the hub transmitter of your channel with greatest coverage.

	Location	Km.		Location	Km.
1)	.....[1] or [2]	[ ]	6)	.....[1] or [2]	[ ]
2)	.....[1] or [2]	[ ]	7)	.....[1] or [2]	[ ]
3)	.....[1] or [2]	[ ]	8)	.....[1] or [2]	[ ]
4)	.....[1] or [2]	[ ]	9)	.....[1] or [2]	[ ]
5)	.....[1] or [2]	[ ]	10)	.....[1] or [2]	[ ]

continue on separate sheet if necessary.

b) Please provide coverage maps for each system from your promotional kit and brochures.

B. Looking to the future

7. Over the next five years:
   a) How much coverage expansion (%) do you expect to add to existing systems? % [ ]
   b) How many new market areas do you expect to open
      in total? [ ]
      in predominantly rural areas? [ ]
   c) How many new radio channels will be added?
      in total? [ ]
      in predominantly rural areas? [ ]

8. At the end of the next five years:
   a) How many pagers do you expect to serve? [ ]
   b) Estimate percentage of tone only units % [ ]
   c) Estimate percentage increase over a five year period of annual gross revenues for paging service (taking into account your expected increase in pagers served and any price changes that you can anticipate)? % [ ]

9. Are you thinking about joining a national paging network, or integrating your paging system with other RCC operations to provide regional or national paging networks? YES [ ] NO [ ]

10. In the next five years are you planning to offer enhanced service features such as -
   - voice message retrieval? YES [ ] NO [ ]
   - display paging receivers? YES [ ] NO [ ]

11.a) Is your system using digital paging? YES [ ] NO [ ]
IF YES, go to Question 11c

b) Can it be modified to add digital? YES [ ] NO [ ]
IF NO, Go to Question 12

c) Is the digital code POCSAG?* YES [ ] NO [ ]

12.a) Are your systems interconnected to give direct dial access? YES [ ] NO [ ]
IF NO, go to Question 12c

b) Do you feel that the rules and rates governing your dial access arrangements are reasonable? YES [ ] NO [ ]
IF YES, go to Section II
If not, please explain below.

_____

_____

_____

_____

_____

Go to Section II

c) Do you intend to provide dial access? YES [ ] NO [ ]
IF NO, go to Section II
When do you think this will happen? [19]

*POCSAG = Post Office Code Standardization Advisory Group

II Mobile Radio Service

Do you provide this service? YES [ ] NO [ ]

IF NO, go to Section III

A. Existing

1. Year service began? [19]

2. Number of radio channels in operation? [ ]

3.a) List the locations (City, Town or village) where you have repeaters and indicate whether system coverage from that location is predominantly urban [1] or rural [2]

Location		Location	
1)	[1] or [2]	6)	[1] or [2]
2)	[1] or [2]	7)	[1] or [2]
3)	[1] or [2]	8)	[1] or [2]
4)	[1] or [2]	9)	[1] or [2]
5)	[1] or [2]	10)	[1] or [2]

continue on separate sheet if necessary.

b) Please provide coverage maps for each system from your promotional kit and brochures.

4. Number of mobiles? [ ]

5. Number of customer owned mobiles? [ ]

6.a) Do you have conventional single channel systems? YES [ ] NO [ ]

IF YES, go to Question 7

b) If not conventional single channel systems, explain type of system provided.

_____

_____

_____

_____

_____

continue on a separate sheet if necessary.

B. **Looking to the future**

7. Over the next five years:

a) How many new service areas do you expect to open? [ ]
b) How many new radio channels do you expect to add? [ ]
c) How many of these new channels will be for trunked systems? [ ]
d) How many new channels will serve predominantly rural areas? [ ]

8. At the end of the next five years:

a) What do you expect your number of mobiles to be? [ ]
b) Estimate the percentage of:

Trunked Mobiles	%	[ ]
Conventional Mobiles	%	[ ]
TOTAL	%	100

c) Estimate the percentage increase over the five year period of your annual gross revenues from mobile radio services, taking into account your expected subscriber base and anticipated price changes. % [ ]

9.a) Do you wish to offer limited interconnect* capability to your mobile radio subscribers? YES [ ] NO [ ]
IF NO, go to Question 10
b) Would you wish to offer this capability on a trunked system? YES [ ] NO [ ]
c) Do you prefer that this interconnect capability would be:
- manual patching by your operator? [ ]
- automatic dial access to and from specific mobiles? [ ]

10.a) Do you expect to see a significant increase in the use of portables on your MRS channels? YES [ ] NO [ ]
IF NO, go to Section III
b) If so, on your current systems provide the percentage of:

Mobiles	%	[ ]
Portables	%	[ ]
TOTAL	%	100

c) What do you expect this to be at the end of five years:

Mobiles	%	[ ]
Portables	%	[ ]
TOTAL	%	100

*Limited Interconnect means calls in off-peak hours or on an emergency basis or less than 10% of all calls are connected to the switched network.

III Mobile Telephone Service

Are you presently operating a mobile telephone system interconnected to the public telephone network, or carrying mobile telephone traffic on your two-way channels? YES [ ] NO [ ]

IF NO, go to Question 6

A. Existing

1. Number of radio channels handling radio-telephone traffic? [ ]

2. Number of mobile telephone units? [ ]

3. Number of customer-owned units? [ ]

4. Number of mobile telephone calls per month? [ ]

5. Is your interconnect agreement with your telco - experimental? [ ]
   - permanent? [ ]

B. Looking to the Future

6. **Cellular Radio** Cellular radio will be a nationwide service, involving equity participation by local RCC operators. The top 23 markets have been applied for; the remaining markets can now be applied for. Do you intend to get involved in cellular?

   YES [ ] NO [ ]

   IF NO, go to Question 7

   a) What percentage of existing private system mobiles and RCC mobiles will be attracted to cellular in your market areas?

Less than	5%	[ ]
	10%	[ ]
	15%	[ ]
Over	15%	[ ]

   c) If you plan to be part of the nationwide cellular network please provide:
   - estimated number of units in 1990 [ ]
   - percentage of portables/mobiles in 1990

Mobiles	%	[ ]
Portables	%	[ ]
TOTAL	%	100

   d) Some of the factors affecting the implementation of cellular radio are listed below. Please rank from 1 to 5 with 1 representing the factor you expect will have the most adverse impact on your cellular offering.
   - telco facility agreements [ ]
   - telco interconnect rates [ ]
   - telco cellular pricing [ ]
   - RCC implementation delays [ ]
   - telco nationwide promotion [ ]

e) MSAT could provide extended coverage for cellular radio, linking together terrestrial coverage areas. In your market areas do you feel that MSAT is vital to the success of cellular: YES [ ] NO [ ]

f) Which of the following MSAT/cellular scenarios best meets your needs:

i) single standard mobile terminal working into compatible MSAT/terrestrial cellular systems, [ ]

ii) dual standard mobile terminal working into incompatible MSAT/terrestrial cellular systems [ ]

7. a) **Conventional Mobile Telephone** If interconnect is permitted in your area, do you plan to implement narrowband FM or other types of single channel or trunked channel mobile telephone service during the next five years? YES [ ] NO [ ]
IF NO, go to Question 8

b) How many service areas? [ ]

c) How many radio channels? [ ]

d) How many units do you expect to have in service by the end of five years? [ ]

e) Will these systems have direct dial in both directions? YES [ ] NO [ ]

f) What type of systems will they be:
i) single channel? YES [ ] NO [ ]
ii) trunked channels? YES [ ] NO [ ]
iii) IMTS or AMTS type? YES [ ] NO [ ]
iv) DTMF type? YES [ ] NO [ ]
v) Other? YES [ ] NO [ ]
IF YES, specify .....

.....

8. **Air-Ground Radio Telephone Service** There is a proposal to introduce an air-ground radio-telephone service in the 900 MHz band with much greater capacity than the 450 MHz systems already being operated in Canada by the telephone companies. These new channels would permit service to commercial and private aircraft.

a) Would you be interested in providing this service in your principal areas of operation? YES [ ] NO [ ]

b) In other areas? YES [ ] NO [ ]

IV Mobile Radio Equipment Sales

Do you sell radio equipment? YES [ ] NO [ ]

IF NO, go to Section V

A. Existing

1. Current Sales Volume
   a) mobiles/portables % [ ]
   b) pagers % [ ]
   c) fixed station equipment and others % [ ]
   TOTAL % 100

B. Looking to the Future

2. Future Sales Volume
   Over the next five years do you expect your gross revenues from equipment sales to grow: substantially, over 15% per annum [ ]
   moderately, 5 - 15% " " [ ]
   minimally, 0 - 5% " " [ ]

3. Capabilities
   a) Do you have trained sales employees that can handle system sales such as a mobile radio system using MSAT? YES [ ] NO [ ]
   b) Are you willing to employ and train such people? YES [ ] NO [ ]

V Maintenance and Installation

Do you proved maintenance and installation services? YES [ ] NO [ ]

IF NO, go to Section VI

1. a) What is the percentage split of gross revenue between:

Maintenance Revenues	%	[ ]
Installation Revenues	%	[ ]
TOTAL	%	100

b) What is the percentage split of maintenance revenues for:

Mobile Radios, Portables & Pagers	%	[ ]
Fixed Equipment	%	[ ]
TOTAL	%	100

c) Do you install and/or maintain systems and equipment you haven't sold? YES [ ] NO [ ]

2. In comparison with the overall growth of your business, is revenue growth in maintenance and installation services expected to be:

Higher	[ ]
Lower	[ ]

3. How many of your locations have equipped shops and trained technical staff? [ ]

VI Others

VI.A Data Services

Proposals have been made that broadcast-type channels, similar to radio paging, will be used to send data messages such as stock reports, data retrieval from centralized banks (Telidon) to mobile and fixed radio receivers. These channels might use a sub-carrier on an FM broadcast station (FM-SC), or a transmission during the blanking interval of a TV broadcast signal (TV-VBI).

1 a) Would you be interested in providing such services YES [ ] NO [ ]
If NO, go to Question 2

b) Would you wish to use:
Your own message processor to interface with the local TV or FM broadcast transmitter [ ]
Share a message processor with other common carriers [ ]

2. Would you be interested in marketing the fixed data receivers, mobile data receivers and data display paging receivers required for the subscribers? YES [ ] NO [ ]

3. Do you see these services as a threat to your radio paging operations YES [ ] NO [ ]

VI.B Mobile Data

4. a) Do any of your customers need mobile data terminals to improve their communications? YES [ ] NO [ ]
b) Do you envision a market for mobile data channels, separate from your two-way voice channels? YES [ ] NO [ ]

VI.C Radio Links

5. a) Which do you plan to use in controlling your radio channels?
   - Wireline [ ]
   - UHF radio [ ]

   b) What alternatives are you considering to UHF links which are becoming increasingly scarce?
   - i) 960 MHz microwave? YES [ ] NO [ ]
   - ii) Low band VHF YES [ ] NO [ ]
   - iii) Others: ..... YES [ ] NO [ ]

   IF YES, Specify.....

   .....

   .....

   c) Are you prepared to use newer 5 KHz bandwidth technologies such as ACSB or PELPC/DMSK?* YES [ ] NO [ ]

*ACSB - amplitude compandored sideband (analogue)
PELPC/DMSK - pitch excited linear predictive coding/diphase minimum shift keying (digital).

VI.D Personal Radio Communications Systems (PRCS)

Proposals have been made to introduce a Personal Radio Communication service (PRCS) in the 900 MHz band that will provide inexpensive mobile radio equipment to the general public offering:

- vehicle/vehicle direct calling
- vehicle/vehicle through repeaters
- limited interconnect through base stations at the users' home or office

6. Are you interested in providing the repeater systems and service for these operations in your territory? YES [ ] NO [ ]

7. Are you interested in selling PRCS mobile radios? YES [ ] NO [ ]

8. Are you interested in installing and maintaining PRCS mobile radios? YES [ ] NO [ ]

PART C

MSAT - RELATED QUESTIONS

In a few weeks we shall be conducting in-depth interviews with those RCCs who have decided that MSAT may form part of their future and want to find out more by participating in this study to determine how MSAT is most likely to affect the RCC industry. Meanwhile, so we can obtain a good base knowledge of RCC interest please answer the following:

1. Do you agree to an in-depth personal interview during the next phase of our study - Nov/Dec.1983? YES [ ] NO [ ]

2. Are you willing to provide details of your current operations and assess the most likely impacts resulting from MSAT? YES [ ] NO [ ]

3. Are you interested in participation in review trials on MSAT? YES [ ] NO [ ]

4. MSAT could provide new business opportunities for the RCCs by introducing new application areas, particularly in under served regions of Canada. The following identifies application areas for MSAT. Please rank each application area, based on your high medium or low interest as a future service provisioner

	CHECK ONE ONLY		
	High	Medium	Low
MOBILE RADIO SERVICE			
Despatch service to intercity trucking operations	[ ]	[ ]	[ ]
Emergency communications systems for forest fire control, disaster relief.	[ ]	[ ]	[ ]
Emergency communications in wilderness areas	[ ]	[ ]	[ ]
Wide area distress communications with vehicles, boats and aircraft.	[ ]	[ ]	[ ]
MOBILE TELEPHONE SERVICE			
Public telephone service on public transport vehicles such as intercity buses, train, ferries and aircraft.	[ ]	[ ]	[ ]
Remote and rural telephone service	[ ]	[ ]	[ ]
Extension of the mobile cellular service	[ ]	[ ]	[ ]
MOBILE PAGING SERVICE			
True wide area paging	[ ]	[ ]	[ ]

	CHECK ONE ONLY High	Medium	Low
MOBILE DATA SERVICE			
Wide area voice and data communications for ambulance patient care.	[ ]	[ ]	[ ]
Remote monitoring of cargo being transported by rail or road.	[ ]	[ ]	[ ]
Monitor, alarm and control facilities for remote equipment, pipelines, waterpumps, etc.	[ ]	[ ]	[ ]
Data acquisition and control.	[ ]	[ ]	[ ]

SECTION 11.0

BASELINE QUESTIONNAIRE RESULTS

MSAT/RCC Impact Study Baseline Questionnaire Results
December 83

Part A - General

	Canada	BC	Alta	Sask	Man	Ont	Que	Atlantic
Total Respondents:	78	13	11	0	4	34	14	2

1) If Government interest in RCC operators as National providers of services is a welcome trend.

Reply	Of All Respondents
YES	87.1%
NO	8.9%
NOT STATED	4.0%
TOTAL	100%

2) If RCC position is adequately defined.

Reply	Of All Respondents
YES	37.1%
NO	57.6%
NOT STATED	5.3%
TOTAL	100%

3) Willingness to participate in an in-depth evaluation.

Reply	Of All Respondents
YES	88.4%
NO	8.9%
NOT STATED	2.4%
TOTAL	100%

4) Total employees

	BC	Alta	Man	Ont	Que	Atlantic	Canada	
UNDER 10	61.5	45.4	50.0	41.1	71.4	100.0	52.5	%
10-49	23.0	54.5	50.0	41.1	21.4		35.8	%
50-99	7.6			5.8	7.1		5.1	%
100 OR MORE	7.6			5.8			3.8	%
NOT STATED				5.8			2.5	%
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	%

Total employees:	BC	Alta	Man	Ont	Que	Atlantic	Canada
	315	105	41	1992	198	5	2656

5) Gross Revenues for most recent 12 month period.

Gross Revenues (000's) — Of All Respondents

	BC	Alta	Man	Ont	Que	Atlantic	Canada
UNDER 100	23.0		25.0	14.7	7.1	100.0	15.3%
100-250	15.3		25.0	11.7	14.2		11.5%
250-500	23.0	54.5	25.0	5.8	35.7		21.7%
500-1,000	7.6	27.2		44.1	21.4		29.4%
1,000 OR MORE	7.6	18.1	25.0	23.5	21.4		21.7%
NOT STATED							0.0%
	100.0	100.0	100.0	100.0	100.0	100.0	100 %

Totel Gross Revenues of ell BC respondents:	$ 14,516,500
Totel Gross Revenues of all Alta. respondents:	$ 7,630,000
Totel Gross Revanues of ell Men. respondents:	$ 1,440,000
Total Gross Revenues of all Ont. respondents:	$ 47,251,000
Total Gross Revenues of ell Que respondents:	$ 14,288,000
Totel Gross Revenues of all Atlantic respondents:	$ 74,000
Totel Gross Revenues of all respondents:	$ 85,199,500

6) Totel estimeted investment cost in operating equipment.

Investment (000's) — Of All Respondents

	BC	Alte	Men	Ont	Que	Atlantic	Canada
UNDER 100	46.1	9.1	25.0	17.6	28.5	100.0	25.6 %
100-250		18.1	25.0	29.4	14.2		19.2 %
250-500	15.3	36.3	25.0	26.4	35.7		26.9 %
500-1,000	23.0	36.3	25.0	11.7			15.3 %
1,000 OR MORE	15.0			14.7	21.4		12.8 %
NOT STATED							
	100.0	100.0	100.0	100.0	100.0	100.0	100 %

Totel investment cost of ell BC respondents:	$ 9,041,000
Total investment cost of ell Alta. respondents:	$ 4,596,000
Total investment cost of all Men. respondents:	$ 1,125,000
Totel investment cost of all Ont. respondents:	$25,177,174
Total investment cost of ell Que. respondents:	$10,596,000
Total investment cost of all Atlantic respondents:	$ 70,000
Total investment cost of ell respondents:	$50,605,174

7,8) Percentege of gross revenues per service cetegory.

Service Category	Percentage of Gross Revenues * UNDER 100 GROSS REVENUES (000's)	100-250 GROSS REVENUES (000's)	250-500 GROSS REVENUES (000's)	500-1,000 GROSS REVENUES (000's)	1,000 OR MORE GROSS REVENUES (000's)	GROSS REVENUES $	GROSS REVENUES %
TOTAL							
RADIO PAGING	21.5	8.2	31.5	20.9	88.3	31057750	36.4
MOBILE RADIO	35.6	26.7	20.5	12.3	1.5	8381360	9.8
MOBILE TELEPHONE		2.2	0.6	3.1		71750	0.8
RADIO EQPT SALES	18.0	44.3	19.0	29.2	3.5	17504420	20.5
MAINT & INST	17.1	17.9	17.9	16.4	1.3	8132480	9.5
OTHERS-TELEPHONE ANSWERING	7.5		2.0	14.4	3.7	19405740	22.7
-MICROWAVE EQPT							
-OTHER		0.4	8.2	4.0	1.3		
TOTAL	100%	100%	100%	100%	100%	85199500	99.9
NUMBER OF RESPON-DENTS PER GROSS REVENUE CATEGORY	12	9	17	23	17		

*To determine the percentege thet eech service cetegory contributes to the totel gross revenue, responses were evereged for ell respondents in eech gross revenue cetegory.

BC							
RADIO PAGING	47.5		60.5	12.5	31.2	4450000	30.6
MOBILE RADIO	1.6	6.8	4.4	6.4	4.8	725100	4.9
MOBILE TELEPHONE		3.1		5.8		96250	0.6
RADIO EQPT SALES	34.2	57.4	1.1	32.8	37.6	5103600	35.1
MAINT & INST	2.7	30.6	10.3	22.7	10.2	1732850	11.9
OTHERS-TELEPHDNE ANSWERING	13.7		6.0		14.0	2408700	16.5
-MICROWAVE EQPT							
-OTHER		1.8	17.5	19.5	2.0		
TOTAL	100%	100%	100%	100%	100%	14516500	100%
NUMBER OF RESPON-DENTS PER GROSS REVENUE CATEGORY	3	2	3	2	3		

Service Cetegory	Percentage of Gross Revenues * UNDER 100 GROSS REVENUES (000's)	100-250 GROSS REVENUES (000's)	250-500 GROSS REVENUES (000's)	500-1,000 GROSS REVENUES (000's)	1,000 OR MORE GROSS REVENUES (000's)	GROSS REVENUES $	GROSS REVENUES %
ALBERTA							
RADIO PAGING			29.5	33.4	1.1	1444750	18.9
MOBILE RADIO			10.2	7.7	20.6	1014100	13.2
MOBILE TELEPHONE			1.4	1.6		76000	0.9
RADIO EQPT SALES			30.3	43.1	64.3	3636810	47.6
MAINT & INST			23.4	12.6	13.8	1221340	16.1
OTHERS-TELEPHONE ANSWERING						237000	3.1
-MICROWAVE EQPT							
-OTHER			4.9	5.0			
TOTAL			100%	100%	100%	7630000	100%
NUMBER OF RESPON-DENTS PER GROSS REVENUE CATEGORY			6	3	2		
MANITOBA							
RADIO PAGING	20.0		95.0		32.0	613000	42.5
MOBILE RADIO	20.0	25.0	5.0		15.0	198000	13.7
MOBILE TELEPHONE		5.0			4.0	45000	3.1
RADIO EQPT SALES	40.0	50.0			5.0	116000	8.0
MAINT & INST	20.0	20.0			44.0	468000	32.5
OTHERS-TELEPHONE ANSWERING						0	
-MICROWAVE EQPT							
-OTHER							
TOTAL	100%	100%	100%		100%	1440000	100%
NUMBER OF RESPON-DENTS PER GROSS REVENUE CATEGORY	1	1	1		1		

Service Category	Percentage of Gross Revenues * UNDER 100 GROSS REVENUES (000's)	100-250 GROSS REVENUES (000's)	250-500 GROSS REVENUES (000's)	500-1,000 GROSS REVENUES (000's)	1,000 OR MORE GROSS REVENUES (000's)	GROSS REVENUES $	GROSS REVENUES %
ONTARIO							
RADIO PAGING	16.6	10.1		22.2	93.5	20071920	42.4
MOBILE RADIO	51.5	35.6	42.1	10.4	0.7	3888660	8.2
MOBILE TELEPHONE		2.4		1.3		243600	0.5
RADIO EQPT SALES	9.0	39.4	12.8	25.8	0.6	4780110	10.1
MAINT & INST	22.7	12.3	45.0	16.4	0.6	3818270	8.0
OTHERS-TELEPHONE ANSWERING				20.8	3.1	14448440	30.5
-MICROWAVE EQPT							
-OTHER				3.0	1.0		
TOTAL	100%	100%	100%	100%	100%	47251000	100%
NUMER OF RESPONDENTS PER GROSS REVENUE CATEGORY	5	4	2	15	8		
QUEBEC							
RADIO PAGING		15.3	18.0	5.6	39.1	4450080	31.1
MOBILE RADIO	45.0	27.7	37.8	30.8	11.7	2551000	17.8
MOBILE TELEPHONE			0.1	10.8	0.1	256900	1.7
RADIO EQPT SALES	25.0	40.0	21.6	24.3	27.9	3854400	26.9
MAINT & INST	25.0	16.9	6.1	17.1	3.5	892020	6.2
OTHERS-TELEPHONE ANSWERING						2283600	15.9
-MICROWAVE EQPT							
-OTHER	5.0		16.1	11.0	17.5		
TOTAL	100%	100%	100%	100%	100%	14288000	100%
NUMBER OF RESPONDENTS PER GROSS REVENUE CATEGORY	1	2	5	3	3		

Service Category	Percentage of Gross Revenues * UNDER 100 GROSS REVENUES (000's)	100-250 GROSS REVENUES (000's)	250-500 GROSS REVENUES (000's)	500-1,000 GROSS REVENUES (000's)	1,000 OR MORE GROSS REVENUES (000's)	GROSS REVENUES $	GROSS REVENUES %
ATLANTIC PR.							
RADIO PAGING	37.8					28000	37.8
MOBILE RADIO	6.0					4500	6.0
MOBILE TELEPHONE						0	
RADIO EQPT SALES	18.2					13500	18.2
MAINT & INST						0	
OTHERS-TELEPHONE ANSWERING	37.8					28000	37.8
-MICROWAVE EQPT							
-OTHER							
TOTAL	100%					74000	100%
NUMBER OF RESPONDENTS PER GROSS REVENUE CATEGORY	2						

* To determine the percentage thet each service category contributes to the total gross revenue, responses were averaged for all respondents in each gross revenue category.

Percentage of investment cost classified by service category and gross revenues.

Service Category	Percentage of Investment Cost* UNDER 100 GROSS REVENUES (000's)	100-250 GROSS REVENUES (000's)	250-500 GRDSS REVENUES (000's)	500-1,000 GROSS REVENUES (000's)	1,000 OR MORE GROSS REVENUES (000's)	GROSS INVESTMENT $	GROSS INVESTMENT %
TOTAL							
RADIO PAGING	38.6	23.4	61.5	38.6	59.1	27311330	53.9
MOBILE RADIO	38.9	37.9	18.7	17.5	15.1	8532430	16.8
MOBILE TELEPHONE	2.3	11.0	0.5	7.7	0.3	989750	1.9
RADIO EQPT SALES	10.0	22.8	4.0	14.7	7.4	4564100	9.0
MAINT & INST	8.6	4.6	13.8	15.9	5.8	4412500	8.7
DTHERS	1.3	0.0	1.1	5.7	12.3	4795063	9.4
TOTAL	100%	100%	100%	100%	100%	50605174	100%
NUMBER OF RESPON-DENTS PER GROSS REVENUE CATEGORY	12	9	17	23	17		
BC							
RADIO PAGING	80.4		96.9	25.7	65.3	5975100	66.0
MOBILE RADIO	1.8	19.0	1.7	9.6	11.3	899600	9.9
MOBILE TELEPHONE		18.1	0.9	11.9		97600	1.0
RADIO EQPT SALES	9.1	33.6	0.2	20.7	17.4	1409000	15.5
MAINT & INST	3.6	28.6	0.1	18.4	3.3	382950	4.2
OTHERS	4.9	0.4		13.4	2.5	276750	3.0
TOTAL	100%	100%	100%	100%	100%	9041000	100%
NUMBER OF RESPON-DENTS PER GROSS REVENUE CATEGORY	3	2	3	2	3		

Service Category	Percentage of Investment Cost*						
	UNDER 100 GROSS REVENUES (000's)	100-250 GROSS REVENUES (000's)	250-500 GROSS REVENUES (000's)	500-1,000 GROSS REVENUES (000's)	1,000 OR MORE GROSS REVENUES (000's)	GROSS INVESTMENT $	GROSS INVESTMENT %
ALBERTA							
RADIO PAGING			80.8	51.3	1.4	1985400	43.1
MOBILE RADIO			16.5	24.3	24.1	984550	21.4
MOBILE TELEPHONE			0.4	5.4		108000	2.3
RADIO EQPT SALES			2.7	9.1	59.3	851100	18.5
MAINT & INST			16.4	7.0	15.0	566950	12.3
OTHERS			2.9	2.7		100000	2.1
TOTAL			100%	100%	100%	4596000	100%
NUMBER OF RESPONDENTS PER GROSS REVENUE CATEGORY			6	3	2		
MANITOBA							
RADIO PAGING	20.0		95.0		40.0	652500	58.0
MOBILE RADIO	20.0	25.0	5.0		20.0	160000	14.2
MOBILE TELEPHONE		5.0			5.0	27500	2.4
RADIO EQPT SALES	40.0	50.0			10.0	125000	11.1
MAINT & INST	20.0	20.0			25.0	160000	14.2
OTHERS							
TOTAL	100%	100%	100%		100%	1125000	100%
NUMBER OF RESPONDENTS PER GROSS REVENUE CATEGORY	1	1	1		1		

Service Category	Percentage of Investment Cost*					GROSS INVESTMENT	
	UNDER 100 GROSS REVENUES (000's)	100-250 GROSS REVENUES (000's)	250-500 GROSS REVENUES (000's)	500-1,000 GROSS REVENUES (000's)	1,000 OR MORE GROSS REVENUES (000's)	$	%
ONTARIO							
RADIO PAGING	33.0	12.5		50.8	66.7	15048130	59.7
MOBILE RADIO	52.3	37.9	24.2	14.6	8.4	2971250	11.8
MOBILE TELEPHONE	4.0	16.8		2.3	0.1	238650	0.9
RADIO EQPT SALES	1.2	30.3	3.9	14.9	0.8	1236800	4.9
MAINT & INST	9.3	2.1	71.8	12.4	5.4	2087600	8.2
OTHERS				5.5	18.4	3594743	14.2
TOTAL	100%	100%	100%	100%	100%	25177174	100%
NUMBER OF RESPONDENTS PER GROSS REVENUE CATEGORY	5	4	2	15	8		
QUEBEC							
RADIO PAGING	50.0	50.9	39.4	0.4	43.7	3610200	34.0
MOBILE RADIO		43.0	43.2	21.9	34.3	3487030	32.9
MOBILE TELEPHONE	40.0		0.7	22.4		518000	4.8
RADIO EQPT SALES		3.0	12.0	16.9	5.7	942200	8.8
MAINT & INST		3.0	3.8	31.4	6.5	1215000	11.4
OTHERS	10.0		0.5	6.6	9.5	823570	7.7
TOTAL	100%	100%	100%	100%	100%	10596000	100%
NUMBER OF RESPONDENTS PER GROSS REVENUE CATEGORY	1	2	5	3	3		

Service Cetegory	Percentage of Investment Cost* UNDER 100 GROSS REVENUES (000's)	100-250 GROSS REVENUES (000's)	250-500 GROSS REVENUES (000's)	500-1,000 GROSS REVENUES (000's)	1,000 OR MORE GROSS REVENUES (000's)	GROSS INVESTMENT $	%
ATLANTIC PR.							
RADIO PAGING	57.1					40000	57.1
MOBILE RADIO	42.8					30000	42.8
MOBILE TELEPHONE							
RADIO EQPT SALES							
MAINT & INST							
OTHERS							
TOTAL	100%					70000	100%
NUMBER OF RESPDN-DENTS PER GROSS REVENUE CATEGORY	2						

* To determine the percentage that each service category contributes to the total investment cost, responses were averaged for all respondents in each gross revenue category.

9A) Competing with regulated common carriers.

Reply	Of All Respondents
YES	61.5%
NO	38.4%
NOT STATED	%
TOTAL	100 %

9B) If RCC should be regulated.

Reply	Of All Respondents
YES	16.6%
NO	69.2%
NOT STATED	14.1%
TOTAL	100 %

10) Industry service standards established and maintained by:

	Of All Respondents
AN INTERNAL RCC INDUSTRY COMMITTEE	47.4%
A JOINT INDUSTRY GOV'T COMMITTEE	41.0%
NO STANDARDS AT ALL	11.5%
NOT STATED	%
TOTAL	100 %

11) Effect of creating large nationwide RCC's through aquisition or licencing.

Effect	Percentage of Respondants with Gross Revenues (000's)				
	UNDER 100	100-250	250-500	500-1,000	1,000 OR MORE
POSITIVE	58.3	11.1	41.1	29.1	52.9
ADVERSE	25.0	88.8	47.0	66.6	41.1
NOT STATED	16.6		12.0	4.3	5.8
TOTAL	100%	100%	100%	100%	100%

12) Willingness to accept RCC applicants as customers on existing channels.

Reply	Of All Respondents
YES	65.3%
NO	30.7%
NOT STATED	3.8%
TOTAL	100 %

Part B – I Radio Paging Service

Number of Reepondents providing paging service:

BC	Alta	Man	Ont	Que	Atlantic	Canada
11	8	3	21	7	1	51

A: Existing

1) Year service began — Of All Respondents

	BC	Alta	Man	Ont	Que	Atlantic	Canada
BEFORE 1970	27.2		33.3	19.0			15.6%
1970–1974	18.1		33.3	19.0	28.5		17.6%
1975–1979	36.3	50.0		42.8	42.8		39.2%
1980–PRESENT	18.1	50.0	33.3	19.0	28.5	100.0	27.4%
NOT STATED							%
	100%	100%	100%	100%	100%	100%	100%

2) Number of unite — Of All Respondents

	BC	Alta	Man	Ont	Que	Atlantic	Canada
UNDER 200	36.3	50.0	33.3	19.0	14.2	100.0	29.4%
200–499	18.1			19.0	42.8		17.6%
500–1500	18.1	25.0	66.6	33.3	28.5		29.4%
OVER 1500	27.2	12.5		23.8	14.2		19.6%
NOT STATED		12.5		4.7			3.9%
	100%	100%	100%	100%	100%	100%	100%

Total number of units: 18,006 6,140 2,150 53,720 18,814 110 98,940

3) Total number of customer owned units:	BC	Alta	Man	Ont	Que	Atl	Canada
	502	517	55	6,237	1,757	96	9,164
Percentage customer owned units/total units:	2.7	8.4	2.5	11.6	9.3	87.2	13.2
Number of respondents serving over 50% customer owned units:	5	4	1	5	2	1	18

4) Total number of – display units: 2,573
– tone units: 27,901
– tone & voice units: 68,466

Percentage of display units/total units: 3.7

Percentage of tone & voice units/tone units: 245.0

Percentage of respondants providing 50% or more tone units: 0.0

Percentage of respondents providing 80% or more tone & voice units: 7.8

Percentage surveyed with no response: 3.9

5) Number of radio paging channels — Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
1-2	81.8	87.5	66.6	57.1	42.8	100.0	66.6%
3-4	9.0	12.5	33.3	33.3	28.5		23.5%
5-6				4.7			1.9%
7-10	9.0				14.2		3.9%
OVER 10				4.7	14.2		3.9%
NOT STATED							
	100.0	100.0	100.0	100.0	100.0	100.0	100.0%
Total number of radio paging channels:	21	13	7	61	27	1	130

6) Percentage of hub transmitters in Urban vs Rural Location.

Location — Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
URBAN	42.8	18.1	33.3	29.0	18.1	100.0	29.0%
RURAL	57.1	81.8	66.6	71.0	81.8		70.9%
	100.0	100.0	100.0	100.0	100.0	100.0	100.0%
Total number of hub transmitters:	28	22	6	100	22	1	179
Percentage surveyed with no response:				4.7	14.2		3.9

B: Looking to the Future

7) Over the next five years:

a) Percentage increase in coverage expansion — Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
UNDER 20	9.0			0.0	14.2		3.9%
20-49	27.2	12.5	66.6	33.3	28.5		29.4%
50-99	9.0	12.5		23.8	42.8		19.6%
100 OR MORE	27.2	50.0	33.3	23.8			25.4%
NOT STATED	27.2	25.0		19.0	14.2	100.0	21.5%
	100.0	100.0	100.0	100.0	100.0	100.0	100.0%
b) Percentage of rural/total market areas to be opened:	62.0	80.0	40.0	40.2	43.2		49.6
Percentage surveyed with no response:	27.2			23.8	42.8		21.5

c) URBAN

	BC	Alta	Man	Ont	Que	Atl	Canada
Current percentage of radio channels	57.1	38.4	57.1	72.1	66.6	100.0	64.6%
Future percentage of radio channels	55.2	38.4	50.0	70.1	63.4	100.0	62.1%
Percentage surveyed with no response:							

RURAL

	BC	Alta	Man	Ont	Que	Atl	Canada
Current percentage of radio channels	42.8	61.5	42.8	27.8	33.3		35.3%
Future percentage of radio channels	44.7	61.5	50.0	29.8	36.5		37.8%
Percentage surveyed with no response:							

Future number of radio paging channels Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
1-2	45.4	25.0		42.8	28.5	100.0	37.2%
3-4	36.3	75.0	100.0	23.8	28.5		39.2%
5-6	9.0			19.0	14.2		11.7%
7-10	9.0			4.7			3.9%
OVER 10				9.5	28.5		7.8%
NOT STATED							
	100.0	100.0	100.0	100.0	100.0	100.0	100.0%

Total future number of radio paging channels:	38	26	10	104	93	1	272

8) At the end of the next five years:

a) Number of pagers to be served — Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
UNDER 200	18.1	25.0		9.5	14.2	100.0	15.6%
200-499	27.2	12.5	33.3	23.8	42.8		25.4%
500-1500	27.2	12.5		28.5	14.2		19.6%
OVER 1500	27.2	37.5	66.6	33.5	28.5		35.3%
NOT STATED		12.5		4.7			3.9%
	100.0	100.0	100.0	100.0	100.0	100.0	100.0%
Percentage growth in total pagers served:	130.3	384.9	104.7	87.6	21.5		101.4
Total number of pagers:	41465	29777	4400	100778	22866	110	199286
b) Percentage of tone units/ total units:	38.7	40.4	10.0	51.7	21.4		42.0
Number of respondents with 50% or more tone only units:	2	1	0	8	1	0	12
Percentage surveyed with no response:	27.2	50.0		19.0	28.5		27.4

c) Percentage increase of annual gross revenues for paging service.

Percentage Increase — Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
UNDER 25	27.2			9.5	14.2	100.0	11.7%
25-49	9.0			9.5	71.4		15.6%
50-74	9.0		33.3	9.5			7.8%
75-99							
100 OR MORE	36.3	87.5	66.6	57.1			49.0%
NOT STATED	18.1	12.5		14.2	14.2		15.6%
	100.0	100.0	100.0	100.0	100.0	100.0	100.0%

9) Possibility of becoming a franchise or co-op.

REPLY	Percentage of Respondents with Gross Revenues ('000's) UNDER 100	100-250	250-500	500-1,000	1,000 OR MORE
YES	62.5	66.6	81.8	87.5	92.3
NO	37.5	33.3	18.1	12.5	7.6
NOT STATED					
TOTAL	100%	100%	100%	100%	100%

10) Plans to provide enhanced service features.

Service Feature	Of All Respondents YES	NO	NOT STATED	TOTAL
Voice Message Retrieval	66.6%	25.4%	7.8%	100%
Display Paging Service	82.3%	13.7%	3.9%	100%

11a) If system uses digital paging.

Reply	Of All Respondents
YES	25.4%
NO	72.6%
NOT STATED	2.9%
TOTAL	100%

b) Possibly modified to add digital.

Number of respondents: 37

Reply	Of All Respondents
YES	54.0%
NO	35.1%
NOT STATED	10.8%
TOTAL	100%

c) POCSAG digital code

Number of respondents: 51

Reply	Of All Respondents
YES	33.3%
NO	11.7%
NOT STATED	52.9%
TOTAL	100%

12a) If interconnected systems provide direct dial access.

Reply	Of All Respondents
YES	84.3%
NO	15.6%
NOT STATED	%
TOTAL	100%

b) If dial access arrangements are reasonable.

Number of respondents: 43

Reply	Of All Respondents
YES	39.5%
NO	53.4%
NOT STATED	6.9%
TOTAL	100%

c) Intention to provide dial access.

Number of respondents: 8

Reply	Of All Respondents
YES	50.0%
NO	50.0%
NOT STATED	%
TOTAL	100%

Year in which dial access will be provided.

Number of respondents: 4

Year	Of All Respondents
1983-1985	%
BEYOND 1985	100%
NOT STATED	%
TOTAL	100%

Part B – II Mobile Radio Service

Number of respondents providing mobile radio service:

BC	Alta	Man	Ont	Que	Atlantic	Canada
8	8	4	28	12	1	61

A: Existing

1) Year service began — Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
BEFORE 1970	25.0		25.0	39.2	33.3		29.5%
1970–1974	25.0	25.0		21.4	16.6		19.6%
1975–1979	37.5	62.5	25.0	10.7	41.6		27.8%
1980–PRESENT	12.5	12.5	50.0	28.5	8.3	100.0	22.9%
NOT STATED							%
	100%	100%	100%	100%	100%	100%	100%

2) Number of radio channels — Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
1–2	37.5	12.5	75.0	32.1	25.0	100.0	32.7%
3–5	25.0	25.0		32.1	33.3		27.8%
6–10	25.0	25.0	25.0	7.1	8.3		13.1%
OVER 10	12.5	37.5		17.8	33.3		21.3%
NOT STATED				10.7			4.9%
	100%	100%	100%	100%	100%	100%	100%

Total number of radio channels:

BC	Alta	Man	Ont	Que	Atl	Canada
51	98	15	202	108	1	475

3) Percentage of urban and rural repeaters

Location — Percentage

	BC	Alta	Man	Ont	Que	Atl	Canada
URBAN	36.3	6.5	28.5	29.0	23.8	100.0	24.4%
RURAL	63.6	93.4	71.4	70.9	76.1	0	75.5%
NOT STATED							%
	100%	100%	100%	100%	100%	100%	100%

Total number of repeaters:

BC	Alta	Man	Ont	Que	Atl	Canada
22	46	7	110	63	1	249

4) Number of mobiles — Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
UNDER 25	12.5	12.5	50.0	10.7	8.3		13.1%
25-49			25.0	10.7			6.5%
50-99	50.0	25.0		14.2	8.3		18.0%
100-250	12.5	25.0	25.0	28.5	25.0		24.5%
OVER 250	12.5	37.5		25.0	58.3		29.5%
NOT STATED	12.5			10.7		100.0	8.1%
	100%	100%	100%	100%	100%	100%	100%

Total number of mobiles:

BC	Alta	Man	Ont	Que	Atl	Canada
1922	2610	234	8000	4795	---	17,561

Percentage surveyed with 50 or more mobiles/channel:

BC	Alta	Man	Ont	Que	Atl	Canada
12.5			25.0	58.3	---	24.5

	BC	Alta	Man	Ont	Que	Atl	Canada
5) Total number of customer owned mobiles:	837	1429	191	5459	1650	---	9566
Percentage of customer owned/ total mobiles:	43.5	54.7	81.6	68.2	34.4	---	54.4
Percentage surveyed servicing more than 50% customer owned mobiles:	37.5	50.0	100.0	64.2	25.0	---	52.4
Percentage surveyed with no response:	12.5			10.7	8.3	100.0	9.8

6) Conventional single channel systems.

Reply	Of All Respondents
YES - single channel only	70.5%
YES - single channel plus others	1.6%
NO	22.9%
NOT STATED	4.9%
TOTAL	100%

B: Looking to the Future

7) Over the next five years:

	BC	Alta	Man	Ont	Que	Atl	Canada
a) Existing number of service areas:	17	39	7	91	51	1	206
Number of service areas to be added:	9	25	2	44	44	8	132
Percentage increase in service areas:	52.9	64.1	28.5	48.3	86.2	800.0	64.0
Percentage surveyed with no response:	7.7		50.0	11.7	7.1		10.3

b) New radio chennels to be added — Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
< 2	12.5	12.5	75.0	21.4			18.0%
3-5	25.0	12.5		25.0	33.3		22.9%
6-10	12.5	62.5		28.5	33.3		29.5%
OVER 10	12.5	12.5		7.1	25.0		11.4%
NOT STATED	37.5	____	25.0	17.8	8.3	100.0	18.0%
	100%	100%	100%	100%	100%	100%	100%
Total number of new redio chennels:	36	76	4	150	180	---	446

c) New channels for trunked systems — Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
1-2	62.5	37.5	75.0	42.8	33.3		44.2%
3-5				7.1	16.6		6.5%
6-10	25.0	37.5	25.0	25.0	16.6		24.5%
OVER 10		25.0		21.4	25.0		19.6%
NOT STATED	12.5	____	____	3.5	8.3	100.0	18.0%
	100%	100%	100%	100%	100%	100%	100%

	BC	Alta	Man	Ont	Que	Atl	Canada
Total number of new redio chennels for trunked systems:	28	29	4	101	57	-	219
Percentage of new redio channels for trunked systems:	77.7	38.1	100.0	67.3	31.6	-	49.1

d) Existing percentage of rural/total channels:	41.1	61.2	33.3	41.0	58.3	-	48.8
Percentage rural/total channels in 5 years:	40.2	70.1	47.3	49.7	33.6	-	48.0
Percentage surveyed with no response:	7.7		25.0	8.8	14.3	100.0	8.9

8) At the end of the next five years:

a) Number of Mobiles — Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
UNDER 25							
25-49	12.5						1.6%
50-99		12.5					1.6%
100-250	25.0	12.5	25.0	14.2	25.0		18.0%
OVER 250	25.0	75.0		60.7	75.0		57.3%
NOT STATED	37.5		75.0	25.0		100.0	21.3%
	100%	100%	100%	100%	100%	100%	100%
Total number of mobiles:	4,955	5,650	250	17,080	13,400	-	41,635
Percentage growth in mobiles:	157.8	116.4	6.8	113.5	179.4	-	137.1

b) Percentage of trunked mobiles — Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
UNDER 30%	75.0	75.0	100.0	60.7	50.0	-	63.9%
30% OR MORE	25.0	25.0		39.2	50.0	-	36.0%
NOT STATED							%
	100%	100%	100%	100%	100%	100%	100%

c) Annual gross revenues at the end of five years from mobile radio services

Gross Revenues (000's) — Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
UNDER 100	50.0	62.5	50.0	64.2	41.7	100.0	50.9%
100-250		37.5		17.8	25.0		18.0%
250-500					16.6		3.2%
500-1,000					8.3		8.4%
1,000 OR MORE	12.5			3.5			3.2%
NOT STATED	37.5		50.0	14.2	8.3		16.3%
	100%	100%	100%	100%	100%	100%	100%

Percentage growth in gross revenues for all respondents:

BC	Alta	Man	Ont	Que	Atl	Canada
204.3	81.8	15.6	113.1	77.3	100.0	103.8

9a) Future offering of limited interconnect.

Reply	Of All Respondents
YES	88.5%
NO	4.9%
NOT STATED	6.5%
TOTAL	100%

b) Future offering of limited interconnect on a trunked system.

Number of Respondents: 54

Reply	Of All Respondents
YES	68.5%
NO	22.2%
NOT STATED	9.2%
TOTAL	100%

c) Preference for interconnect capability.
Number of Respondents: 54

Interconnect Capability	Of All Respondents
MANUAL PATCHING	3.7%
AUTOMATIC DIAL ACCESS	94.4%
NOT STATED	1.8%
TOTAL	100%

10a) Significant increase in portable use.

Reply	Of All Respondents
YES	65.5%
NO	31.1%
NOT STATED	3.2%
TOTAL	100%

b) Number of respondents: 40

Current system - percentage of Mobiles: 90.7
Portables: 9.2

c) Number of Respondents: 40

Future system - percentage of Mobiles: 71.7
Portables: 27.7

Part B – III Mobile Telephone Service

Number of respondents providing mobile telephone service: 10

A: Existing

1) Total number of MRS channels carrying radio-telephone traffic: 48

Percentage of MRS chennels carrying radio-telephone traffic: 10.1

Percentage surveyed with no response: 0.0

2) Total number of mobile telephone units: 425

Percentage of Mobile radio units that are mobile telephone units: 2.4

Percentage surveyed with no response: 0.0

3) Total number of customer owned units: 298

Percentage of customer owned/total units: 70.1

Percentage surveyed with no response: 0.0

4) Number of mobile telephone calls per month/channel: 244

Number of mobile telephone calls per month/unit: 27

Number surveyed with more than 100 calls per month/channel: 10

Percentage surveyed with no response: 30.0

5) Interconnect agreement — Of All Respondents

EXPERIMENTAL	40.0%
PERMANENT	30.0%
NOT STATED	30.0%
TOTAL	100%

B: Looking to the Future

6a) Number surveyed intending to get involved in cellular:

BC	Alta	Man	Ont	Que	Atl	Canada
5	6	3	20	9	1	44

b) Percentage of MRS Users that could be attracted to cellular — Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
LESS THAN 5%	40.0	16.6	66.6	60.0	55.5		50.0%
10%	20.0	50.0	33.3	15.0	22.2		22.7%
15%					11.1		2.2%
OVER 15%	40.0	16.6		25.0	11.1	100.0	22.7%
NOT STATED		16.6					2.2%
	100%	100%	100%	100%	100%	100%	100%

	BC	Alta	Man	Ont	Que	Atl	Canada
c) Estimated number of Cellular units in 1990:	113000	3200	1000	6520	252456	15000	391176
Percentage surveyed with no response:	60.0	66.6	33.3	45.0			38.6
Ratio of Portables/Mobiles in 1990:	1.8	0.3	0.6	0.4	0.9	4.0	1.2
Percentage surveyed with no response:	40.0	66.6	33.3	30.0	11.1		31.8
Number surveyed who feel 10% or more will be portable:				1	1		2
Number surveyed who feel 50% or more will be portable:	2			4		1	7

d) Factors impecting e cellular offering:

Factor	Of All Respondents with Ranking 1 (most adverse)	5 (least adverse)
TELCO FACILITY AGREEMENTS	50.0%	2.2%
TELCO INTERCONNECT RATES	20.4%	4.5%
TELCO CELLULAR PRICING	11.3%	11.3%
RCC IMPLEMENTATION DELAYS	9.0%	15.9%
TELCO NATIONWIDE PROMOTION	6.8%	43.1%

e) Dependence of cellular success on MSAT

Reply	Of All Respondents
YES	54.5%
NO	43.1%
NOT STATED	2.4%
TOTAL	100%

f) MSAT/cellular scenarios

	Of All Respondents
SINGLE STANDARD	56.8%
DUAL STANDARD MOBILE TERMINAL	22.7%
NOT STATED	20.4%
TOTAL	100%

Conventional Mobile Telephone

7e) Number surveyed planning to implement mobile telephone service:

BC	Alta	Man	Ont	Que	Atl	Canada
3	8	2	17	8	1	39

b) Number of service erees — Of All Respondents

	BC	Alte	Man	Ont	Que	Atl	Canada
1-2		50.0	100.0	64.7	50.0		53.8%
3-5	100.0	37.5		35.2	25.0		35.8%
OVER 5					25.0	100.0	7.6%
NOT STATED		12.5					2.5%
	100%	100%	100%	100%	100%	100%	100%
Total number of service erees:	11	17	2	36	37	8	111

c) Number of radio channels — Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
1-2		12.5	50.0	11.7	12.5		12.8%
3-5	33.3	25.0	50.0	47.0	37.5		38.4%
6-10		37.5		41.1	25.0	100.0	33.3%
OVER 10	33.3	12.5			25.0		10.2%
NOT STATED	33.3	12.5					5.1%
	100%	100%	100%	100%	100%	100%	100%
Total number of radio channels:	20	59	6	98	100	10	293
d) Percentage surveyed with no response:	33.3	12.5		11.7	12.5		12.8
Percentage of conventional mobile telephone units/total mobile radio:	34.3	22.1	140.0	34.1	208.6	---	90.2
Total number of conventional mobile telephone units:	1700	1250	350	5825	27958	500	37583

e) Direct dial in both directions

Reply — Of All Respondents

YES	84.6%
NO	12.8%
NOT STATED	2.5%
TOTAL	100%

f) Type of system — Of All Respondents

	YES	NO	NOT STATED	TOTAL
SINGLE CHANNEL	43.5%	20.5%	35.8%	100%
TRUNKED CHANNELS	64.1%	10.2%	25.6%	100%
IMTS OR AMTS	33.3%	28.2%	38.4%	100%
DTMF	58.9%	7.6%	33.3%	100%
OTHER	5.1%	30.7%	64.1%	100%

8) Air Ground Radio Telephone Service

Interest in providing service in; — Of All Respondents

	YES	NO	NOT STATED	TOTAL
a) principal area	69.2%	30.7%		100%
b) other areas	38.4%	51.2%	10.2%	100%

Part B - IV Mobile Radio Equipment Sales

A: Existing

Number of respondents that sell radio equipment:

BC	Alta	Man	Ont	Que	Atl	Canada
7	8	3	27	12	1	58

1) Sales Cetegory

Percentage of Sales Revenues

	BC	Alta	Man	Ont	Que	Atl	Canada
MOBILES/PORTABLES	70.0	86.0	41.9	75.5	28.2	-	64.8
PAGERS	8.3	0.8	38.0	10.4	59.0	50.0	19.2
FIXED STATION EQPT & OTHERS	21.6	13.1	20.0	14.0	12.6	50.0	15.9
TOTAL	100%	100%	100%	100%	100%	100%	100%

Percentage of Total Revenue

	BC	Alta	Man	Ont	Que	Atl	Canada
MOBILES/PORTABLES	24.7	41.0	3.4	8.2	7.6		13.7
PAGERS	2.9	0.4	3.0	0.8	15.9	9.1	3.7
FIXED STATION EQPT & OTHERS	7.5	6.2	1.6	1.1	3.4	9.1	3.1
TOTAL	35.1	47.6	8.0	10.1	26.9	18.2	20.5

B: Looking to the Future

2) Future Sales Volume
Expacted five year growth in gross revenues from equipment sales

Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
SUBSTANTIALLY	28.5	25.0	100.0	62.9	66.6		55.1
MODERATELY	71.4	75.0		25.9	25.0	100.0	37.9
MINIMALLY					8.3		1.7
NOT STATED				11.1			5.3

CANADA

(3) Capabilities

Of All Respondents

	YES	NO	NOT STATED	TOTAL
TRAINED SALES EMPLOYEES	67.2%	31.0%	1.7%	100%
WILLING TO TRAIN	89.6%	3.4%	6.8%	100%

BC

Capabilities

Of All Respondents

	YES	NO	NOT STATED	TOTAL
TRAINED SALES EMPLOYEES	57.1%	42.8%		100%
WILLING TO TRAIN	85.7%	14.2%		100%

ALBERTA

Capabilities	Of All Respondents			
	YES	NO	NOT STATED	TOTAL
TRAINED SALES EMPLOYEES	75.1%	25.0%		100%
WILLING TO TRAIN	100.0%			100%

MANITOBA

Capabilities	Of All Respondents			
	YES	NO	NOT STATED	TOTAL
TRAINED SALES EMPLOYEES	33.3%	66.6%		100%
WILLING TO TRAIN	66.6%		33.3%	100%

ONTARIO

Capabilities	Of All Respondents			
	YES	NO	NOT STATED	TOTAL
TRAINED SALES EMPLOYEES	77.7%	18.5%	3.7%	100%
WILLING TO TRAIN	92.5%		7.4%	100%

QUEBEC

Capabilities	Of All Respondents			
	YES	NO	NOT STATED	TOTAL
TRAINED SALES EMPLOYEES	58.3%	41.6%		100%
WILLING TO TRAIN	91.6%	8.3%		100%

ATLANTIC PR

Capabilities	Of All Respondents			
	YES	NO	NOT STATED	TOTAL
TRAINED SALES EMPLOYEES		100.0%		100%
WILLING TO TRAIN			100.0%	100%

Part B - V Maintenance and Installation

	BC	Alta	Man	Ont	Que	Atl	Canada
Number of respondents providing maintenance and installation services:	8	9	3	27	12	0	59
1a) Percentage split of gross revenues - maintenance:	79.5	72.7	65.0	81.1	54.1		74.8
- installation:	20.4	27.2	34.9	18.8	45.8		25.1
Percentage surveyed with no response:							
Number of respondents that earn 50% or more, gross revenues from installation:	0	0	0	0	0		0
	100%	100%	100%	100%	100%	100%	100%

	BC	Alta	Man	Ont	Que	Atl	Canada
b) Percentage split of maintenance revenues - mobile radios, portables & pagers:	89.0	81.8	84.6	74.0	83.9		81.3
- fixed equipment:	10.9	18.1	15.3	25.9	16.6		18.6
	100%	100%	100%	100%	100%	100%	100%
Percentage surveyed with no response:					16.6		3.3
Number surveyed with 10% or less of fixed equipment revenues:	5	4	0	17	5		31

c) Installation and maintenance of equipment not sold by respondent

Reply — Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
YES	87.5	100.0	100.0	81.4	83.3		86.4
NO	12.5			14.8	16.6		11.8
NOT STATED				3.7			1.6
	100%	100%	100%	100%	100%	100%	100%

2) Revenue growth of maintenance and installation services compared to overall growth

Growth — Of All Respondents

	BC	Alta	Man	Ont	Que	Atl	Canada
HIGHER	62.5	66.6	33.3	59.2	83.3		64.4
LOWER	37.5	33.3	66.6	25.9	16.6		28.8
NOT STATED				14.2			6.8
	100%	100%	100%	100%	100%	100%	100%

		BC	Alta	Man	Ont	Que	Atl	Canada
3)	Number of locations with equipped shops and trained technical staff:	13	11	3	106	18		151
	Percentage of locations with equipped shops and trained technical staff/total locations:	68.4	27.5	42.8	75.7	36.0		58.9

Part B - VI Others

VI A Data Services

1a) Respondents interested in providing data message services: 52
Total respondents: 78

b) Choice of data message processor

	Of All Respondents
OWN	55.7%
SHARED	34.6%
NOT STATED	9.6%
TOTAL	100%

2) Interest in marketing receivers

Reply	Of All Respondents
YES	82.0%
NO	11.5%
NOT STATED	6.4%
TOTAL	100%

3) Threat to radio paging operations.

Reply	Of All Respondents
YES	17.9%
NO	69.2%
NOT STATED	12.8%
TOTAL	100%

VI B Mobile Data

4a) Customer need for mobile data terminals.

Reply	Of All Respondents
YES	52.5%
NO	33.3%
NOT STATED	14.1%
TOTAL	100%

b) Future markets available for mobile data channels.

Reply	Of All Respondents
YES	60.2%
NO	23.0%
NOT STATED	16.6%
TOTAL	100%

VI C Radio Links

5a) Control of radio channels — Of All Respondents

WIRELINE	8.9%
UHF RADIO	73.0%
NOT STATED	17.2%
TOTAL	100%

b) Alternetive to UHF Links — Of All Respondents

	YES	NO	NOT STATED	TOTAL
960 MHz MICROWAVE	53.8	12.8	33.3	100%
LOW BAND UHF	26.9	23.0	50.0	100%
OTHERS	14.1	15.3	70.6	100%

c) Prepared to use newer 5 KHz bendwidth technologies.

Reply — Of All Respondents

YES	48.7%
NO	20.5%
NOT STATED	30.7%
TOTAL	100%

VI D Personal Radio Communications — Of All Respondents

	YES	NO	NOT STATED	TOTAL
Interest in:				
6) Providing repeater systems and services	83.3	14.1	2.5	100%
7) Selling PRCS mobile radios	82.0	15.3	2.5	100%
8) Installing and maintaining PRCS mobile radios	82.0	15.3	2.5	100%

Part C - MSAT - Related Questions **CANADA - 78**

	Of All Respondents			
	YES	NO	NOT STATED	TOTAL
1) Agreement to in-depth personal interview	82.0%	14.1%	3.8%	100%
2) Willingness to provide necessary details	85.8%	8.9%	5.1%	100%
3) Participation in service trials	82.0%	12.8%	5.1%	100%

4) MSAT Business Opportunities	Of All Respondents				
	HIGH	MEDIUM	LOW INTEREST	NOT STATED	TOTAL
MOBILE RADIO SERVICE					
Despatch service to intercity trucking operations.	48.7	25.6	12.8	12.8	100%
Emergency communications sytems for forest fire control, disaster relief.	35.8	29.4	20.5	14.1	100%
Emergency communications in wilderness areas.	30.7	24.3	30.7	14.1	100%
Wide area distress communications with vehicles, boats and aircraft.	37.1	23.0	25.6	14.1	100%
MOBILE TELEPHONE SERVICE					
Public telephone service on public transport vehicles such as intercity buses, trains, ferries and aircraft.	39.7	24.3	21.7	14.1	100%
Remote and rural telephone service.	42.3	33.3	12.8	11.5	100%
Extension of the mobile cellular service.	38.4	24.3	21.7	15.6	100%
MOBILE PAGING SERVICE					
True wide area paging.	52.7	16.6	19.2	11.5	100%
MOBILE DATA SERVICE					
Wide area voice and data communications for ambulance patient care.	41.0	25.6	20.5	12.8	100%
Remote monitoring of cargo being transported by rail or road.	16.6	37.1	32.0	12.8	100%
Monitor, alarm and control facilities for remote equipment, pipelines, waterpumps, etc.	53.8	24.3	11.5	10.2	100%
Data acquisition and control.	30.7	44.8	14.1	10.2	100%

Part C – MSAT – Related Questions **BC – 13**

	Of All Respondents YES	NO	NOT STATED	TOTAL
1) Agreement to in-depth personal interview	76.9%	23.0%		100%
2) Willingness to provide necessery details	84.6%	15.3%		100%
3) Participation in service trials	84.6%	15.3%		100%

4) MSAT Business Opportunities

	Of All Respondents HIGH	MEDIUM	LOW INTEREST	NOT STATED	TOTAL
MOBILE RADIO SERVICE					
Despatch service to intercity trucking operations.	46.1	15.3	23.0	15.3	100%
Emergency communications sytems for forest fire control, disaster relief.	38.4	38.4	7.6	15.3	100%
Emergency communications in wilderness areas.	30.7	7.6	46.1	15.3	100%
Wide area distress communications with vehicles, boats and aircraft.	46.1	7.6	30.7	15.3	100%
MOBILE TELEPHONE SERVICE					
Public telephone service on public transport vehicles such as intercity buses, trains, ferries and aircraft.	46.1	23.0	15.3	15.3	100%
Remote and rural telephone service.	53.8	15.3	15.3	15.3	100%
Extension of the mobile celluler service.	30.7	23.0	38.4	7.9	100%
MOBILE PAGING SERVICE					
True wide area peging.	54.1	15.3	23.0	7.6	100%
MOBILE DATA SERVICE					
Wide aree voice and dete communicetions for embulence petient cere.	53.8	15.3	23.0	7.6	100%
Remote monitoring of cergo being transported by reil or road.	30.7	30.7	30.7	7.6	100%
Monitor, elerm and control facilities for remote equipment, pipelines, waterpumps, etc.	53.8	23.0	15.3	7.6	100%
Date acquisition and control.	53.8	7.6	30.7	7.6	100%

Part C - MSAT - Related Questions **ALBERTA - 11**

	Of All Respondents YES	NO	NOT STATED	TOTAL
1) Agreement to in-depth personal interview	90.9%	9.0%		100%
2) Willingness to provide necessary details	100.0%			100%
3) Participation in service trials	100.0%			100%

4) MSAT Business Opportunities	Of All Respondents HIGH	MEDIUM	LOW INTEREST	NOT STATED	TOTAL
MOBILE RADIO SERVICE					
Despatch service to intercity trucking operations.	27.2	36.3	36.3		100%
Emergency communications sytems for forest fire control, disaster relief.	45.4	36.3	18.1		100%
Emergency communications in wilderness areas.	36.3	63.6			100%
Wide area distress communications with vehicles, boats and aircraft.	36.3	18.1	45.4		100%
MOBILE TELEPHONE SERVICE					
Public telephone service on public transport vehicles such as intercity buses, trains, ferries and aircraft.	18.1	18.1	63.6		100%
Remote and rural telephone service.	54.5	27.2	18.1		100%
Extension of the mobile cellular service.	36.3	27.2	36.3		100%
MOBILE PAGING SERVICE					
True wide area paging.	54.7	18.1	27.2		100%
MOBILE DATA SERVICE					
Wide area voice and data communications for ambulance patient care.	27.2	36.3	36.3		100%
Remote monitoring of cargo being transported by rail or road.	9.0	54.5	36.3		100%
Monitor, alarm and control facilities for remote equipment, pipelines, waterpumps, etc.	81.8	18.1			100%
Data acquisition and control.	27.2	63.6	9.0		100%

Part C - MSAT - Related Questions **MANITOBA - 4**

	Of All Respondents YES	NO	NOT STATED	TOTAL
1) Agreement to in-depth personal interview	100.0%			100%
2) Willingness to provide necessary details	100.0%			100%
3) Participation in service trials	75.0%	25.0%		100%

4) MSAT Business Opportunities	Of All Respondents HIGH	MEDIUM	LOW	NOT STATED	TOTAL
	INTEREST				
MOBILE RADIO SERVICE					
Despatch service to intercity trucking operations.	75.0	25.0			100%
Emergency communications sytems for forest fire control, disaster relief.	50.0		50.0		100%
Emergency communications in wilderness areas.	50.0		50.0		100%
Wide area distress communications with vehicles, boats and aircraft.	50.0		50.0		100%
MOBILE TELEPHONE SERVICE					
Public telephone service on public transport vehicles such as intercity buses, trains, ferries and aircraft.	50.0	25.0	25.0		100%
Remote and rural telephone service.	25.0	25.0	50.0		100%
Extension of the mobile cellular service.	25.0		50.0	25.0	100%
MOBILE PAGING SERVICE					
True wide area paging.	50.0	25.0	25.0		100%
MOBILE DATA SERVICE					
Wide area voice and data communications for ambulance patient care.	50.0	25.0	25.0		100%
Remote monitoring of cargo being transported by rail or road.		25.0	50.0	25.0	100%
Monitor, alarm and control facilities for remote equipment, pipelines, waterpumps, etc.	100.0				100%
Data acquisition and control.	50.0	25.0	25.0		100%

Part C – MSAT – Related Questions **ONTARIO – 34**

	Of All Respondents			
	YES	NO	NOT STATED	TOTAL
1) Agreement to in-depth personal interview	76.4%	17.6%	5.8%	100%
2) Willingness to provide necessary details	82.3%	11.7%	5.8%	100%
3) Participation in service trials	73.5%	17.6%	8.8%	100%

4) MSAT Business Opportunities	Of All Respondents				
	HIGH	MEDIUM	LOW	NOT STATED	TOTAL
MOBILE RADIO SERVICE			INTEREST		
Despatch service to intercity trucking operations.	50.0	23.5	8.8	17.6	100%
Emergency communications sytems for forest fire control, disaster relief.	23.5	26.4	26.4	23.5	100%
Emergency communications in wilderness arees.	14.7	26.4	38.2	20.5	100%
Wide area distress communicetions with vehicles, boats and aircraft.	26.4	35.2	14.7	23.5	100%
MOBILE TELEPHONE SERVICE					
Public telephone service on public transport vehicles such as intercity buses, trains, ferries and aircraft.	41.1	20.5	17.6	20.5	100%
Remote and rural telephone service.	32.3	41.1	8.8	17.6	100%
Extension of the mobile cellular service.	44.1	26.4	5.8	23.7	100%
MOBILE PAGING SERVICE					
True wide area paging.	56.1	11.7	11.7	20.5	100%
MOBILE DATA SERVICE					
Wide area voice and data communications for ambulance patient care.	38.2	20.5	14.7	26.4	100%
Remote monitoring of cargo being transported by rail or road.	14.7	32.3	29.4	23.5	100%
Monitor, alarm and control facilities for remote equipment, pipelines, waterpumps, etc.	47.0	20.5	11.7	20.5	100%
Data acquisition and control.	23.5	50.0	8.8	17.6	100%

Part C – MSAT – Related Questions **QUEBEC – 14**

	Of All Respondents			
	YES	NO	NOT STATED	TOTAL
1) Agreement to in-depth personal interview	92.8%		7.1%	100%
2) Willingness to provide necessary details	85.7%		14.2%	100%
3) Participation in service trials	92.8%		7.1%	100%

4) MSAT Business Opportunities	Of All Respondents				
	HIGH	MEDIUM	LOW	NOT STATED	TOTAL
MOBILE RADIO SERVICE			INTEREST		
Despatch service to intercity trucking operations.	57.1	35.7		7.1	100%
Emergency communications sytems for forest fire control, disaster relief.	50.0	35.7	7.1	7.1	100%
Emergency communications in wilderness areas.	64.2	14.2	14.2	7.1	100%
Wide area distress communications with vehicles, boats and aircraft.	50.0	21.4	21.4	7.1	100%
MOBILE TELEPHONE SERVICE					
Public telephone service on public transport vehicles such as intercity buses, trains, ferries and aircraft.	50.0	35.7	7.1	7.1	100%
Remote and rural telephone service.	42.8	42.8	7.1	7.1	100%
Extension of the mobile cellular service.	35.7	28.5	28.5	7.3	100%
MOBILE PAGING SERVICE					
True wide area paging.	35.9	28.5	28.5	7.1	100%
MOBILE DATA SERVICE					
Wide area voice and data communications for ambulance patient care.	42.8	35.7	21.4		100%
Remote monitoring of cargo being transported by rail or road.	14.2	50.0	35.7		100%
Monitor, alarm and control facilities for remote equipment, pipelines, waterpumps, etc.	28.5	50.0	21.4		100%
Data acquisition and control.	21.4	64.2	14.2		100%

Part C - MSAT - Related Questions **ATLANTIC - 2**

	Of All Respondents			
	YES	NO	NOT STATED	TOTAL
1) Agreement to in-depth personel interview	50.0%	50.0%		100%
2) Willingness to provide necessary details	50.0%	50.0%		100%
3) Participation in service trials	50.0%	50.0%		100%

4) MSAT Business Opportunities	Of All Respondents				
	HIGH	MEDIUM	LOW	NOT STATED	TOTAL
MOBILE RADIO SERVICE			INTEREST		
Despatch service to intercity trucking operations.	50.0			50.0	100%
Emergency communications sytems for forest fire control, disaster relief.	50.0		50.0		100%
Emergency communications in wilderness areas.			50.0	50.0	100%
Wide area distress communications with vehicles, boats and aircraft.	50.0		50.0		100%
MOBILE TELEPHONE SERVICE					
Public telephone service on public transport vehicles such as intercity buses, trains, ferries and aircraft.		50.0		50.0	100%
Remote and rural telephone service.	100.0				100%
Extension of the mobile cellular service.	50.0			50.0	100%
MOBILE PAGING SERVICE					
True wide area peging.	100.0				100%
MOBILE DATA SERVICE					
Wide area voice and data communications for embulance patient care.	50.0			50.0	100%
Remote monitoring of cargo being transported by rail or road.	50.0			50.0	100%
Monitor, alerm and control facilities for remote equipment, pipelines, waterpumps, etc.	100.0				100%
Data acquisition and control.	50.0			50.0	100%

SECTION 12.0

MSAT/RCC REVISED STUDY PLAN AND METHODOLOGY FOR IMPACT ANALYSIS

TABLE OF CONTENTS

1. Introduction This report describes how TASK 6 (Impact Analysis) of the Statement of Work (SOW) was carried out.

Data collected in our baseline study, TASK 3, which resulted in 80 replies from the 200 RCCs surveyed, was used in conjunction with our in-depth study of 30 RCCs (TASK 5) in early February 84 to provide the required input values for the impact analysis model.

The objective of the impact analysis was to assess the economic and financial effects of MSAT on the RCC industry in each province - the Atlantic provinces being grouped together as one entity of RCCs.

This document puts together assumptions, definitions and methodology that have been previously published to the Scientific Authority as separate documents or letters, and in addition provides the precise methodology used to derive input values for the model from data obtained through the indepth interviews and from the Scientific Authority.

2. Demand Model

2.1 Methodology

The methodology in arriving at MSAT market projections for the years 1989 to 2002, based on RCCs forecasts, was to derive as much information through interviews with the participating RCCs and to ascertain market projections based on historical trends and present RCC market conditions.

The opportunities that MSAT represent in terms of traditional RCC applications, private systems (traditionally out of reach of the RCCs) and the suppressed market (for which terrestrial systems do not meet the communication coverage requirements) were explored in detail with each participating RCC.

Based on the data obtained from the participating RCCs, the MSAT sample forecast was derived. Adjustments to collected data were made for:

- high forecasts in comparison to other inputs from RCCs of similar size and geographic location.
- unusual growth rates between various point years.

Special attention was given to ascertain airtime prediction per service category from the participating RCC in order to arrive at a realistic average usage per month.

2.1.1 Comparison of User Projections by Province

The total MSAT demand was derived by comparing the MSAT sample derived with the 1983 total and sample terrestrial demand. From our baseline questionnaire and the licensing data as provided by DOC, we could determine with reasonable accuracy, the number of licensed mobiles in each province that are served or have been sold by RCCs. Thus a ratio was derived for each service based on Terrestrial total demand/Terrestrial sample demand. This ratio when multiplied by the MSAT sample demand produces the MSAT total demand. Adjustments to total MSAT demand figures were made to account for minor RCCs (2 base stations or less). All metropolitan minor RCCs were excluded since the input results indicated demand could be satisfied by the larger metropolitan RCCs, who could more effectively finance and compete for MSAT services. One half of the minor rural RCCs were excluded since lack of demand and financial restrictions would inhibit them from becoming involved. The remaining minor rural RCCs are expected to take part in MSAT, since they will be the only service providers available in given areas.

2.1.2 Analysis of RCC Penetration by Province Within the provincial MSAT demand derived through the in-depth interviews, the following analysis (test) was conducted:

The RCC penetration was determined based on the modified Woods Gordon results as provided by Telesat. As a test of its validity, this ratio was compared to the RCC penetration of the current terrestrial market.

A second test involved utilizing the results of the in-depth questionnaire, in which the RCCs were asked to predict increases in demand if competition changed to exclude either Telesat or the Telcos. RCC penetration was thus determined from the additional demand to be served by Telesat or the Telcos, as predicted by RCCs.

2.2 RCC Units by Service Type Mobile Telephone Service (MTS) is assumed to be a one-on-one communication for the call duration. For example, one mobile telephone talking to a telephone in the PSTN. On the other hand, Mobile Radio Service (MRS), is assumed to be point-to-multipoint, with several users sharing a single MSAT channel for the call duration. For Data Aquisition and Control Systems (DACS) and Mobile Paging Service (MPS), an RCC paging terminal can request an MSAT channel and then send calls at rates of 10 or more per minute to receivers. This means that many more DACS and MPS units can be accommodated within the capacity of MSAT. Since MSAT is capacity limited to serve MRS and MTS units, we assumed that the RCC demand developed in 2.0 above represented the demand for MRS and MTS units only. MRS and MTS units with voice/data capability were presumed to offer as much traffic load as voice only units. DACS and MPS units were assumed to be data only units whose traffic load could easily be accommodated within the capacity of MSAT. See Appendix I for the rationale for this assumption. For MPS we assumed that every 190 MPS units served would reduce the MRS/MTS capability by 1 unit. For DACS this ratio was 3:1 for polling units and 106:1 for alarm units.

2.2.1 MRS/MTS Demand Within the total RCC penetration some units would be MTS, depending on the interconnection scenarios in each province. The MTS proportion of RCC units would vary. The present ratio of MTS within the total licensed radios in Canada was reported in Woods Gordon phase A at 12.5%, and all these units are served by Telcos.

By the time MSAT is operational cellular radio will be interconnected in all provinces except Manitoba. Woods Gordon's estimate for radio license in 2001 is 1,085,000. Cantel, the RCC cellular licensee, has estimated the cellular market at 95,000-105,000 by 1995. If we assume that 2001's MTS market is mostly cellular and that it will approach 140,000-150,000 units then the proportion of MTS to total licensed radios will still be in the order of 12.5%. This was verified through KVA research. MTS was determined as specified in 2.1.1. in which the ratio of terrestrial total to terrestrial sample demand is multiplied by MSAT sample demand.

2.2.2 DACS Demand By presenting the benefits of DACS, in terms of reduced airtime charges per message and capability to interface directly with terrestrial data networks, we determined a ratio of DACS units sold to MRS & MTS units sold. Each RCC in our in-depth survey was asked questions relating to his market from which KVA determined DACS/MRS and DACS/MTS ratios for each province. Care was taken to ensure that averaged results were for homogenous markets. We averaged the results from several RCCs operating in similar markets but only averaged results from dissimilar markets if they appeared to be unaffected by the nature of the markets, eg. urban-vs-rural.

2.2.3 MPS Demand From our baseline questionnaire, we determined the total RCC population of pagers on terrestrial systems by aggregating the responses of the 80 respondents in appropriate categories of urban-vs-rural and used this data in conjunction with DOC licensing data. On a provincial basis, we produced a reasonably close estimate of the number of pagers in service on RCC systems. By asking RCCs in our in-depth interview how many MSAT MPS units they could sell in proportion to growth in their existing services, we obtained a short term annual sales ratio, and by aggregating the units in service we obtained an estimate of MSAT/terrestrial MPS units for the long term (1995-2001). Judgement was used to calculate the expected demand in the early years.

2.3 Demand Elasticity Changes in MSAT market projections by service and province were determined through RCC input and KVA industry knowledge. The following methodology was used.

Each RCC was asked to determine the impact on his projected market demand (i.e. +/- % change) when specific MSAT factors were varied. The impact was determined for each of the following factors:

Terminal costs - higher prices
- lower prices
Airtime costs - higher prices
- lower prices
Access charges - higher prices
- lower prices

and variations in the competitive scenarios.

The RCCs were then asked to rank the factors in order of highest impact to lowest impact based on the variations above. Through data analysis KVA determined each factors impact on RCC market projections. Market projection curves were then derived considering the impact that these factors would have. The overall impact on market demand was determined by comparing these market projection curves to those derived initially when all factors were constant.

2.4 RCC Demand Summary by Province For each province we developed a table as follows:

	From Section	Year 1989 2002
a) MSAT Projections for Canada	Sect. 2.0	
b) MSAT Distribution to "This Province"	Sect. 2.0	
c) MSAT Units in Service with RCCs	Sect. 2.0	
d) MSAT MRS Units with RCCs	Sect. 2.1.1	
e) MSAT MTS Units with RCCs	Sect. 2.1.1	
f) MSAT DACS Units with RCCs	Sect. 2.1.2	
g) MSAT MPS Units with RCCs	Sect. 2.1.3	

3.0 DEFINITION & ASSUMPTIONS

In the following sections many references are made to determining unit costs and ratios with the RCCs. These refer to incremental costs or revenues. For example, if an MSAT radio is expected to take 25% longer to install than an existing radio the incremental cost is 25% higher than the current RCC cost. As much as possible we have attempted to find an industry average and only used province or size differentiations where the answers were too significantly different to be averaged.

3.1 Rentals/Sales From our baseline questionnaire we determined the rental ratio on present RCC channels. We then determined how this will change with MSAT given the investment and carrying costs of an MSAT mobile are greater than the costs for equipment currently on rental.

A basic difference between MSAT and current operations is that RCCs sell equipment that is used on private systems as well as their own channels. This has resulted in a present situation where nationwide, of all licensed mobiles on MRS channels, approximately 50%, are customer provided. In addition, the RCCs have sold and maintained a further percentage of all licensed mobiles. MSAT will change this situation somewhat because the RCCs will obtain a bigger percentage market share as service providers. This may affect their ability to penetrate the private and telco market shares by selling MSAT terminals into those market shares.

Consequently, we have assumed that because the RCCs have been very successful in not only selling and renting radios on their own channels but also in penetrating the market for private and telco channels that on MSAT they will at least hold their own. All MSAT terminals in service with RCCs will be presumed to have been rented or sold by RCCs.

3.1.1 Ratio of Rental/Sales By discussion with the sample RCCs, KVA determined an appropriate rental/sales ratio for RCC units in service. The existing ratio of mobile radios on terrestrial RCC channels is in the range 50% to 55% for rentals across Canada on a provincial basis. This was used as our starting point.

3.1.2 Revenues from Sales and Rentals Based on the price per terminal as provided by DOC/Telesat, the net profit on each sale is the selling price less the cost of an MSAT terminal on delivery to an RCC. Where the gross margin varies from RCC to RCC, we did not average significantly different answers.

The rental rate for an MSAT terminal was based on rental rates of $15/month per $1000 retail. Thus the rental rate of a $3,000 terminal would be $45/month.

3.1.3 Replacement Sales After several years MSAT radios must be replaced. Rental customers will have their units replaced on a regular basis by the RCC, based on new models, high failure rates and other factors. The replacement of these units is covered in capital require- ments to replace

rental units. Sold units are replaced with some trade-in allowance which reduces the net profit/unit on the sale.

Assume that new MRS units always sell at $3,000 + 25%. If a user trades in after three years, he might be offered $750 for his old radio. The RCC will then sell this old radio at perhaps $1,000 to another customer (including refurbishing costs). Assuming the $750 offered as trade-in offsets completely the net profit on the sale then the net profit of $750 is really earned on reselling the trade-in. We can assume that someone willing to pay $1,000 for a trade-in is not a candidate for a new unit at $3,000 + 25% so there is no additional loss of profit.

If the user trades in after 5 years, we can assume the radio has less resale value. Assume the RCC discounts $250 on the $3,000 + 25% to keep the user on his MSAT service. The RCC will resell the unit at a price which maintains his overall net profit. Between the MSAT and trade-in sale, the RCC will have earned overall net profit of $750.

In almost all situations we can conclude and assume that the net profit on a replacement unit will be the same for the prices and margin we are considering in this study. This net profit was determined from the in-depth interviews.

3.2 Access Charges The revenue earned from an access charge was established with RCC input through the in-depth interviews. We assumed that those RCCs which don't invest in base stations would obtain access to MSAT for their customers through another RCC. As explained in Appendix II, the cost trade-off between ownership of MSAT bases or access through other RCCs should not result in higher costs. The RCC providing access will probably charge a lower access charge to the RCC who has the customers. This cost is about 50% of his own cost of owning the MSAT base which means that both RCCs have similar margins on access revenues to cover billing and collection and associated service costs. Consequently, we can assume that incremental costs of access charges within the RCC industry are adequately covered by the ownership costs associated with the average investment per unit in base station equipment. No separate line item was included for access charges paid to other RCCs by the serving RCC.

3.3 Airtime Charges As discussed in Attachment 9, the investment-vs-airtime cost trade off appears to favour SHF base stations over UHF base stations at almost all volume levels because a UHF base station call will incur double the airtime charge per minute of an SHF base station call to cover the Telesat cost of a double hop connection for UHF-UHF calls.

The average airtime used was determined based on the RCCs inputs. The airtime revenue per unit per month was based on:

a) ratio of SHF to UHF airtime
b) cost/minute of UHF & SHF airtime
c) airtime minutes/unit/month

For DACS units, we have used the monthly airtime figure as provided by DOC and Telesat. Revenues were determined based on the ratio of SHF to UHF airtime.

For MPS units, we have projected only link applications and have used the airtime provided as specified in the "Study Assumptions", derived as follows:

2 pages/day, 30 days/month = 60 pages/month

60 pages/month @ 6 sec./page = 360 sec./month = 6 min./month

3.3.1 Airtime Revenues An RCC to generate the necessary profit margin, will add 25% to Telesat airtime charges. The airtime revenue will thus be 25% higher than the airtime costs.

3.3.2 Airtime Charges Between RCCs We assume that an RCC who does not own a base station and obtains MSAT access through another RCC will negotiate a revenue sharing agreement. For example, the serving RCC may collect $2.00 per minute and the RCC providing MSAT access will pay Telesat $1.50/minute. In whatever manner this 50 cents/minute is apportioned within the RCC industry does not affect our impact analysis and no attempt at apportionment is therefore made.

3.3.3 Other Usage Related Charges MTS and DACS units making calls into the long distance networks from MSAT base stations and gateways will incur charges from the telephone and data network operators. We assume that these charges are transferred directly to the account of the user generating the charge, just as the Telesat charge is passed through on a per minute basis. However, we will assume no discount benefit to the RCCs from these charges since we have no reasonable basis to assume such a discount based on present regulations. Also, based on present regulations, we have no reasonable basis to assume that RCCs will be permitted to resell telephone calls at a premium. Thus, for these items, revenues equal costs as they flow through the RCC system.

3.4 Installations The model calculates installations by province for each service from the following formula:

Total annual installations = installation of sold units (S)
+ installation of rental units (R)

(S) = increase in customer-provided units base from previous year plus replacement units [see Section 3.4.3]

(R) = increase in rental units base from previous year plus removals during the year.

3.4.1 Installation Costs

In discussion with each RCC, we determined the average number of hours involved in installing trunk-mount radios and then obtained an estimate of the increase in hours that the RCC visualized for MSAT terminals. Using the RCC's loaded labour rate, we obtained an installation cost per terrestrial mobile and a comparative cost for an MSAT mobile.

3.4.2 Installation Charges

Each RCC was asked to assess a reasonable charge for an MSAT installation based on the comparative costs derived in 3.4.1. We assumed that installation charges would be levied for all installations, rental, new sales and replacement. The monthly cost of rental does not include the installation charge. This is assumed to be collected up front on all installations.

3.4.3 Replacement Installations This item, which appears in formula (3) above is calculated as follows: Equipment sold has a service life of 7 years so that after some years of the program we can assume that 15% of all equipment in the customer-provided base will be replaced annually, with an attendant installation charge. In the early years of the program, the equipment is new and replacement rates will be lower. Accordingly, we assumed the following replacement rates:

1988	1%	1991	11%
1989	4%	1992	14%
1990	7%	1993 onwards	15%

The replacement rate for each year is therefore the % from the above table of the total customer-provided units in service.

3.5 Removals

We assumed that every installation of a replacement radio is associated with removal of an old radio, [A].

From RCCs, we determined the ratio of rental terminations per year within the rental base. This percentage was applied each year to determine the number of removals per year, [B].

Total removals, therefore, equaled [A] + [B].

3.5.1 Removal Cost In comparison with a trunk mount radio, each RCC was asked to determine the number of hours and costs using loaded labour rates to remove an MRS, DACS or MTS unit. Results were averaged to provide a typical removal cost for each province.

3.6 Repairs While new equipment should require fewer repairs than the long term average, the length of repairs may increase due to unfamiliarity with the equipment. On balance, it was assumed that repair rates (failures per 100 units in service) would remain constant and that each repair had a fixed cost including parts and labour.

3.6.1 Repair (Failure) Rates While rental units were assumed to have higher failure rates than customer provided units (evidence seemed to point to ownership inducing more careful usage), RCC inputs indicated that failure rates amongst rental and customer owned units were consistent. Thus with each RCC we determined failure rates, or intervals between repairs for trunk mount radios and, by comparison, determined appropriate failure rates for MSAT terminals in terms of failures per 100 units per year. The categories were:

a) MRS, MTS, DACS, MPS rentals
b) MRS, MTS, DACS, MPS customer provided

3.6.2 Repair Cost Each RCC was asked to assess the repair cost of an MRS, MTS, DACS unit in terms of hours to repair x loaded labour rate. Results were averaged to determine the typical repair cost per service type.

3.6.3 Repair Charges Repairs to rental units are not billed directly. Repairs to customer provided units are billed directly. RCCs were asked to assess a reasonable charge for a repair costed as in 3.6.2. Since a reasonable concensus existed on a typical repair markup we marked up the average cost by the typical markup. Otherwise we would have averaged the results of the charge estimation from each RCC. The result was a typical repair charge for billable repairs to customer-provided units.

3.7 Displacements Our objective in displacements was to determine an average cost to the RCC industry for loss of one rental unit or one customer-provided unit. Each was treated separately. The displacement cost was assumed to include loss of revenue, reduction in expenses and changes in carrying costs to arrive at a net displacement cost.

3.7.1 Rental Units For each rental unit displaced from an existing channel, we asked the RCC the net cost/month assuming that the revenue source is lost forever. We assumed no capital costs associated with the displacement by assuming that the unit will be used to either serve a new growth user or replace an aging rental unit.

3.7.2 Customer-Provided Units For end users who could use either MSAT or terrestrial systems, there will be a displacement cost associated with the purchase of an MSAT terminal. Assuming the revenues from installation and repair of an MSAT unit and terrestrial unit are similar, the net result of an MSAT unit sale displacing a sale onto a terrestrial channel would be a reduction in gross profit. This reduction in gross profit would be the displaced profit from the terrestrial sale.

3.8 Promotion Each RCC was asked to provide % of revenues devoted to promotion and advertising. The amount, in early years of the program, was determined by asking RCCs to estimate the increased % of revenues for early years of the program. Answers in terms of % of revenues were averaged across the RCCs by province.

3.9 Selling We presumed that the cost of selling a rental unit would be different than selling a customer-owned unit in that the sales commission plan and salaries might be different. Therefore, we asked RCCs to estimate, based on each individual RCC's sales projections , what their selling costs would be in terms of selling hours per mobile unit rented or sold and how the selling hours could be costed in terms of loaded labour rate or loaded labour rate + commission. The objective was to determine an average selling cost per unit rented, and per unit sold. Results were averaged by Province.

3.10 Billing and Collection Costs These are the incremental costs associated with billing and collection from MSAT customers. Billing airtime and access charges may be a new process for many RCCs. Their own bill from Telesat, or other common carriers, will have to be broken down to individual units that made or received the calls. With some RCCs this may involve the introduction of a computerized bill generation process which would not be contemplated except for MSAT. If so, then the costs of the mechanization are incremental to MSAT and are included. The RCC was also asked to include the cost of bad debts as a collection cost. Billing and collection is related to the number of customer accounts. Each account may represent more than one MSAT mobile. We obtained an RCC estimate of the billing and collection cost

associated with an MSAT customer account and obtained an estimate of average numbers of MSAT mobiles expected per account. Our objective was an average billing and collection cost per MSAT mobile, which was derived by averaging cost per account divided by the average number of MSAT mobiles per account to provide the average billing and collection cost per mobile.

3.11 Capital Requirements The RCC will invest in SHF base stations, and mobile units required to provide rental service. This study does not take account of any investment in RCC sold units that become customer-provided units in service. This cost is assumed to be covered by customer capital or financial house capital on a third party lease arrangement. The profit on the sale is a source of working capital for the RCC.

Capital is required for new growth and replacement, and for inventory to support growth and rental service. The latter element is generally called non-revenue earning investment (NREI). Each element is discussed in the following sections.

3.11.1 New Growth Mobiles Each mobile terminal is assumed to cost the end user the prices as outlined in "The Socio-Economic Input Study Assumptions".

By establishing the required gross margin per MSAT terminal, through the in-depth questionnaire, the investment required by the RCC per terminal was determined.

The RCC has no investment in mobile terminals for customer provided equipment. For rental units in service, the model calculates the capital requirements in each year as follows:

Capital requirements for mobile terminals

= increase in rental units base during the year
- rental service terminations during the year
+ NREI to cover growth (% of annual increase)
+ replacement (% based on curves in Fig. 3.1)

If this result is negative, then there is no capital required to maintain rental service and the investment of previous years can be used to cover new growth and NREI requirements.

The over-investment will be carried forward to future years until it is "used up" in the capital requirements calculation for each year.

3.11.2 Inventory Each RCC was asked for his estimate of the inventory required to support a given annual increase in sales and rentals. The answer was requested in terms of units in stock to support annual sales and rentals of 100 units. The additional capital requirements for inventory in each year is therefore the number of units x cost per unit per 100 units increase in the units in service **less** the inventory investment from the previous year.

3.11.3 NREI This is expressed as % of units held in repair stock to support the rental units in service. Each RCC was asked to estimate an NREI percentage appropriate to MSAT rentals for each service. This percentage will be applied to the capital requirements calculation in 3.11.1.

3.11.4 Fixed Equipment Investment RCC systems will require investment in fixed equipment which includes only SHF base stations, UHF base stations presumed to be customer owned. Appendix II explains how an average investment per unit in service is calculated. The total investment for each year is therefore the average investment per unit x the number of units in service.

The average investment/unit calculated in accordance with Appendix II takes account of several possibilities: some RCCs serve small volumes of units through SHF bases at high average investment/unit; other RCCs obtain access through larger RCCs who serve 100 or more units at low average investment/unit; or larger RCCs who have their own customer base to support an investment in SHF base equipment.

The average investment/unit is a weighted average of several mixes of the possibilities described above. Also in the average investment used for each year, we included an allowance for spare capacity. In the early years of the

program, many RCCs will invest in fixed equipment that will not reach capacity for two or three years. To capture this impact we have assumed that in the mature period after several years of growth, RCCs will on average run their systems with spare capacity in the order of 15% ie. 85% utilization. We assumed the longer term to be year 5 onwards. Utilization estimates for the earlier years were as follows:

Year 1	50%
Year 2	60%
Year 3	70%
Year 4	80%

3.11.5 Fixed Equipment-Capital Requirements The investment curve generated in 3.11.4 provided the total investment level for each year of the program for each province. The capital requirements for each year were:

increase in investment level from previous year
+ replacement of obsolete or unrepairable equipment

Replacement was assumed to be zero since fixed radio equipment is assumed to have an average service life of 15 years.

3.11.6 Fixed Equipment-Maintenance The expense of maintaining SHF bases and associated fixed equipment was determined as a percentage of installed cost (investment value) and applied to the total investment value in each year to calculate the maintenance expense for that year. Each RCC was asked to provide estimates of this maintenance cost percentage and results were averaged to produce a percentage that was applied on a provincial basis.

3.11.7 Capital Cost Allowances For calculating taxes, any incremental operating profits must be reduced by the annual capital cost allowances to produce income taxable at the marginal tax rate. The two pools of capital, represented by total investment in mobile terminal rentals, and total investment in fixed equipment, were multiplied by the appropriate rates for classes of equipment of this nature. The sum of the two capital cost allowances are the total capital cost allowance for each year. The class rates were assumed to remain unchanged during the study period.

4. ELEMENTS OF THE IMPACT ANALYSIS MODEL The specifications for the Impact Analysis Model are included in a separate document.

Using the RCC demand tables generated in Section 2.3, and the values assumed or generated in the relevant sections of Section 3, KVA produced an input worksheet for each province for each service type.

4.1 Typical Worksheet A typical worksheet is included below.

Province:

Economic Model Inputs
RCC Impact Study
(in 1984 constant dollars)

Run No. _____
Date: _____

		YEAR													
		1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
unit/month	- MRS														
	- MPS														
	- MTS														
	- DACS														
AC2: Telesat wholesale access fees/unit/month (in current 1984 dollars	- MRS														
	- MPS														
	- MTS														
	- DACS														
AT1: Retail end user airtime charges/unit/ minute (in current 1984 dollars) SHF	- MRS														
	- MPS														
	- MTS														
	- DACS														
AT2: Wholesale airtime costs/unit/minute charged by Telesat (in current 1984 dollars) SHF	- MRS														
	- MPS														
	- MTS														
	- DACS														
SP: Retail selling price of a mobile terminal	- MRS														
	- MPS														
	- MTS														
	- DACS														
BP: Wholesale terminal costs to service provider	- MRS														
	- MPS														
	- MTS														
	- DACS														

Province:

Economic Model Inputs
RCC Impact Study
(in 1984 constant dollars)

Run No. _____
Date: _____

	YEAR													
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Scenario II - most likely price														
Total Units - MRS														
- MPS														
- MTS														
- DACS														
A: Percentage of Units Switching Over														
- MRS														
- MPS														
- MTS														
- DACS														
WO: % of units replaced per year														
AP: Promotional cost - % of revenue														
AFI: Avg. fixed investment/unit														
- MRS														
- MPS														
- MTS														
- DACS														
PSHF: Proportion of total airtime minutes on SHF														
- MRS														
- MPS														
- MTS														
- DACS														
ACl: Retail access/ charge (current 1984 dollars)														
Marked-up Telesat access cost/unit/month														
- MRS														
- MPS														
- MTS														
- DACS														
Capital investment recovery component/														

Run No. _____
Date _____

ECONOMIC MODEL INPUTS
RCC Impact Study
(in 1984 constant dollars)

Province:

Revenue Expense & Investment Components	SERVICE MRS	MPS	MTS	DACS
LS: Percentage of Switchover MSAT mobile terminals rented out by service provider:				
RA: Percentage of Additional MSAT mobile terminals rented out by service provider:				
Scenario II - Optimistic Price + % change in total units:				
Scenario II - Pessimistic Price - % change in total units:				
Scenario I - Most Likely Price + % change in total units:				
Scenario III - Most Likely Price + % change in total units:				
p: proportion of fixed investment in common base stations and gateways that is replaced:				
IR: Mobile Terminal installation charge/ installation:				
REP: Mobile Terminal repair charge/ repair:				
RF: Mobile terminal rental charges/unit/ month/$1000 equivalent retail price:				
CT: Average monthly profit per mobile displaced by MSAT:				
IC: Mobile terminal installation cost/installation:				
URC:Mobile terminal removal cost/ removal:				
RPC: Mobile terminal repair cost/repair:				

Run No. _____
Date _____

ECONOMIC MODEL INPUTS
RCC Impact Study
(in 1984 constant dollars)

Province:

	SERVICE			
Revenue Expense & Investment Components	MRS	MPS	MTS	DACS

VTI: Assumed value of a mobile terminal trade-in:

FR: Failures/100 mobile terminals
- rental:
- customer owned:

ISC: Selling cost/mobile terminal:

BBD: Billing & collection cost/mobile terminal
- rental:
- customer owned:

UHFP: Premium for UHF Airtime:
(ratio of UHF airtime cost to SHF airtime cost)

MCFC: Maintenance cost fixed common base stations and gateways
- % of investment per annum:

NREI: % of rental mobiles held in repair stock:

ST:
% of rentals that are terminations/year:

Y: % of units installed that are reinstallation
- rental:
- customer owned:

LTC: Labour training cost/mobile terminal/annum:

M: # minutes of airtime/unit/annum:

Notes: CF = ST + Y (Rentals)

Province:

Run No.:
Date :

Economic Model Inputs
RCC Study Inputs

Financial Model Components	VALUE	
	Constant	Current
Discount Rate in percent:		
Tax Rate in percent:		
Debt Ratio:		
Cost of Debt Capital:		
Price Deflator:		
Price Inflator:		
Capital Cost Allowance Rate for Base Stations and Gateways:		
Capital Cost Allowance for Mobile Terminals:		

4.2 Revenues From worksheets developed by KVA in accordance with Section 4.1, the economic model generates the incremental RCC revenue projections by province by service type in the following categories for each year 1988 through 2001:

- o Total revenue from equipment rentals and sales
- o Access charges
- o Airtime charges
- o Installation
- o Repairs

The annual revenue totals were present worthed.

4.3 Expenses Incremental annual costs in the following categories for each province, by service type, were generated by the model and present worthed.

- o Access charges to Telesat or other providers
- o Airtime charges to Telesat or other providers
- o Installations
- o Removals
- o Repairs
- o Selling costs
- o Billing and Collection costs
- o Net cost of displacements
- o Maintenance of fixed equipment
- o Advertising and promotion costs

4.4 Capital Requirements and Associated Costs The model calculates the annual capital requirements for fixed equipment and mobile terminals, which includes new growth and replacement. The expenses associated with the total capital invested - taxes and capital cost allowances - are computed for each year. The present worth of capital requirements and associated expenses were also calculated.

4.5 Sensitivity Analysis By varying a few of the inputs, such as: units in service, price of MSAT mobile terminals and average investment/mobile, the model measures sensitivity to changes in these input elements.

APPENDIX I

RATIONALE FOR TRAFFIC LOADING

OF DACS & MPS

APPENDIX I

RATIONALE FOR TRAFFIC LOADING OF DACS & MPS

The user demand curves for MSAT are based on MRS and MTS traffic, which has message lengths of tens of seconds and blocking probabilities of P.1 to P.25

By contrast, DACS and MPS messages or calls are short in duration and can be stored for forwarding as airtime or processing time is made available.

For example, mobile paging calls are of three types - tone only, tone & voice or tone & message display. None of these calls generally exceeds 8 seconds [tone & voice]. With tone only pagers, 5 messages can be sent in 1 second. Thus MSAT, which can typically handle the busy hour traffic load of 0.0106 erlangs of message time per MRS or MTS mobile, can accommodate at least 190 MPS units for every MRS or MTS unit displaced, assuming each MPS unit receives one call per busy hour. Terrestrial paging systems typically have average call rates of 5 per day and 1 call per busy hour. Thus, the ratio of MPS/MRS units could be as high as 190:1 for the same traffic load effect. We expect that most paging traffic on MPS will be tone only. From our baseline study we find a very high penetration of tone only to tone & message (voice or data display), over 80% on the larger systems. Therefore we assume the 190:1 ratio is reasonable for MPS.

Statistics on DACS are harder to find and we therefore relied on the assumptions provided by Telesat/DOC. The traffic assumptions for DACS busy hour peak range are: alarm - 0.0001 erlangs
polling - 0.0035 erlangs

Thus, MSAT can accomodate at least 106 alarm units or 3 polling units for every MRS or MTS unit displaced, assuming each DACS unit receives one call per busy hour.

APPENDIX II

AVERAGE INVESTMENT PER UNIT ANALYSIS

TABLE OF CONTENTS

1. Fixed -vs- Mobile Equipment

Mobile equipment is treated as a capital requirement at time of sale or rental, or replacement. The investment per unit is covered in the capital requirements section 3.11.

Fixed equipment is studied on a provincial basis as an average investment per mobile spread across the RCC systems providing access to MSAT. This average investment must take account of the types of fixed equipment that can be used to serve MSAT mobiles, the capital involved in each installation, the mix of base station capacities installed by the RCCs and the percentage utilization of the systems as a whole. For each year of the study an average investment per mobile unit is generated, taking all these factors into consideration as discussed in the following sections.

2. Types of Fixed Equipment and Costs

The types of base stations available for RCC customers are as follows:

2.1 UHF Private Base: Used by end-user to communicate with his MSAT mobiles. The bases can be bought by the end user or rented to the end user by the RCC. Because of the relatively low cost of UHF base stations, we have assumed that all are customer owned. UHF private bases are assumed to be located at the customer's premises.

2.2 UHF Common Base An RCC could establish a UHF base that could be used by several end-users on a time-sharing basis to communicate with their mobiles. Because few economies can be realized by using a UHF common base,particularly given the premium for UHF airtime, we have assumed no UHF common bases in the system.

2.3 SHF Multicircuit Common Base SHF bases can be installed with two, or more circuit capability depending on traffic handling requirements. Interface equipment is required to connect end-users to any available circuit.

3. Selection Trade-Offs

3.1 UHF-vs-SHF UHF calls will require a double hop connection through the SHF central control station. Thus, there is a premium placed on UHF airtime compared to SHF airtime. In addition to the type of base station (UHF or SHF, private or common), the size and the distance of an end user to a common base, must all be considered in determining the mix of base station.

3.2 Private Base-vs-Common Base A user may be many miles away from the common base operated by an RCC. Several methods exist for connecting to the common base. He can rent a telephone line or use "voicecom" service; he can use an inexpensive VHF base to access an RCC repeater at the MSAT common base site, or he can use his existing radio system to talk directly to a radio at the common base site that is connected to the MSAT circuits by the RCC. The most expensive option is probably a dedicated telephone line. By trunking his traffic with other users' traffic, the common base can lower the overall investment per mobile.

Our conclusion, is that most users would access their MSAT mobiles through an RCC operated common base.

A percentage of users would, however, prefer to operate private base stations. The private bases are customer owned or leased. In calculating average investment for the RCC, we were only interested in base stations that are RCC owned.

4. Spare Capacity In the early years of the program we can visualize many RCCs investing in common base equipment that will leave considerable spare capacity unused through the system. We projected a percentage utilization curve for years 1988 through 1992 as indicated below. From the 5th year onwards, we assumed that percentage utilization of investment on a provincial basis had reached the normal 85% utilization, 15% spare capacity. The spare capacity percentage for each year will be translated into increased average investment/mobile to serve the RCC users in each province.

Because SHF bases can be incrementally increased in capacity without any major stair steps, we assumed that once in business the RCC will increase capacity on a basis that keeps his % utilization around 85%. Also, because the minimum capacity is two circuits - a small number - we can expect that percentage utilization even in the early years will be quite high. Values in the order of 50% in 1988 reaching 85% in year 5 are therefore quite reasonable.

5. Calculation of Average Investment/Mobile

5.1 Private Bases Average investment/mobile was calculated with the use of an IBM PC and Lotus software. The total yearly investment was calculated based on the mix of stations and their costs including federal sales tax and installation. The total yearly investment was then divided by yearly incremental increase in mobile units, to arrive at an average investment/mobile.

SECTION 13.0

IN-DEPTH QUESTIONNAIRE

Revised January 25/84

MSAT/RCC Impact Study
In-Depth Questionnaire

Company Name:
Address: Prov:
Postal Code:
Study Contact:
Phone No:

SECTION I - MSAT MARKET PROJECTIONS

In this section, the market potential that you can identify and project for the period of 1988 - 2002 will be discussed.

Please refer to the MSAT SYSTEM CONCEPTS (Attachment I) prior to responding to these marketing questions.

A Mobile Radio Service (MRS)

The MSAT market potential for the RCCs in terms of Mobile Radio Services can be determined according to three (3) types of applications:

1) - **New users** (communication needs cannot be met without MSAT)
2) - **Displaced users** (From private terrestrial systems to MSAT)
3) - **Displaced users** (From RCC systems to MSAT)

Each customer (Company) could have MSAT users of all types. In forecasting the demand for MSAT MRS, you should consider your existing customer base , your terrestrial market demand for wide area coverage and the limitations and age of existing private systems in your territory.

Your forecasts will be based on a typical price level and the "most likely" competitive environment. Subsequently at the end of the interview these price levels and the competitive scenario will be varied to arrive at market elasticity curve.

MRS (ML)

Most Likely Price Level (RCC costs)

MRS Terminal Costs $4,500	$135/month (rental)
MRS Airtime Costs (SHF to UHF)	$ 1.25/minute
MRS Access Costs	$ 7.5/month

Typical RCC monthly costs (200 minutes/month)/subscriber
(Rental) $392.50
Typical RCC monthly costs (200 minutes/month)
(Customer owned equipment) $257.50

Competitive Scenario: No. II

RCCs compete with Telcos, CNCP and Telesat, (Telesat only deals on a limited basis, directly with national and major accounts)

Please indicate in the table below your forecast for Terrestrial and MSAT MRS Terminals, considering the following typical applications of MRS.

TYPICAL APPLICATIONS

Dispatch - system where the mobiles are directed from a central base. Typical applications include taxi companies, utility companies and municipalities.

Network Services - typically, a system that assists in the maintenance and operation of a network. Included are oil and gas networks, road and railway networks, and communication networks.

Emergency - typically, a system required in any emergency situation, such as forest fires and medical or police emergencies.

Performance Reporting - typically, a system where mobiles report in at regular intervals. Includes crews reporting daily results and salesmen reporting daily calls.

Traffic Management - typically, a system for keeping track of the movement of goods and people.

Other - uses not covered by any of the above.

RCC COSTS

Terminal Costs $4,500, Airtime Costs $1.25/Min (Minimum charge $0.75/Call)

Access Costs $7.5/Month

MRS Service (Mobile Radio)	Terrestrial	MSAT-Types of Applicants (1)	(2)	(3)	Terrestrial	MSAT
• Dispatch • Network Services • Emergency • Performance Reporting • Traffic Management • Other	Forecast without MSAT	New Users	Displaced Users from Private Systems	Displaced Users from RCC/Telco Systems	Average Airtime per Month [ ] Min	Average Airtime per Month [ ] Min
					Average Length per Call [ ]Min	Average Length per Call [ ]Min
Historic growth/yr [ ]%						
Year 1984					Estimate the No. of Calls that are Less than .40 Sec	Estimate the No. of Calls that are Less than .40 Sec
1988						
1992						
1996					[ ]	[ ]
2002						

B Mobile Telephone Services (MTS)

The MSAT market potential for the RCCs in terms of Mobile Telephone services can be determined according to two types of applications.

1) - **New Users** (Mobile Telephone services are not available and can not be provided economically without MSAT)
2) - **Displaced Users** (From existing or planned conventional IMTS or MTS as well as from planned cellular systems)

Your forecasts will be based on your knowledge of the demand for Mobile Telephone needs in your territory, the level of penetration of the MTS Telco services in your area, the coverage limitations of existing systems and the demand analysis conducted in your area for enhanced cellular MTS services.

MTS (ML)

Most Likely Price Level (RCC costs)	
MTS Terminal Costs $4,500	$135/month (rental)
MTS Airtime Costs (SHF to UHF)	$ 1.25/minute
MTS Access Costs	$ 7.5/month
Typical RCC monthly costs (135 minutes/month)/subscriber (Rental)	$311.25
Typical monthly costs (135 minutes/month) (Customer owned equipment)	$176.25

Competitive Scenario: No. II

RCCs compete with Telcos, CNCP and Telesat, (Telesat only deals on a limited basis, directly with national and major accounts)

RCC COSTS Terminal Costs $4,500, Airtime Costs $1.25/Min (Minimum charge $0.75/Call) Access Costs $7.5/Month					
MTS Service (Mobile Telephone)	Terrestrial MTS, IMTS Cellular	MSAT-Types of Applicants (1)	(2)	Terrestrial	MSAT
• Remote Public • Mobile Telephone in Rural Areas • Second terminal to cellular user	without MSAT	New Users	Displaced Users	Average Airtime per Month [ ]Min	Average Airtime per Month [ ]Min
Year 1984				Average Length per Call	Average Length per Call
1988					
1992				[ ]Min	[ ]Min
1996				Estimate % of Calls that are Less than .40 Sec	Estimate % of Calls that are Less than .40 Sec
2002					
				[ ]%	[ ]%

C Mobile Paging Service (MPS)

The MSAT market potential for the RCCs in terms of Mobile Paging service can be determined according to three types of applications.

1 - **New Users** - communities that do not have terrestrial RCC paging systems, could now become satellites of existing systems by using MSAT as a link. An MSAT receiver terminal will be used to input calls to a local VHF, or UHF paging transmitter. The entry point (Paging Terminal) will remain at the prime system.

2 - **Displaced Units** (Nationwide/wide area - link application) - Similar to the link application described under category 1. For remote paging, some users might change their local paging service and join a nationwide service which will be linking local paging systems via MSAT.

3 - **Mobile Paging Receiver** - This application would serve new users that are roaming in areas where no existing terrestrial or MSAT (link) paging services are available. The MSAT paging receiver could be transportable under certain conditions, but will be primarily designed to work with a vehicular antenna.

MPS (ML)

Most Likely Price Level (RCC costs)	
MPS Receiver(Direct Broadcast) - $1,000	$ 30/month (rental)
MPS Airtime Costs (Direct Broadcast)	$ 1.25/minute
MPS Access Costs (Direct Broadcast)	$ 7.5/month

Typical RCC monthly costs (6.5 minutes/month)/subscriber (Direct Broadcast)	$45.63
Typical monthly costs (6.5 minutes/month) (Customer owned equipment)	$15.63

Competitive Scenario: No. II

RCCs compete with Telcos, CNCP and Telesat, (Telesat only deals on a limited basis, directly with national and major accounts)

RCC COSTS

Paging Receiver Costs $1,000, Airtime Costs $1.25/Min, Access Charge $7.5/Mo

(Direct paging broadcast)

MPS Service Paging	Terrestrial Paging (Conventional)	MSAT Types of Applicants (1)	(2)	(3)	Terrestrial (Conventional)	MSAT
Historic growth/yr [ ]%	Without MSAT	Link Application New Users	Link Application Displaced Users	Direct Broadcast Paging	Average Number of Calls Per Month/ User [ ]	Average Number of Calls Per Month/ User [ ]
• Remote Communities (link paging) • Wide area/national paging • Roaming direct broadcast paging						
Year 1984						
1988						
1992						
1996						
2002						

D Mobile Data Services (MDS)

The MSAT market potential for the RCCs in terms of Mobile Data services can be determined according to two types of applications.

1 - **New Users** - Applications for data communications in areas where terrestrial services are not economically feasible.

2 - **Enhancement to MRS Services** - Data capability added to MSAT applications as determined in MRS Market projection.

3 - **Displaced User** - From terrestrial MDT (Mobile Data Terminal) to MSAT due to coverage requirements.

MDS (ML)

Most Likely Price Level (RCC costs)

MDS Terminal Costs $3,000	$ 90/month (rental)
(Data Acquisition and Control Service (DACS)	
MDS Terminal Enhancement Costs	
(add on to an MRS/MTS terminal) $1,000	$ 30/month (rental)
MDS Airtime Costs	$ 1.25/minute
DACS Airtime Costs	.35/minute
	(based on 4 sec packets)
MDS Access Costs	$ 7.5/month

Typical RCC monthly costs (50 minutes/month/subscriber unit)-DACS (Rental) $115

Typical RCC monthly costs (50 minutes/month/subscriber unit) -DACS (Customer owned equipment) $25

Competitive Scenario: No. II

RCCs compete with Telcos, CNCP and Telesat, (Telesat only deals on a limited basis, directly with national and major accounts)

RCC COSTS

DACS Terminal Costs $3,000, Add on to MRS/MTS $1,000, Airtime Costs $1.25/Min

Airtime Costs (DACS) 0.35/min (based on 4 sec packets)

Minimum charge $.75/Call-(MRS/MTS) Access costs $7.5/Month

MDS Service (Data Terminals)	Terrestrial	MSAT-Type of Applicants (1)	(2)	(3)	Terrestrial MDTs	MRS/MTS add on
Telemetry (emergency, Medical) Remote sensing & control data acquisition (general)	Without MSAT (MDTs)	New User (DACS)	Enhancement to MRS/MTS Terminals	From Terrestrial DACS Systems	Average Airtime per Month per Unit [ ] Min	Average Airtime per Month per Unit [ ]Min
Year 1984					Average Length per transmission [ ] Min	Average Length per transmission [ ]Min
1988						
1992						
1996						
2002					Estimate % of transmissions that are Less than .40 Sec [ ]%	Estimate % of transmissions that are Less than .40 Sec [ ]%

SECTION II INVESTMENT REVENUES AND EXPENSES

A Investment

1. Fixed Equipment Investment. There are several options available for investment in fixed equipment. The types of base stations available to your customers are as follows:

   a) UHF Private Base - is used by the end-user to communicate with his MSAT mobiles. The base can be bought by the end-user, or rented to the end-user by the RCC and the assumed wholesale cost is $4,100. UHF base to mobile calls will incur double the airtime costs ($2.00 min) due to the double hop connection. A small user of UHF bases rented from an RCC is defined as one with 3 MSAT mobiles, and a large user of UHF bases is defined as one with 13 MSAT mobiles.

   b) UHF Common Base - established by the RCC and can be used by several end-users on a time sharing basis to communicate with their mobiles. The assumed wholesale cost including interface equipment is $6,100. While UHF base to mobile calls will still incur double the airtime charge ($2.00 min), the common base can lower the overall investment per mobile.

   c) SHF Single Channel Common Base or Gateway - similar to a UHF common base but uses the SHF side of the satellite. The expected cost is $40,000 from SHF common base and $66,000 for an SHF common gateway. Airtime costs are $1.25/min. A single circuit SHF base or gateway can accommodate 13 mobiles.

   d) SHF Multicircuit Common Base or Gateway - SHF bases or gateways can be installed with three, five or ten circuit capability. Interface equipment is more complex and costly. The assumed wholesale cost including interface equipment, is assumed to be $61,000 for a three circuit base, $77,000 for a five circuit and 112,000 for a ten circuit base. For gateways, the costs are $80,000 (3 circuit), $96,000 (5

circuit), and $133,000 (10 circuit). Arrangements can be made between RCCs to share an SHF base station. The capacity of multicircuit common bases or gateways are:

3 circuits	92 mobiles
5 circuits	188 mobiles
10 circuits	455 mobiles

Based on your knowledge of your current MRS customer base and your projected MSAT MRS and MTS customer base, estimate the mix of private bases by allocating a percentage of the units to be in service to these categories.

- private base - customer owned.....%
- private base - rented from RCC - 3 mobiles/base ....%
  - 13 mobiles/base ....%
- served by common bases .....%

100%

2. How many MRS units are kept in stock to support annual sales and rentals of 100 units on terrestrial MRS service? .....

3. Based on the current number of rental mobiles in service, what percentage of these mobiles is held in repair stock to support the rental mobiles on MRS terrestrial services? .....

B Revenue and Expenses

4. Specify the ratio of rental units to customer owned units that you expect with MSAT, considering the increased cost of MSAT mobiles.

	MRS	MPS
Customer owned		
Rental		
Total	100%	100%

5. If the cost of a mobile to you is as indicated below, what would be your estimated markup? [ ]%

Service	Most Likely Cost	Opti-mistic Cost	Pessi-mistic Cost
MRS	4,500	3,900	5,900
MPS	1,000	1,000	1,000
MTS	4,500	3,900	5,900
MDS	3,000	2,400	3,900

6a. Currently, on average, how many hours does it take to install a trunk-mount radio? .....hours

6b. What is the hourly loaded labour cost for a trunk-mount radio installation? $...../hr

6c. Based on the costs of an MSAT mobile being higher than a terrestrial mobile and assumed increased complexity of an MSAT mobile, how many hours would it take to install an MSAT mobile?

Service Category	Average number of Hours per Installation
MRS	
MPS	
MDS	
MTS	

7. The hourly loaded labour rate x the average number of hours per installation is equivalent to your cost for mobile installation. Based on this cost, what would a customer be charged for a mobile installation?

Current terrestrial terminal $.....

MSAT Terminal MRS $.....

MPS $.....

MDS $.....

MTS $.....

8. Based on previous experience, what percentage of the mobiles rented by you must be removed as a result of rental terminations per year?

[ ]%

9a. To determine the cost of removal, we need to know for current terrestrial mobiles;

- the average number of hours required per removal .....hours

and

- the hourly loaded labour rate .....$/hr

associated with a terminal removal.

9b. Comparing this with an MSAT mobile removal, on average how many hours will be required to remove an MSAT mobile -

MRS .....hours

MPS .....hours

MDS .....hours

MTS .....hours

10. Estimate the failure rate of mobile radios on your current terrestrial systems per 100 base units per year.

	Failures/100 base units/year	
Service Category	Rentals	Customer owned
MRS		

11. To determine the cost of repair, estimate

- the average number of hours required per repair .....hours

and

- the hourly loaded labour rate $...../hr

and

- the average cost of parts per repair associated with a mobile repair. $.....

12. What percentage of your yearly revenues do you spend on advertising and promotion? %.....

MSAT being a new service offering, will require heavier expenditures on advertising and particularly promotion, during the early years of the program. Estimate the percentage of revenues you expect to spend on advertising and promotion for the following years.

Year	Advertising & Promotion Expenditure % of revenue
1988	% [ ]
1989	% [ ]
1990	% [ ]
1991	% [ ]

13a. For MRS units on current terrestrial systems, estimate your selling costs by completing the following table.

	MRS
Rental Unit	
- selling hours unit	
- hourly loaded labour rate	
- % sales commission/unit	
Customer Owned Unit	
- selling hrs/unit	
- hourly loaded labour rate	
- % sales commission/unit	

13b. Estimate your selling costs of MSAT mobiles by completing the following table and assuming the competitive scenario II and the most likely price level.

	MRS	MPS	MTS	MDS
Rental				
- selling hrs/unit				
- % sale commission/unit				
Customer Owned				
- selling hrs/unit				
- % sale commission/unit				

14a. Estimate an average billing and collection cost per year per customer account, and the average number of units per account. Include the cost of bad debts as a collection cost.

Customer account	Yearly Billing and Collection Costs		Average Number of Units per Account	
	MRS	MPS	MRS	MPS
Rental				
Customer Owned				

14b. With MSAT, billing airtime and access charges may be a new process. In addition, bills received from Telesat, or other common carriers, will have to be broken down to individual units that made or received calls and this may involve the introduction of a computerized bill generation process. Taking this into consideration, estimate the average billing and collection cost per year per MSAT customer account and the average number of units per account.

Customer account	Yearly Billing and Collection Costs				Average Number of Units per Account			
	MRS	MPS	MDS	MTS	MRS	MPS	MDS	MTS
Rental								
Customer Owned								

14c. What is the hourly loaded labour cost for clerical staff who process the billing and collection data? $...../hr

15a. Expressed as a percentage of investment cost, what is your annual maintenance cost for fixed equipment? % [ ]

15b. Expressed as a percentage of the investment value to be made in MSAT fixed equipment, what will your yearly maintenance costs be? % [ ]

16. Estimate what your labour training costs will be per annum for technicians and billing clerical staff, associated with MSAT services.

Technician $.....

Billing clerical staff $.....

17. Estimate as a percentage of the units installed, the number of yearly re-installations due to car change-overs on current terrestrial systems for:

mobile rental units % [ ]

customer owned units % [ ]

C Other

18. Estimate the engineering or consulting fees paid for every $1000 of capital investment placed. $.....

19. To verify results from the baseline questionnaire, please complete the following question concerning your terrestrial radio equipment sales. In this question, we require the number of units to be sold that will not go into service on one of your systems.

YEAR	Mobiles/Portables Terrestrial Forecast Without MSAT Historic growth/yr: %	Pagers Terrestrial Forecast Without MSAT Historic growth/yr: %
1984		
1988		
1992		
1996		
2001		

SECTION III MSAT MARKET PROJECTIONS - Price and Competitive Environment Elasticity Analysis.

In Section I of this questionnaire we addressed the market potential for the RCC based on a most likely (ML) price level, and on competitive scenario No.II under which RCCs would compete with Telcos, CNCP and Telesat, (where Telesat will restrict its end user activities to selected national and/or security sensitive accounts). We would now like to investigate the effects of some of the prices and the competitive environment.

1. Your market projections for MSAT services as discussed in Section I could vary if the price to the end user would be higher or lower. Please indicate below the % change in total units to be served based on different price levels.

   - o If the cost of the terminals is to be 30% higher - your forecast reduction will be [ ]%
   - o If the cost of the terminals is to be 30% lower - your forecast increase will be [ ]%
   - o If the airtime costs are 30% higher - your forecast reduction will be [ ]%
   - o If the airtime costs are 30% lower - your forecast increase will be [ ]%
   - o If the access charge is 30% higher - your forecast reduction will be [ ]%
   - o If the access charge is 30% lower - your forecast increase will be [ ]%

2. Your market projections for MSAT services as discussed in Section I could vary if the competitive environment is different. Please indicate below the % change based on different competitive scenarios.

   - o Scenario I - **Telesat is excluded**

     The total market is shared by RCCs, Telcos, CNCP and other possible new carriers.

     Market projection per Section I will increase by [ ]%

o Scenario II is the competitive scenario on which Section I forecasts are based.

o Scenario III - **Telcos are excluded**

The total market is shared by RCCs, CNCP, other carriers and Telesat (limited to national and security sensitive accounts).

Market projections per Section I will increase by [ ]%

3. Which of the above variables, in order of priority, represent the most important impact on the MSAT market projection.
(Indicate below from 1 to 4 with 1 representing the most important impact variable).

User Terminal Costs [ ]
Airtime Costs [ ]
Access Costs [ ]
Competitive Scenarios [ ]

Section V - MSAT Trial Services

1) Are you interested in participating in a trial MSAT service in order to assess the performance and operating effectiveness of the system.

YES [ ] NO [ ]

2) Would you wish to begin this trial service immediately upon launch in 1988?

YES [ ] NO [ ]

If no, at which time?

Within first six months [ ]
Within first year [ ]

3) Which MSAT service offerings would you be interested in on a trial basis?

MRS [ ]
MTS [ ]
MPS [ ]
MDS [ ]

SECTION 14.0

ECONOMIC MODEL

JANUARY 18, 1984

THE ECONOMIC MODEL

CONTENTS

EQUATIONS #1 - #115

ELEMENTS OF THE MODEL

Let U = total number of MSAT units registered for year in Province
Let u = proportion of MSAT units licensed to RCC's for year in Province
Let Y_t = U.u = total number of RCC licensed MSAT units for year in Province
Let RS = $y_1.Y_T$ = MSAT MRS units licensed to RCC's in Province for year
Let TS = $y_2.Y_T$ = MSAT MTS units licensed to RCC's in Province for year
Let PS = $y_3.Y_T$ = MSAT MPS units licensed to RCC's in Province for year
Let DS = $y_4.Y_T$ = MSAT MDS units licensed to RCC's in Province for year

where $y_1 + y_2 + y_3 + y_4 = 1.0$ and are specified

MSAT MRS Units in Province to RCC's

Let $RS = a_1.RS + (1-a_1).RS$

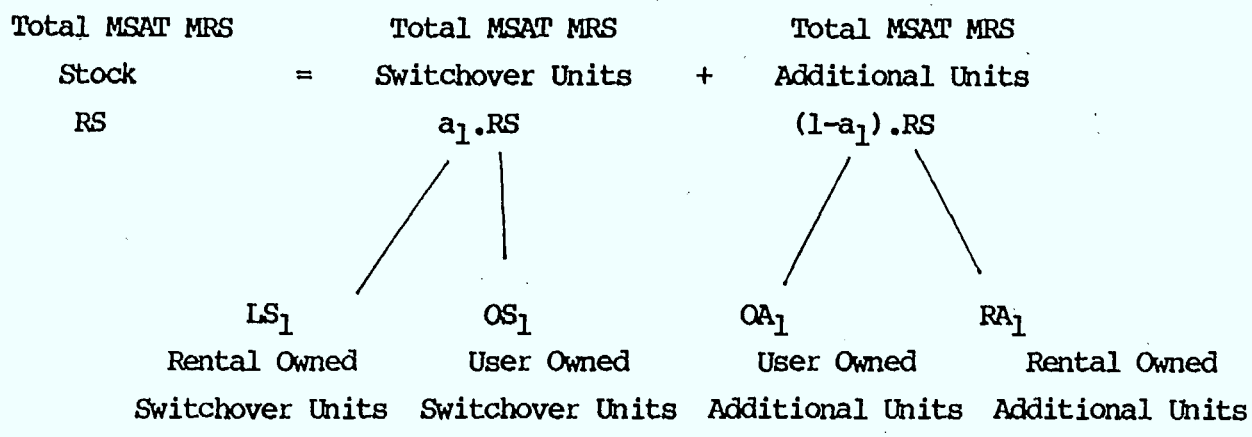
where a_1 = $\frac{\text{Units switching to MSAT from Terrestrial for this service}}{\text{Total MSAT Units in this service.}}$

and where $a_1 < 1.0$, and is specified in decimal notation.

Thus: $a_1.RS$ = # of Switchover units in total to MSAT, for this service
$(1-a_1).RS$ = # of Additional units to MSAT, this service.

For MRS MSAT Service: Stock Analysis and Flow Analysis

Stock Analysis:



Where: $LS_1 \leq 1.0$ and ≥ 0

$OS_1 \leq 1.0$ and ≥ 0

and $LS_1 + OS_1 = 1.0$

$OA_1 \leq 1.0$ and ≥ 0

$RA_1 \leq 1.0$ and ≥ 0

and $OA_1 + RA_1 = 1.0$

Stock of User Owned MRS Units = SUOMR = $OS_1.a_1.RS + OA_1.(1-a_1).RS$

Stock of Rental MRS Units = SROMR = $LS_1.a_1.RS + RA_1.(1-a_1).RS$

Flow Analysis

$$RS = a_1.RS + (1-a_1).RS$$

or: $$RS_t - RS_{t-1} = a_1.(RS_t - RS_{t-1}) + (1-a_1).(RS_t - RS_{t-1})$$

Annual Increment of User Owned Units = IUOMR = $OS_1.a_1(RS_t - RS_{t-1}) + OA_1.(1-a_1)(RS_t - RS_{t-1})$

Annual Increment of Rental Units = IROMR = $LS_1.a_1(RS_t - RS_{t-1}) + RA_1.(1-a_1)(RS_t - RS_{t-1})$

Revenues to RCC's from MSAT MRS Service:

ADDITIONAL UNITS - All revenues are a gain; no offsetting revenue losses.

1. Access Fees: **EQUATION #1**

$$R_1 = (1-a_1).RS.(AC_1.12)$$

where AC_1 = The monthly Access Charge per unit of MRS.
and R_1 = The incremental MRS revenues from access charges - additional units.

2. Airtime Fees: **EQUATION #2**

$$R_2 = (1-a_1).RS.[\ AT._{1t}\ .PSHF_1.M_1+UHFP_1.\ AT_{1t}\ (1-PSHF_1).M_1]$$

where AT_1 = Per Minute Air Time Charge to MRS user for SHF
$PSHF_1$ = Proportion of Total MRS Air Time Minutes on SHF vs UHF
M_1 = Assumed annual # Minutes of Air Time per unit for MRS service
$UHFP_1$ = Price premium charged over SHF Air Time Charge to UHF user for each minute of Air Time
R_2 = The incremental MRS revenues from Airtime Fees - additional units.

3. Contribution from Sale of this Year's Additional Units:

EQUATION #3

$$R_3 = QA_1.(1-a_1)\ (RS_t-RS_{t-1}).(SP_1-BP_1)$$

where QA_1 = Proportion of new MRS additional units that are user owned
BP_1 = Buying Price to RCC of the MRS unit in $
SP_1 = Selling Price by RCC to User of MRS unit in $
R_3 = $ Contribution to RCC from sale of MSAT MRS units to users per annum.

4. Contribution from Rental of Additional Units:

EQUATION #4

$$R_4 = RA_1.(1-a_1).[RS.(RF_1 x 12)]$$

where RA_1 = Proportion of additional MRS units that are rented out as RCC owned
RF_1 = Monthly Rental Fee to user for MSAT MRS user equipment
R_4 = Dollar contribution per annum to RCC from rental of MRS MSAT units to users

SWITCHOVER UNITS - These revenues have some offsets to be taken into account. (Except for Equation #5)

5. Access Fees:

EQUATION #5

$$R_5 = a_1.RS.(AC_1.12)$$

where R_5 = Incremental MRS MSAT Revenues from access charges - switchover units. There are no offsets.
Other elements are as previously set out.

6. Airtime Fees:

EQUATION #6

$$R_6 = [a_1.RS.[AT_{1t}.PSHF_1.M_1+UHFP_1.AT_{1t}(1-PSHF_1).M_1]$$

$$- a_1.RS.(CT_1.12)]$$

where CT_1 = The average monthly contribution to an RCC from each terrestrial Mobile Radio served by him.

R_6 = Dollar contribution from airtime charges from switchover units.

Other elements are as have been described.

7. Contribution from Sale of this Year's Switchover Units:

EQUATION #7

$$R_7 = OS_1.a_1(RS_t-RS_{t-1}).[SP_1-BP_1-VTI_1]$$

where OS_1 = Proportion of Switchover Units in MSAT MRS that are User Owned

VTI_1 = Assumed Value of Trade In allowed to user on Terrestrial Mobile Radio

R_7 = $ Revenues from Sale of Units to this year's Switchovers.

8. Contribution from Rental of Switchover Units:

EQUATION #8

$$R_8 = LS_1.a_1.RS.[RF_1.12]$$

where LS_1 = The proportion of MRS Switchover units that are rented

R_8 = $ Revenues from Rentals to Switchover Units

9. Repair Revenues:

EQUATION #9

$R_9 = (REP_1.SUOMR.FR_1)$

where REP_1 = Repair Revenues per MRS MSAT Unit each repair, on average

SUOMR = Stock in year, of user owned MRS MSAT Units

Equation #25

$= OS_1.a_1.RS+OA_1.(1-a_1).RS$

FR_1 = # of times on average that MRS MSAT equipment is repaired. ie. # of times per annum.

R_9 = Incremental MSAT MRS Income from Repairs.

10. Installation Revenues:

EQUATION #10

$R_{10} = [IR_1.(IUOMR + IROMR) + RS.CF_1)]$

where IR_1 = Average Installation Revenue per MSAT MRS Unit

IUOMR = Annual Increment of User Owned MSAT MRS equipment

IROMR = Annual Increment of RCC Rental Equipment Units

CF_1 = The Relevant 'Churn Factor' < 1.0 for MSAT MRS Installations. Caused by Reinstallations - car changeovers, service terminations and worn-out items.

R_{10} = Incremental MRS Income from MSAT Units Installation, per annum.

Equation #23

Note $IUOMR = OS_1.a_1(RS_t - RS_{t-1}) + OA_1.(1-a_1)(RS_t - RS_{t-1})$

Equation #24

and $IROMR = LS_1.a_1(RS_t - RS_{t-1}) + RA_1.(1-a_1)(RS_t - RS_{t-1})$

The Total Incremental Revenues to RCC from MSAT MRS = RRS

Where $RRS = [R_1+R_2+R_3+R_4+R_5+R_6+R_7+R_8+R_9+R_{10}].1(1+i)^{t-1}$

where $(1+i)^{t-1}$ is the Revenue inflation index appropriate to the year, for MRS Service

Expenses to RCC's from MSAT MRS Service:

11. SHF Air Time Cost:

EQUATION #11

$$C_1 = [RS.M_1.(1-PD_1) \ . \ AT_{1t} \ . \ PSHF_1]$$

where RS = Total Stock of MSAT MRS units

M_1 = Assumed Annual # Minutes of Air Time per MRS MSAT Unit.

PD_1 = % Discount from user air-time charge at which RCC can purchase time. Discount in decimal notation.

AT_1 = Air Time charge per minute to end user for MRS MSAT time

$PSHF_1$ = Proportion of MSAT MRS Air-Time on SHF vs UHF

C_1 = Incremental MSAT MRS Costs to RCC associated with buying SHF Air-Time

13. UHF Air Time Cost:

EQUATION #13

$$C_3 = [RS.M_1.(1-PD_1).AT_{1t}.UHFP_1.(1-PSHF_1)]$$

where $UHFP_1$ = UHF Price Cost Premium over SHF

C_3 = Incremental MSAT MRS Costs associated with buying UHF Airtime

14. Advertising & Promotion: A Function of Revenues

EQUATION #14

$$C_4 = (AP_1.RRS)$$

where AP_1 = The % of MSAT MRS revenues (in decimal terms) that is spent on advertising and promotion.

C_4 = Incremental MSAT MRS Costs associated with advertising and promotions

15. Incremental Selling Cost: for example - Selling Commission

EQUATION #15

$$C_5 = [ISC_1.(IUOMR + IROMR + (ST_1.RS))]$$

where ISC_1 = The per unit $ Cost of Selling Commission

ST_1 = Proportion of MSAT MRS stock of units that are service terminations each year (in decimal notation).

C_6 = Incremental MSAT MRS Costs associated with Billing and Bad Debts.

16. Billing and Bad Debt Expense: **EQUATION #16**

$$C_6 = (BBD_1.RRS)$$

where BBD_1 = % of MSAT MRS revenues (in decimal terms) that goes to service billing expense and bad debts.

C_6 = Incremental MSAT MRS Costs associated with Billing and Bad Debts.

17. Labour Training Costs: **EQUATION #17**

$C_7 = (LTC_1.RS)$

where LTC_1 = Labour Training Costs per annum per MSAT MRS unit, in Dollars

C_7 = Labour Training Costs in connection with MSAT MRS Service

Note: When aggregating **ALL** Labour Training Costs, guard against double or treble counting in adding all services.

18. Repair Expenses - User Equipment: **EQUATION #18**

Repairs to both Rental Equipment and User Owned Equipment

$C_8 = (RPC_1.RS.FR_1)$

where RPC_1 = Average repair costs per MSAT MRS unit, each repair

C_8 = Incremental MSAT MRS Equipment Repair Expenses

19. Installation Expenses - User Equipment:

Installation expenses arise from both new installations and re-installations.

$C_9 = [IC_1.[(IUOMR + IROMR). + CF_1.RS]]$ **EQUATION #19**

where IC_1 = Average Installation Cost per MSAT MRS unit

CF_1 = The 'Churn Factor' as before regarding reinstallations

C_9 = Incremental MSAT MRS user-equipment installation expenses

20. Removal Expenses - User Equipment:

Costs of removing units from vehicles **EQUATION #20**

$$C_{10} = (CF_1 . RS) . URC_1$$

where CF_1 = The Churn Factor <1.0, caused by service terminations, units wearing out, and car changeovers.

URC_1 = Unit removal cost in $ per MSAT MRS unit

C_{10} = Incremental MSAT MRS removal costs

21. Non Revenue Earning Inventory: Holding Expense:

NREI is assumed from industry knowledge to be 10% of the total # of units

$$C_{11} = [0.1 . SROMR . BP_1, OCF] \quad \textbf{EQUATION \#21}$$

where OCF = The opportunity cost of funds to an RCC, or the cost of borrowing

C_{11} = The holding expense on NREI MSAT MRS equipment

The Total Incremental Expenses to RCC from MSAT MRS = CRS

Where $CRS = [C_1 + C_3 + C_4 + C_5 + C_6 + C_7 + C_8 + C_9 + C_{10} + C_{11} + C_{12}.] . 1(1+i)^{t-1}$

Where $(1+i)^{t-1}$ is the Cost Inflation Index appropriate to MRS expenses for the year.

MSAT MTS Units in Province to ROC's

The analysis in this section proceeds in a similar way to that in the MSAT MRS section. The same cost and revenue items will be considered here, as before with MSAT MRS. The same symbols as before will be utilized - the only difference being that MRS items had the subscript$_1$, and MTS items below have the subscript$_2$. Later MPS will have the subscript$_3$ to its symbols, and DACS will have the subscript$_4$.

Accordingly:

$$\text{Let } TS = a_2.TS + (1-a_2)TS$$

$$\text{Where } a_2 = \frac{\text{Units switching to MSAT from Terrestrial this service}}{\text{Total MSAT units in this service}}$$

, and where $a_2 < 1.0$

Thus: $a_2.TS$ = # of Switchover units in total to MSAT, for this service

$(1-a_2)TS$ = # of Additional units to MSAT, this service

By a similar Stock Analysis and Flow Analysis as before in the case of MSAT MRS:

EQUATION #26

$$\text{Stock of User Owned MTS Units} = SUOMT = OS_2.a_2.TS+OA_2.(1-a_2).TS$$

EQUATION #27

$$\text{Stock of Rental MTS Units} = SROMT = LS_2.a_2.TS+RA_2.(1-a_2).TS$$

EQUATION #28

$$\text{Annual Increment of User Owned Units} = IUOMT = \frac{OS_2.a_2(TS_t-TS_{t-1})+OA_2(1-a_2)}{(TS_t-TS_{t-1})}$$

EQUATION #29

$$\text{Annual Increment of Rental Units} = IROMT = \frac{LS_2.a_2.(TS_t-TS_{t-1})+RA_2.(1-a_2)}{(TS_t-TS_{t-1})}$$

Where $LS_2 \leq 1.0$ and ≥ 0 AND $OA_2 \leq 1.0$ and ≥ 0

$OS_2 \leq 1.0$ and ≥ 0 $RA_2 \leq 1.0$ and ≥ 0

and $LS_2 + OS_2 = 1.0$ and $OA_2 + RA_2 = 1.0$

Revenues to RCC's from MSAT MTS Service Sector:

Proceeding in the same manner as with MSAT MRS, and using similar symbols, we have the following equations:

ADDITIONAL UNITS

1. Access Fees:

$$R_{11} = (1-a_2).TS.(AC_2.12)$$ **EQUATION #30**

2. Airtime Fees: **EQUATION #31**

$$R_{12}=(1-a_2).TS.[\ AT_{2t}\ .\ PSHF_2.M_2+UHFP_2\ .\ AT_{2t}\ (1-PSHF_2).M_2]$$

3. Contribution from Sale of this year's Additional Units:

EQUATION #32

$$R_{13} = OA_2.(1-a_2)(TS_t-TS_{t-1}).(SP_2-BP_2)$$

4. Contribution from Rental of Additional Units:

EQUATION #33

$$R_{14} = RA_2.(1-a_2)[TS.(RF_2 x 12)]$$

SWITCHOVER UNITS:

5. Access Fees: **EQUATION #34**

$$R_{15} = a_2.TS.(AC_2.12)$$

6. Airtime Fees: EQUATION #35

$$R_{16} = [a_2.TS[\ AT_{2t}\ .PSHF_2.M_2+UHFP_2.\ AT_{2t}\ (1-PSHF_2).M_2] - a_2.TS(CT_2.12)]$$

7. Contribution from Sale of this Year's Switchover Units:
EQUATION #36

$$R_{17} = OS_2.a_2.(TS_t-TS_{t-1}).[SP_2-BP_2-VTI_2]$$

8. Contribution from Rental of Switchover Units:
EQUATION #37

$$R_{18} = LS_2.a_2.TS[RF_2.12]$$

9. Repair Revenues: EQUATION #38

$$R_{19} = (REP_2.SUOMT.FR_2)$$

10. Installation Revenues: EQUATION #39

$$R_{20} = [IR_2\ ((IUOMT + IROMT) + TS.CF_2)]$$

The Total Incremental Revenues to RCC from MSAT MTS = RTS

Where $RTS = [R_{11}+R_{12}+R_{13}+R_{14}+R_{15}+R_{16}+R_{17}+R_{18}+R_{19}+R_{20}].1(1+i)t-1$

Where $(1+i)^{t-1}$ is the Revenue Inflation index for MTS Service, for the year.

Expenses to ROC's from MSAT MTS Service:

11. SHF Air Time Cost: **EQUATION #40**

$$C_{13} = [TS.M_2.(1-PD_2).AT_2.PSHF_2]$$

13. UHF Air Time Cost: **EQUATION #41**

$$C_{14} = [TS.M_2.(1-PD_2).AT_2.\ UHFP_2.(1-PSHF_2)]$$

14. Advertising and Promotion: **EQUATION #42**

$$C_{15} = (AP_2.RTS)$$

15. Incremental Selling Cost: **EQUATION #43**

$$C_{16} = [ISC_2.(IUOMT + IROMT + (ST_2.TS))]$$

16. Billing and Bad Debt Expense: **EQUATION #44**

$$C_{17} = (BBD_2.RTS)$$

17. Labour Training Costs: **EQUATION #45**

$$C_{18} = (LTC_2.TS)$$

18. Repair Expenses - User Equipment: **EQUATION #46**

$$C_{19} = (RPC_2.TS.FR_2)$$

19. Installation Expense - User Equipment: **EQUATION #47**

$$C_{20} = [IC_2.[(IUOMT + IROMT) + CF_2.TS]]$$

20. Removal Expenses - User Equipment: EQUATION #48

$$C_{21} = (CF_2.TS).URC_2$$

21. Non-Revenue Earning Inventory: Holding Expense: EQUATION #49

$$C_{22} = [0.1.SROMT.BP_2.OCF]$$

22.

The Total Incremental Expenses to RCC from MSAT MTS = CTS

Where CTS = $[C_{13}+C_{14}+C_{15}+C_{16}+C_{17}+C_{18}+C_{19}+C_{20}+C_{21}+C_{23}.] .1(1+i)^{t-1}$

MSAT MPS Units in Province to RCC's

The analysis proceeds in accordance with the pattern and format developed in the previous two sections. MPS items have the subscript$_3$ to the symbols.

Accordingly: Let $PS = a_3.PS + (1-a_3).PS$

Where a_3 = $\frac{\text{Units switching to MSAT from Terrestrial this service,}}{\text{Total MSAT Units in this Service}}$

, and where $a_3 < 1.0$

Thus: $a_3.PS$ = # of Switchover Units in total to MSAT, for this service

$(1-a_3).PS$ = # of Additional Units to MSAT, this service

By a similar Stock Analysis and Flow Analysis as before for MSAT MRS, and MSAT MTS:

EQUATION #51

Stock of User Owned MPS Units = $SUOMP = OS_3.a_3.PS+OA_3(1-a_3).PS$

EQUATION #52

Stock of Rental MPS Units = $SROMP = LS_3.a_3.PS+RA_3.(1-a_3).PS$

EQUATION #53

Annual Increment of User Owned Units = $IUOMP = OS_3.a_3.(PS_t-PS_{t-1}) + OA_3(1-a_3)(PS_t-PS_{t-1})$

EQUATION #54

Annual Increment of Rental Units = $IROMP = LS_3.a_3(PS_t-PS_{t-1}) + RA_3(1-a_3)(PS_t-PS_{t-1})$

Where $LS_3 \leq 1.0$ and ≥ 0 AND $OA_3 \leq 1.0$ and ≥ 0

$OS_3 \leq 1.0$ and ≥ 0 $RA_3 \leq 1.0$ and ≥ 0

and $LS_3 + OS_3 = 1.0$ and $OA_3 + RA_3 = 1.0$

Revenues to RCC's from MSAT MPS Service Sector:

Proceeding in the same manner as before, and using similar symbols, we have the following equations:

ADDITIONAL UNITS

1. Access Fees: **EQUATION #55**

$$R_{21} = (1-a_3).PS.(AC_3.12)$$

2. Airtime Fees: **EQUATION #56**

$$R_{22}=(1-a_3).PS.[\ AT_{3t}\ .\ PSHF_3.M_3+\ UHFP_3\ .\ AT_{3t}\ (1-PSHF_3).M_3]$$

3. Contribution from Sale of this year's Additional Units: **EQUATION #57**

$$R_{23} = OA_3.(1-a_3).(PS_t-PS_{t-1}).(SP_3-BP_3)$$

4. Contribution from Rental of Additional Units: **EQUATION #58**

$$R_{24} = RA_3.(1-a_3).[PS.(RF_3.12)]$$

SWITCHOVER UNITS:

5. Access Fees: **EQUATION #59**

$$R_{25} = a_3.PS.(AC_3.12)$$

6. Airtime Fees: **EQUATION #60**

$$R_{26}=[a_3.PS[AT_3.PSHF_3.M_3+UHFP_3.AT_{3t}(1-PSHF_3).M_3] -a_3.PS(CT_3.12)]$$

7. Contribution from Sale of this Year's Switchover Units:

EQUATION #61

$$R_{27} = OS_3.a_3.(PS_t-PS_{t-1}).[SP_3-BP_3-VTI_3]$$

8. Contribution from Rental of Switchover Units:

EQUATION #62

$$R_{28} = LS_3.a_3.PS[RF_3.12]$$

9. Repair Revenues: **EQUATION #63**

$$R_{29} = (REP_3.SUOMP.FR_3)$$

10. Installation Revenues: **EQUATION #64**

$$R_{30} = [IR_3((IUOMP + IROMP) + PS.CF_3)]$$

The Total Incremental Revenues to RCC from MSAT MPS = RPS

$$\text{Where RPS} = \frac{[R_{21}+R_{22}+R_{23}+R_{24}+R_{25}+R_{26}+R_{27}+R_{28}+R_{29}+R_{30}.]}{(1+i)^{t-1}}$$

Where $(1+i)^{t-1}$ is the revenue inflation index for MPS, appropriate to the year.

Expenses to RCC's from MSAT MPS Service:

11. SHF Airtime Cost: **EQUATION #65**

$$C_{24} = [PS.M_3.(1-PD_3).AT_3 .PSHF_3]$$

12. No Equation

13. UHF Air Time Cost: **EQUATION #66**

$$C_{25} = [PS.M_3.(1-PD_3). AT_{3t}. UHFP_3.(1-PSHF_3)]$$

14. Advertising and Promotion: **EQUATION #67**

$$C_{26} = (AP_3.RPS.)$$

15. Incremental Selling Cost: **EQUATION #68**

$$C_{27} = [ISC_3.(IUOMP + IROMP + (ST_3.PS))]$$

16. Billing and Bad Debt Expense: **EQUATION #69**

$$C_{28} = (BBD_3.RPS)$$

17. Labour Training Costs: **EQUATION #70**

$$C_{29} = (LTC_3.PS)$$

18. Repair Expenses - User Equipment: **EQUATION #71**

$$C_{30} = (RPC_3.PS.FR_3)$$

19. Installation Expense + User Equipment: **EQUATION #72**

$$C_{31} = [IC_3.[(IUOMP + IROMP) + CF_3.PS]]$$

20. Removal Expenses - User Equipment: **EQUATION #73**

$$C_{32} = (CF_3.PS).URC_3$$

21. Non Revenue Earning Inventory: Holding Expense: **EQUATION #74**

$$C_{33} = [0.1.SROMP.BP_3.OCF]$$

22. **The Total Incremental Expenses to ROC from MSAT MPS = CPS**

Where CPS = $[C_{24}+C_{25}+C_{26}+C_{27}+C_{28}+C_{29}+C_{30}+C_{31}+C_{32}$ $C_{33}+C_{34}].1(1+i)^{t-1}$

MSAT DACS Units in Province to RCC's

The analysis proceeds in accordance with the pattern and format developed in the previous sections. DACS items have the subscript$_4$ to the symbols.

Accordingly: Let $DS = a_4.DS + (1-a_4).DS$.

Where $a_4 = \frac{\text{Units Switching to MSAT from Terrestrial this service}}{\text{Total MSAT Units in this Service}}$

Thus: $a_4.DS$ = # of Switchover Units in Total to MSAT, for this Service
$(1-a_4).DS$ = # of Additional Units to MSAT, this Service

By a similar Stock Analysis and Flow Analysis as before for MSAT MRS, and MSAT MTS, and MSAT DACS:

EQUATION #76

Stock of User Owned DACS Units = $SUOMD = OS_4.a_4.DS + OA_4(1-a_4).DS$

EQUATION #77

Stock of Rental DACS Units = $SROMD = LS_4.a_4.DS + RA_4(1-a_4).DS$

EQUATION #78

Annual Increment of User Owned Units = $IUOMD = OS_4.a_4.(DS_t - DS_{t-1}) + OA_4(1-a_4)(DS_t - DS_{t-1})$

EQUATION #79

Annual Increment of Rental Units = $IROMD = LS_4.a_4(DS_t - DS_{t-1}) + RA_4(1-a_4)(DS_t - DS_{t-1})$

Where: $LS_4 \leq 1.0$ and ≥ 0 AND $OA_4 \leq 1.0$ and ≥ 0
$OS_4 \leq 1.0$ and ≥ 0 $RA_4 \leq 1.0$ and ≥ 0
and $LS_4 + OS_4 = 1.0$ and $OA_4 + RA_4 = 1.0$

Revenues to RCC's from MSAT DACS Service Sector:

Proceeding in the same manner as before, and using similar symbols with the subscript$_4$ for DACS, we have the following:

ADDITIONAL UNITS:

1. Access Fees: **EQUATION #80**

$$R_{31} = (1-a_4).DS.(AC_4.12)$$

2. Airitme Fees: **EQUATION #81**

$$R_{32} = (1-a_4).DS.[AT_{4t}.PSHF_4.M_4+UHFP_4.AT_{4t} (1-PSHF_4).M_4]$$

3. Contribution from Sale of this Year's Additional Units: **EQUATION #82**

$$R_{33} = OA_4.(1-a_4)(DS_t-DS_{t-1}).(SP_4-BP_4)$$

4. Contribution from Rental of Additional Units: **EQUATION #83**

$$R_{34} = RA_4.(1-a_4).[DS.(RF_4x12)]$$

SWITCHOVER

5. Access Fees: **EQUATION #84**

$$R_{35} = a_4.DS.(AC_4.12)$$

6. Airtime Fees: **EQUATION #85**

$$R_{36} = [a_4.DS[AT_{4t}.PSHF_4.M_4+UHFP_4.AT_{4t} -a_4.DS(1-PSHF_4)] (CT_4.12).M_4]$$

7. Contribution from Sale of this Year's Switchover Units: EQUATION #86

$$R_{37} = OS_4.a_4.(DS_t - DS_{t-1}).[SP_4 - BP_4 - VTI_4]$$

8. Contribution from Rental of Switchover Units: EQUATION #87

$$R_{38} = LS_4.a_4.DS[RF_4.12]$$

9. Repair Revenues: EQUATION #88

$$R_{39} = (REP_4.SUOMD.FR_4)$$

10. Installation Revenues: EQUATION #89

$$R_{40} = [IR_4((IUOMD + IROMD) + DS.CF_4)]$$

The Total Incremental Revenues to RCC from MSAT DACS = RDS

Where RDS = $[R_{31}+R_{32}+R_{33}+R_{34}+R_{35}+R_{36}+R_{37}+R_{38}+R_{39}+R_{40}] .1(1+i)^{t-1}$

Expenses to RCC's from MSAT DACS Service:

11. SHF Air Time Cost: EQUATION #90

$$C_{35} = [DS.M_4.(1-PD_4).AT_4.PSHF_4]$$

13. UHF Air Time Cost: EQUATION #91

$$C_{36} = [DS.M_4.(1-PD_4).AT_{4t}.UHFP_4.(1-PSHF_4)]$$

14. Advertising and Promotion: EQUATION #92

$$C_{37} = (AP_4.RDS)$$

15. Incremental Selling Cost: EQUATION #93

$$C_{38} = [ISC_4.(IUOMD + IROMD + (ST_4.DS))]$$

16. Billing and Bad Debt Expense: **EQUATION #94**

$$C_{39} = (BBD_4.RDS)$$

17. Labour Training Costs: **EQUATION #95**

$$C_{40} = (LTC_4.DS)$$

18. Repair Expenses - User Equipment: **EQUATION #96**

$$C_{41} = (RPC_4.DS.FR_4)$$

19. Installation Expense - User Equipment: **EQUATION #97**

$$C_{42} = [IC_4.[(IUOMD+IROMD)+CF_4.DS]]$$

20. Removed Expenses - User Equipment: **EQUATION #98**

$$C_{43} = (CF_4.DS).URC_4$$

21. Non-Revenue Earning Inventory: Holding Expense: **EQUATION #99**

$$C_{44} = [0.1.SROMD.BP_4.OCF]$$

The Total Incremental Expenses to RCC from MSAT MDS = CDS

Where $CDS = [C_{35}+C_{36}+C_{37}+C_{38}+C_{39}+C_{40}+C_{41}+C_{42}+C_{43}+C_{44}] .1(1+i)^{t-1}$

Summary of MSAT Total Revenues and Expenses: MRS, MTS, MPS and DACS

MRS Total Revenues: **EQUATION #101**

$$RRS = [R_1+R_2+R_3+R_4+R_5+R_6+R_7+R_8+R_9+R_{10}].1(1+i)^{t-1}$$

MTS Total Revenues: **EQUATION #102**

$$RTS = [R_{11}+R_{12}+R_{13}+R_{14}+R_{15}+R_{16}+R_{17}+R_{18}+R_{19}+R_{20}].1(1+i)^{t-1}$$

MPS Total Revenues: **EQUATION #103**

$$RPS = [R_{21}+R_{22}+R_{23}+R_{24}+R_{25}+R_{26}+R_{27}+R_{28}+R_{29}+R_{30}].1(1+i)^{t-1}$$

DACS Total Revenues: **EQUATION #104**

$$RDS = [R_{31}+R_{32}+R_{33}+R_{34}+R_{35}+R_{36}+R_{37}+R_{38}+R_{39}+R_{40}].1(1+i)^{t-1}$$

Total Revenue Increment from MSAT Services: **EQUATION #105**

$$REV = RRS + RTS + RPS + RDS$$

MRS Total Expenses: **EQUATION #106**

$$CRS = [C_1+C_3+C_4+C_5+C_6+C_7+C_8+C_9+C_{10}+C_{11}].1(1+i)^{t-1}$$

MTS Total Expenses: **EQUATION #107**

$$CTS = [C_{13}+C_{14}+C_{15}+C_{16}+C_{17}+C_{18}+C_{19}+C_{20}+C_{21}+C_{22}+C_{23}] .1(1+i)^{t-1}$$

MPS Total Expenses: **EQUATION #108**

$$CPS = [C_{24}+C_{25}+C_{26}+C_{27}+C_{28}+C_{29}+C_{30}+C_{31}+C_{32}+C_{33}].1(1+i)^{t-1}$$

DACS Total Expenses: EQUATION #109

$$CDS = [C_{35}+C_{36}+C_{37}+C_{38}+C_{39}+C_{40}+C_{41}+C_{42}+C_{43}+C_{44}] .1(1+i)^{t-1}$$

Total Expenses Increment from MSAT Services: EQUATION #110

$$COST = CRS + CTS + CPS + CDS$$

CAPITAL INVESTMENT:

A. INCREMENTAL INVESTMENT IN FIXED CAPITAL ITEMS (E.G. BASE EARTH STATIONS ETC.)

1. Incremental Size in Required Capital Stock = Annual Investment to Accommodate Growth

The required size of the Capital Stock for any year is determined by the # of units to be served in MRS, # of MTS units, # of MPS units, and # of MDS units. Also making allowance for any necessary 'slack' due to scale factors, expected growth (especially in the early years), technological considerations, as well as the mix of SHF to UHF Systems.

KVA will take this items into account along with other considerations and provide Ward Mallette with a $ figure for average fixed investment per unit (AFI), together with an operational specification of what the term 'unit' in this context encompasses. This will be provided for each year and by each province.

Thus the required fixed capital stock by RCC's in a particular province for any year is:

EQ. #111

$$RFCS = AFI(MRS) \times RS + AFI(MTS) \times TS + AFI(DACS) \times DS + AFI(DACS) \times PS$$

Where RFCS = Required fixed capital stock in the year.
AFI = Average fixed investment per unit, in constant $ terms. And,

Hence the required annual investment in fixed capital items in any year is:

$$FCI_t = RFCS_t - RFCS_{t-1} \qquad \text{EQ. \#112}$$

Where FCI_t is the required fixed capital items investment in constant $ terms.

2. Annual Replacement Investment

To maintain the size of the capital stock due to equipment wearing out, a certain replacement investment has to be made. This replacement investment is assumed to be zero due to the 15 year life of the equipment.

Thus Replacement Investment in Fixed Capital Items in any year t is RFI_t

EQ. #113

Where: $RFI_t = p. RFCS_{t-1}$ and where $p = 0.0$ by assumption

3. Total Annual Investment in Fixed Capital Items:

This is the total of Incremental Investment and Replacement Investment in Fixed Capital items in each year. It is equal to:

$$TFCI_t = (RFCS_t - RFCS_{t-1}) + p. RFCS_{t-1} \qquad \text{EQ. \#114}$$

Where $TFCI_t$ is the Total Fixed Capital Investment in Year t.

$TFCI_t$ is a $ figure in real terms. It will be calculated for each year and in each province.

Allowing for the impact of inflation on the cost of investment goods items, we have the following annual investment figure in current $ terms.

$$TFI_t = TFCI_t.1(1+i)^{t-1} \qquad \text{EQ. \#115}$$

where $(1+i)^{t-1}$ is the Fixed Capital Inflation Index for any year t.

B. INCREMENTAL INVESTMENT BY THE RCC IN USER EQUIPMENT

1. The RCC's Incremental Investment in Rental Units.

Handling each of the four service areas of MRS, MTS, MPS and MDS, separately, we have:

MRS

The annual increment of RCC rental equipment units for MRS is IROMR, as previously specified Eq. #24.

Where $IROMR = LS_1.a_1(RS_t-RS_{t-1})+RA_1(1-a_1)(RS_t-RS_{t-1})$
and in $, the annual incremental investment in MRS rental units equals

EQ. #116

$$IRC_1 = [[LS_1.a_1(RS_t-RS_{t-1})+RA_1(1-a_1)(RS_t-RS_{t-1})].BP_1]$$

Where BP_1 = Buying Price to RCC of the MRS unit in $, as previously specified.

Likewise for the Other Service Sectors:

MTS

EQ. #117

$$IRC_2= [[LS_2.a_2(TS_t-TS_{t-1})+RA_2.(1-a_2)(TS_t-TS_{t-1})].BP_2]$$

MPS

EQ. #118

$$IRC_3 = [[LS_3.a_3(PS_t-PS_{t-1})+RA_3.(1-a_3)(PS_t-PS_{t-1}).BP_3]$$

DACS

EQ. #119

$$IRC_4 = [[LS_4.a_4(DS_t-DS_{t-1})+RA_4(1-a_4)(DS_t-DS_{t-1})].BP_4]$$

TOTAL ANNUAL INCREMENTAL INVESTMENT IN RENTAL UNITS BY RCC'S IS:

EQ. #120

$$TIRC = IRC_1 + IRC_2 + IRC_3 + IRC_4$$

2. <u>The RCC's Replacement Investment in Rental Units:</u>

Each year some of the rental units wear out and require replacement for various reasons.

MRS

The annual replacement investment in units = $WO_1.RS_{t-1}$

and in Dollars,

EQ. #121

$$RRC_1 = (WO_1.RS_{t-1}.BP_1)$$

MTS **EQ. #122**

$$RRC_2 = (WO_2.TS_{t-1}.BP_2)$$

MPS **EQ. #123**

$$RRC_3 = (WO_3.PS_{t-1}.BP_3)$$

DACS **EQ. #124**

$$RRC_4 = (WO_4.DS_{t-1}.BP_4)$$

TOTAL ANNUAL REPLACEMENT INVESTMENT IN RENTAL UNITS BY ROC'S IS:

EQ. #125

$$TRRC = RRC_1 + RRC_2 + RRC_3 + RRC_4$$

3. <u>The RCC's Investment in Non-Revenue Earning Inventory Required to Cover Both Rentals and New Sales:</u>

From industry knowledge NREI is assumed to be 1/10 of Total # of User Units in the Service Category.

MRS:

$NREI_t = 0.1 \times RS_t$ where NREI is the non-revenue earning inventory

and $NREI_{t-1} = 0.1 \times RS_{t-1}$

Accordingly $\Delta\ NREI_1 = (NREI_t - NREI_{t-1}) = 0.1(SROMR_t - SROMR_{t-1})$

and the Δ **NREI** is the required increase, or investment, in the number of units for NREI

In \$, the cost of Δ **NREI** = $[0.1.(SROMR_t - SROMR_{t-1}).BP_1]$

EQ. #126

and $NREI_1 = [0.1.(SROMR_t - SROMR_{t-1}).BP_1]$

where NREI, is the cost of the MRS non revenue earning inventory in a year.

MTS **EQ. #127**

$$NREI_2 = [0.1.(SROMT_t - SROMT_{t-1}).BP_2]$$

MPS **EQ. #128**

$$NREI_3 = [0.1.(SROMP_t - SROMP_{t-1}).BP_3]$$

DACS **EQ. #129**

$$NREI_4 = [0.1.(SROMD_t - SROMD_{t-1}).BP_4]$$

TOTAL ANNUAL NREI INVESTMENT IN RENTAL UNITS BY RCC'S IS:

$$TNREI = NREI, + NREI_2 + NREI_3 + NREI_4 \quad \text{EQ. \#130}$$

4. Total Annual Investment by the RCC in User Equipment Capital Items:

This is the total of Incremental Investment, Replacement Investment, and NREI Investment in User Equipment Capital Items; for each of the four service sectors of MRS, MTS, MPS and MDS.

$$TUECI_t = TIRC_t + TRRC_t + TNREI_t \quad \text{EQ. \#131}$$

Where $TUECI_t$ is the total User Equipment Capital Investment by the RCC's in year t.

$TUECI_t$ is a $ figure in real terms. It will be calculated for each year and in each province.

Allowing for the impact of general price changes specific to the cost of User Equipment items (+/- inflation), we have the following annual investment figure in current $ terms.

$$TUCI_t = TUECI_t.1(1+i)_{t-1} \quad \text{EQ. \#132}$$

where $(1+i)^{t-1}$ is the User Capital Inflation Index for any year t.

C. TOTAL OVERALL INVESTMENT BY RCC IN ANY YEAR: FIXED CAPITAL ITEMS PLUS USER EQUIPMENT CAPITAL:

$$TAI_t = TFI_t + TUCI_t \qquad \text{EQ. \#133}$$

This is in Current $ terms. Where TAI_t = Total Annual Investment by RCC in year t.

Capital Asset Pool and CCA: Fixed Capital Items Pool

Let $FCAP_t$ = Fixed Capital Asset Pool at end of Year t

Let $PSFC_t$ = Proceeds of Sale of Fixed Capital Items during Year t. Assumed to be zero.

With TFI_t, as before, the fixed capital investment going into the Pool during Year t.

Then the Pool Total in Year t before C.C.A. deduction for fixed capital equipment is:

$(FCAP_{t-1} + TFI_t)$

And the CCA deduction for fixed capital equipment is $CCAFC_t$

EQ. #134

Where $CCAFC_t = Z_1[FCAP_{t-1} + \frac{TFI_t}{2}]$

Where Z_1 is the CCA rate on the fixed capital Pool in Year t, and recognizing that only one half of a new capital acquisition is eligible for CCA in the year of acquisition. $Z_1 < 1.0$.

EQ. #135

Then: $FCAP_t = [FCAP_{t-1} - PSFC_t + TFI_t] - Z_1[FCAP_{t-1} - PSFC_t + \frac{TFI_t}{2}]$

The Salvage Value at the end of the Project for Fixed Capital is

$$FCSV_N = \sum_{X=2}^{15} \frac{X}{15} \left(TFCI_{(1978+X)}\right)$$

Where TFCI is the total incremental investment in fixed capital items in each year.

Capital Asset Pool and C.C.A.: User Capital Equipment of RCC's

Let $UCAP_t$ = User Capital Asset Pool at end of Year t

Let $PSUC_t$ = Proceeds of Sale of User Capital Items during Year t by RCC's. Assumed to be zero.

With $TUCI_t$ = as before, the user capital investment going into the Pool during year t.

Then the Pool Total in Year t before CCA deduction for user capital equipment is:

$(UCAP_{t-1} - PSUC_t + TUCI_t)$

And the CCA deduction for user capital equipment is $CCAUC_t$

Where $CCAUC_t = Z_2[UCAP_{t-1} - PSUC_t + \frac{TUCI_t}{2}]$ **EQ. #136**

Where Z_2 is the CCA rate on the user capital pool in Year t, and recognizing that only one half of a new capital acquisition is eligible for CCA in the year of acquisition. $Z_2 < 1.0$, and is in decimal notation.

EQ. #137

Then: $UCAP_t = [UCAP_{t-1} - PSUC_t + TUCI_t] - Z_2[UCAP_{t-1} - PSUC_t + \frac{TUCI_t}{2}]$

The Salvage Value at the end of the Project is $UCAP_t$, when t is the final year.

$$UCSV_N = \sum_{X=0}^{6} (100\% - (X \times 15\%)) \times TUECI_{(t-X)}$$

Where $TUECI_t$ is the total incremental investment in user equipment capital items in year t.

Taxable Net Revenue for Year and Taxes Paid: All In Incremental Terms

Taxable net revenue to RCC_t = $[REV_t - COST_t - CCAFC_t - CCAUC_t]$

EQ. #138

TTP_t = Incremental total taxes paid = $y.[REV_t - COST_t - CCAFC_t - CCAUC_t]$

Where $y < 1.0$ and is in decimal terms, and is the appropriate assumed marginal tax rate on the incremental taxable net revenue to RCC.

Salvage Value of Fixed Capital Items and User Capital Equipment

Fixed capital items salvage value in Final Year N is $FCAP_t$ when t has the value N and therefore is $FCAP_N$

$FCSV_N$ **EQ. #139**

And similarly for User Capital Equipment Salvage value, UCSV:

$UCSV_N$ **EQ. #140**

EQ. #141

And Total Salvage Value Proceeds $TSV_N = FCSV_N + UCSV_N$

Cash Flow to RCC in Year T

Cash Flow = Revenues - Expenses - Taxes Paid - Capital Expenditures

$CF_t = REV_t - COST_t - TTP_t - TAI_t$

for all years from t = 1 to N-1., where N is the final year of the Project

In Year N: When t = N

$CF_N = REV_N - COST_N - TTP_N - TAI_N + TSV_N$

Each of these Cash Flows CF_t from t = 1----N are Present Valued, and added together to give the Net Present Value (NPV) of the MSAT Project.

if NPV > 0 Accept Project
if NPV < 0 Reject Project

Additional Equation to Model:

Maintenance Expense on Fixed Capital Equipment:

This maintenance expense is related to the # of units, or the commulative real capital stock. This latter item is given by RFCS - the required fixed capital stock in year t.

From Equation #111. $RFCS_t = AFI_t \times (RS + TS + 0.1DS)$

Setting this annual maintenance expense equal to Cost Item C_2, we have:

$C_{2t} = (MCFC.RFCS_t)$ **EQ. #142**

Where MCFC = Annual Maintenance cost per dollar of Capital Equipment in Constant $.
It is assumed that MCFC is a constant % each year and reflects preventative maintenance as well as any repairs.

This Cost C_{2t} will therefore be a value that changes over time, and is not a constant. It is in real terms. In the model, it has been included as a cost element under section of MRS costs.

Additional Equations to Provide Certain Summary Items in Real Terms:

EQ. #150

Real Total Revenues to RCC from MSAT = $\frac{REV_t}{(1+i)^{t-1}}$

Real Total Expenses to RCC from MSAT = $\frac{COST_t}{(1+i)^{t-1}}$ EQ. #151

Real Fixed Plus User Capital Investment In MSAT Equipment = $TFCI_t + TUECI_t$ EQ. #152

Real Incremental Taxes Paid = $\frac{TTP_t}{(1+i)^{t-1}}$ EQ. #153

(TTP_t is specified in Eq. #138

Real Salvage Value of Fixed Plus User Capital Equipment = $\frac{TSV_N}{(1+i)^{N-1}}$ EQ. #154

SECTION 15.0

ECONOMIC MODEL INPUTS - DERIVATION

ECONOMIC MODEL INPUTS - DERIVATION

(1) TOTAL UNITS - MSAT

The total MSAT units to be serviced by the RCCs was derived as follows:

STEP 1 - DERIVE T_S, T_T AND M_S

T_S - TERRESTRIAL SAMPLE

- For each service the terrestrial sample was based on the RCC inputs
- Adjustments were made to sample data for:
  - high forecasts in comparison to other inputs from RCCs of similiar size and geographic location
  - unusual growth rates between various point years

T_T - TERRESTRIAL AGGREGATED UNITS

MRS, MPS - 1983 Terrestrial Units were based on DOC licensee data - total channels in rural and urban areas and the average units/channel based on the RCC inputs

MPS - 1988 Terrestrial Units - RCC Inputs

MRS - (1988-2002) - Terrestrial Units
This forecast was derived based on the 1983 T_T/T_S ratio x Terrestrial Sample forecast.
ie (1983 T_T/T_S x T_S (of appropriate year))

MPS - (1993-2002) - Terrestrial Units
This forecast was derived based on the T_T/T_S ratio x Terrestrial Sample forecast.
The T_T/T_S ratio is an average of the 1983 T_T/T_S ratio and 1988 T_T/T_S ratio

M_S - MSAT SAMPLE

- For each service, the MSAT Sample was based on the RCC inputs
- Adjustments were made to sample data for:
  - high forecasts in comparison to other inputs from RCCs of similar size and geographic location
  - unusual growth rates between various point years

STEP 2 - DERIVE M_T

M_T - AGGREGATED MSAT UNITS

MRS, MPS - Based on T_T/T_S x MS
(For MPS, the T_T/T_S ratio is an average of the 1983 T_T/T_S ratio and 1988 T_T/T_S ratio)

- Adjustments made:
  - Reduction to exclude minor metropolitan RCCs and 1/2 minor rural RCCs

MTS - Based on T_T/T_S x M_S

MDS - DACS only - Based on T_T/T_S x M_S

- The T_T/T_S ratio used is the MRS 1983 T_T/T_S

- Adjustments Made:

MTS - Reduction based on the percentage of respondents in Baseline Questionnaire **not** intending to get involved in MSAT MTS (PART C)

MDS - Reduction based on the percentage of respondents in Baseline Questionnaire **not** intending to get involved in MSAT MDS DACS - PART C

(2) A_1: PERCENTAGE OF UNITS SWITCHING OVER

- Based on RCC inputs to In-depth Questionnaire
- Average of all inputs taken
- Adjustments made for high and low projections
- Between point years, a straight line projection was used.

(3) WO - % of Units Replaced per Year

- Based on MSAT/RCC revised study plan and methodology (attachment 3)

(4) AP - Promotional Cost - % of Revenue

- Based on an average of RCC inputs from In-depth Questionnaire
- Adjustments made for high and low projections

(5) AFI - Average Fixed Investment/Unit

- Methodology based on MSAT/RCC revised study plan and methodology

MRS - Attachment 8 explains how the ratio of UHF to SHF base stations was derived.

- Using the prices of the various sizes of SHF base stations as stated in the "Socio-economic Input Study Assumptions" (attachment 7), derive the average fixed investment/unit on SHF for the following utilizations.

89	90	91	92	93 - 2002
50%	60%	70%	80%	85%

- All UHF base stations are assumed to be customer owned.

Example: Base Stations SHF(5 channel) - 2
SHF(10 channel) - 2

Total investment in SHF Base Stations (includes federal sales tax and installation): 2 x ($100,000 x 1.1 + $30,000) +
2 x ($150,000 x 1.1 + $30,000)
= $670,000

Yearly Incremental Units Added = 1400

$$\text{AFI (Overall)} = \frac{\$670,000}{1400} = \$478.57/\text{unit}$$

DACS - alarm is 1/160 of MRS average fixed investment because we can put 106 times as many DACS units per channel as MRS units. DACS polling is 1/3 of MRS average fixed investment

MTS - All units are on SHF
- Use same percentage utilization as MRS to calculate AFI for 1989/1990/1991/1992 and 1993-2002

MPS - Linking applications only are considered since RCCs feel this is the only viable applications for MSAT MPS.
- All units are on UHF
- MPS is 1/190 of MRS average fixed investment because we can put 190 times as many MPS units per channel as MRS units

(6) PSHF: PROPORTION OF TOTAL AIRTIME MINUTES ON SHF

MRS, MPS - Based on the ratio of UHF and SHF Base Stations and capacities

MTS - 0.95 since all units operate through SHF but some UHF mobile to UHF mobile calls are assumed.

DACS - 1.0 since all units operate through SHF

(7) LS_1 & RA_1 - PERCENTAGE OF SWITCHOVER AND ADDITIONAL UNITS RENTED OUT

MRS, MPS - Based on In-depth participants response to % of MSAT units to be rented out

DACS, MTS - Same ratio assumed as for MRS

(8) P: - REPLACEMENT OF FIXED INVESTMENT

- Based on MSAT/RCC revised study plan and methodology (Attachment 3)

(9) AC: - ACCESS CHARGE/UNIT/MONTH

- Based on the RCC charges of $19/$1000 (2.4%) of capital investment calculated on a monthly per unit basis
- Then adding to this recovery of the Telesat access charge marked up 25%

(10) AC_2: - RCC ACCESS COST/UNIT/MONTH

- Telesat charge
- For MPS, the access cost is divided by the No. of units and works out to an insignificant amount.

(11) AT_1: - SHF AIRTIME CHARGES/MINUTE

- Based on Telesat airtime charge marked up by 25%

(12) $UHFP_1$: PREMIUM FOR UHF AIRTIME

- Telesat UHF airtime cost divided by SHF airtime cost (1.6)

13) IR_1: INSTALLATION CHARGE/INSTALLATION

MRS, DACS, MTS - Based on in-depth inputs averaged
MPS - $0; no installation required

(14) REP_1: - REPAIR CHARGE/REPAIR

MRS, DACS, MTS - Based on in-depth inputs averaged
MPS - Based on repair charge for a terrestrial unit

(15) LTC_1: - LABOUR TRAINING COSTS/UNIT/ANNUM

- The RCCs training costs were provided in the questionnaire.
- This was divided by total units to be served in year 2002.
- This was then divided by the 14 year study period to arrive at an average cost/unit/annum.

All other model inputs were based on the data collected in the in-depth interviews being averaged. Adjustments were made to unusually high or low inputs.

SECTION 16.0

THE SOCIO-ECONOMIC INPUT

STUDY ASSUMPTIONS

THE SOCIO-ECONOMIC INPUT STUDY ASSUMPTIONS

MSAT PROGRAM OFFICE
October 1984
J.H.C. Braden

INTRODUCTION

This document summarizes various key assumptions on the prices, costs, supply and demand for MSAT equipment and airtime to be used on the various socio-economic study contractors. It is based largely on information supplied by Telesat, the outputs of various internal and other studies, and on information supplied by the manufacturing industry to DOC. It updates and greatly expands upon the information contained in the February 1984 document entitled "Socio-Economic Study Assumptions on Costs, Services and Traffic."

For the purposes of these studies, it has been assumed that the first MSAT spacecraft is launched as of January 1989. The study period covers two generations of satellites and contains information on a Canada Only option, and also on a Canada/US option where it is assumed that there would be some mutual procurement and backup of services. Furthermore, it has been assumed that for the first generation system, 2+2 MHz would be available in Canada and for the second generation this would be increased to 4+4 MHz.

The document contains: market projections for the demand for Mobile Radio, Mobile Telephone, Data Acquisition and Control (DACS), and Paging services; the capacity of both first and second generation satellite systems (some are power limited, others are spectrum limited); the assumed launch, type and ownership of the spacecraft; quantities and wholesale prices of the spacecraft, central control station, base stations, gateways and mobile terminals; the level and type of traffic; channel loadings; the assumed type and level of government supported non-recurring engineering needed; etc.

The material has been prepared with the co-operation of Telesat, Telecom Canada, KVA Communications Ltd., Canadian Marconi Company, ADGA, NovaTel, Spar, Scotcomm, SED, Sinclair Radio, Andrew Antenna, Mobile Data Inc., Glenayre, Motorola, and the MSAT Project Office.

Appreciation is extended to all those who have participated in this effort.

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TABLE 1: INSTALLATION, MAINTENANCE AND EQUIPMENT LIFE ASSUMPTIONS FOR BASE STATIONS AND GATEWAYS

CLASS/TYPE	CAPACITY (no. of mobiles) 75 Percent Utilization	LABOUR HOURS			ANNUAL MATERIAL COSTS IN CONSTANT 1984 DOLLARS		LIFE (YRS)	
		Installation	Annual Mtce	Removal	Installation and Refurbish	Repair/Yr	Equipment	Locatio
Base Stations								
UHF - Private								
1 - channel	50	4	6	2	50	100	7	7
2 - channels	100	4	6	2	100	100	7	7
3 - channels	150	6	12	2	200	100	7	7
4 - channels	200	6	12	2	200	150	7	7
5 - channels	250	6	12	2	200	150	7	7
SHF - Private								
1 - channel	50	450	24	26	11,000	2,500	15	15
2 - channels	100	450	24	26	11,000	3,000	15	15
3 - channels	150	450	24	26	11,000	3,500	15	15
4 - channels	200	450	24	26	11,000	4,000	15	15
5 - channels	250	450	36	26	11,000	5,000	15	15
SHF - Common								
5 - channels	250	480	24	26	11,000	5,000	15	15
7 - channels	350	480	24	26	11,000	5,500	15	15
10 - channels	500	480	36	26	11,000	6,200	15	15
Gateways								
5 - channels	196	500	35	26	14,000	5,000	15	15
7 - channels	313	500	36	26	14,000	5,500	15	15
10 - channels	482	500	40	26	14,000	6,200	15	15

NOTE: Loading for Private and Common Base Stations, used for Mobile Radio Dispatcher are based on DOC Channel Loading Guidelines (Policy for Licensing of Mobile Radio Trunked Systems dated December 1982). Gateway capacities are base on Modified Erlang C using a 15 percent blocking factor, and peak erlangs/mobile of .0106.

TABLE 2: INSTALLATION, MAINTENANCE AND EQUIPMENT LIFE ASSUMPTIONS FOR MOBILE TERMINALS

CLASS/TYPE	LABOUR HOURS PER			MATERIAL COSTS IN CONSTANT 1984 DOLLARS PER		LIFE (YRS)	
	Installation	Removal	Repair	Installation & Refurbish	Repair	Equipment	Location
Land Mobile Radio	3	1	3	100	50	7	3
Mobile Telephone	3	1	3	100	50	7	3
Fixed Link Paging*	0	0	1	--	0	7	0
DACS							
- Alarm	8	7	8	200	50	7	7
- Polling	16	15	16	200	50	7	7

NOTE: - Costs are in current 1984 dollars. Current dollar estimates can be obtained by inflating these costs by the cost deflator/inflator factors contained in the annual costs and quantities contained in a subsequent section of this report (a 5 percent annual growth rate)

- Labour hours and material costs include the antenna

- It is assumed that the equipment and service location life of the mobile antennas is the same as the radio itself.

* These are personal pagers operating through terrestrial base stations which interconnect with MSAT satellite for fixed communications.

TABLE 3: TRAFFIC ASSUMPTIONS BY CLASS OF SERVICE

Class/Type	Peak Usage Erlang/Mobile	Monthly Usage Avg Min/Mo/Mobile	Avg. Call Length in Minutes	Monthly Calls	Attempts Per Call
Mobile Radio	.0106	150	1.0	150	1.2
Mobile Telephone	.0106	150	2.0	75	1.2
Mobile Paging	small	6.5	--	--	--
DACS					
- Alarm	.0001	2	.067	30	--
- Polling	.0035	50	.067	750	--

YEAR

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Total System Capacity in Number of MTS and MRS Users																		
- Canada only system					35,000	39,000	39,000	39,000	39,000	39,000	39,000	105,000	105,000	105,000	105,000	105,000	105,000	105,000
- Canada/US system					17,500	17,500/ 35,000	35,000	35,000	35,000	35,000	35,000	54,500	54,500/ 74,000	74,000	74,000	74,000	74,000	74,000
Number of Users-Canada Only																		
- MRS					1,835	6,505	13,126	20,593	27,843	28,752	28,752	35,973	42,579	47,953	51,832	54,175	55,632	56,854
- MTS					665	2,245	4,374	6,907	9,657	10,249	10,249	12,910	15,281	17,211	18,601	19,443	19,965	20,404
- Paging					31,150	37,760	45,707	54,839	65,209	75,880	88,060	101,343	114,140	128,536	146,223	168,159	190,556	224,817
- DACS - Alarm					935	1,095	1,318	1,693	2,228	2,736	3,361	4,112	4,900	5,804	6,703	7,656	8,499	9,362
- Polling					865	2,805	5,182	6,907	8,272	9,564	10,639	11,582	12,400	13,096	13,697	14,244	14,801	15,338
TOTAL DACS					1,800	3,900	6,500	8,600	10,500	12,300	14,000	15,700	17,300	18,900	20,400	21,900	23,300	24,700
Number of Users-Canada/US																		
- MRS					1,835	6,505	13,126	20,593	25,971	25,971	25,971	33,118	40,045	45,939	50,429	53,329	54,457	54,457
- MTS					665	2,245	4,374	6,907	9,030	9,030	9,030	11,885	14,372	16,487	18,098	19,139	19,543	19,543
- Paging					31,150	37,760	45,707	54,839	65,209	75,880	88,060	101,343	114,140	128,536	146,223	168,159	190,556	224,817
- DACS - Alarm					935	1,095	1,318	1,693	2,228	2,736	3,361	4,112	4,900	5,804	6,703	7,656	8,499	9,362
- Polling					865	2,805	5,182	6,907	8,272	9,564	10,639	11,582	12,400	13,096	13,697	14,244	14,801	15,338
TOTAL DACS					1,800	3,900	6,500	8,600	10,500	12,300	14,000	15,700	17,300	18,900	20,400	21,900	23,300	24,700
Percent Switchover																		
- MRS					19.3	13.7	12.2	10.7	7.9	6.5	4.6	2.6	2.4	2.4	2.4	2.4	2.4	2.4
- MTS					5.0	3.0	2.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
- Paging					0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
- DACS					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NOTE: Switchovers are existing customers of Service Providers (i.e. non-Private) who replace their conventional terrestrial equipment with MSAT.																		
Mix of MTS and MRS Traffic																		
Percent MRS Traffic					75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
Percent MTS Traffic					25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Mix of MRS Traffic																		
Percent UHF-UHF Traffic					9.5	9.7	10.0	10.3	10.5	10.8	11.0	11.2	11.4	11.6	11.8	11.9	12.0	12.0
Percent UHF-SHF Traffic					90.5	90.3	90.0	89.7	89.5	89.2	89.0	88.8	88.6	88.4	88.2	88.1	88.0	88.0
Mix of Total MRS and MTS																		
Percent UHF-UHF Traffic					7.1	7.3	7.5	7.7	7.9	8.1	8.3	8.4	8.6	8.7	8.8	8.9	9.0	9.0
Percent UHF-SHF Traffic					92.9	92.7	92.5	92.3	92.1	91.9	91.7	91.6	91.4	91.3	92.2	91.1	91.0	91.0
NOTE: All MTS Traffic is UHF-SHF while MRS is a mixture of UHF-UHF and UHF-SHF as noted above. All MTS traffic is carried via an SHF Gateway. All MRS UHF-UHF traffic is carried via a Private UHF base while MRS UHF-SHF traffic is served on a mixture of Private and Common SHF bases.																		

YEAR

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Number of MRS and MTS Users Served on Gateways and Base Stations																		
Canada Only Option																		
UHF Private Bases					263	1056	2038	3735	5050	5214	5214	7112	8561	9642	10624	11353	11836	11432
SHF Private Bases					112	444	855	1227	1658	1712	1712	1940	2337	2631	2899	3098	3053	3120
SHF Common Bases					1460	5305	10233	15631	21135	21826	21816	26931	31681	35680	38309	39724	41392	42302
SHF Gateways					665	2245	4374	6907	9657	10249	10249	12910	15281	17211	18601	19443	19965	20404
Number of MRS and MTS Users Served on Gateways and Base Stations																		
Canada/US Option																		
UHF Private Bases					263	1056	2038	3735	4710	4710	4710	6689	8051	9238	10140	10723	10950	10950
SHF Private Bases					112	444	855	1227	1546	1546	1546	1816	2198	2521	2767	2921	2988	2988
SHF Common Bases					1460	5305	10233	15631	19715	19715	19715	24643	29796	34180	37522	39679	40519	40519
SHF Gateways					665	2245	4374	6907	9030	9030	9030	11885	14372	16487	18098	19139	19543	19543
Number of Base Stations Canada Only Option																		
-UHF (Non-Redundant Half Duplex)																		
- 1 Channel					32	118	227	389	540	570	570	730	870	970	1060	1110	1130	1160
-SHF (Non-Redundant Half Duplex)																		
- 2 Channels					1	4	7	10	13	14	14	16	19	21	22	23	24	25
- 3 Channels					1	3	5	8	10	10	10	14	16	18	19	19	20	20
- 4 Channels					1	2	4	5	6	6	6	6	7	9	9	10	10	10
- 5 Channels					2	6	12	7	7	7	7	4	5	5	7	7	7	7
- 7 Channels					1	2	4	6	6	6	6	3	4	5	5	5	5	6
- 10 Channels					2	7	14	25	36	38	38	49	59	65	71	73	74	76
TOTAL					8	24	46	61	79	81	81	92	110	123	134	138	141	145
Number of Base Stations Canada/US Option																		
-UHF (Non-Redundant Half Duplex)																		
- 1 Channel					32	118	227	389	491	491	491	674	815	935	1026	1085	1108	1108

YEAR

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
-SHF (Non-Redundant for Half Duplex MRS)																		
- 1 Channel					0	0	0	0	0	0	0	0	0	0	0	0	0	0
- 2 Channels					1	4	7	10	12	12	12	15	18	20	22	24	24	24
- 3 Channels					1	3	5	8	10	10	10	12	15	17	19	20	20	20
- 4 Channels					1	2	4	5	6	6	6	6	7	8	9	10	10	10
- 5 Channels					2	6	12	7	9	9	9	4	5	6	6	7	7	7
- 7 Channels					1	2	4	6	8	8	8	3	4	4	5	5	5	5
- 10 Channels					2	7	14	25	31	31	31	46	55	63	69	73	75	75
TOTAL					8	24	46	61	76	76	76	86	104	118	130	139	139	139
Number of Gateways (Non-Redundant Full Duplex)																		
Canada Only Option																		
- 5 Channels					6	6	6	6	6	6	6	6	6	6	6	6	6	6
- 10 Channels					6	6	7	12	18	19	19	24	29	33	36	38	39	40
TOTAL					12	12	13	18	24	25	25	30	35	39	42	44	45	46
Canada/US Option																		
- 5 Channels					6	6	6	6	6	6	6	7	8	8	8	8	8	8
- 10 Channels					6	6	7	12	16	16	16	22	27	31	34	36	37	37
TOTAL					12	12	13	18	22	22	22	29	35	39	42	44	45	45
Spacecraft - Canada Only																		
Launch Date					Jan.	Jul.						Jan.	Jul.					
Type					PAM-D	PAM-D						PAM-D II	PAM-D II					
Ownership					Can.	Can.						Can.	Can.					
Spacecraft - Canada/US																		
Launch Date					Jan.	Jul.						Jan.	Jul.					
Type					PAM-D	PAM-D						PAM-D II	PAM-D II					
Ownership					Can.	U.S.						Can.	U.S.					
EQUIPMENT PURCHASES																		
1. Canada Only Option																		
Terminals - Mobile Radio					1,835	4,670	6,621	7,467	7,250	909	0	9,056	11,276	11,995	11,346	9,593	2,366	1,000
- Mobile Telephone					665	1,580	2,129	2,533	2,750	592	0	3,326	4,059	4,059	3,923	3,592	1,114	439
- Paging					31,150	6,610	7,947	9,132	10,370	10,671	12,180	44,433	19,407	22,343	26,819	32,306	33,068	46,441
- DACS					1,800	2,100	2,600	2,100	1,900	1,800	1,700	3,500	4,200	4,200	3,600	3,400	3,200	3,100
Base Stations-																		
UHF - 1 Channel					32	86	119	162	151	30	0	160	140	100	90	50	20	30
SHF - 2 Channels					1	3	3	3	3	1	0	2	3	2	1	1	1	
- 3 Channels					1	2	2	3	2	0	0	4	2	2	1	0	1	0
- 4 Channels					1	1	2	1	1	0	0	0	0	2	0	1	0	0
- 5 Channels					2	4	6	0	0	0	0	0	1	0	2	0	0	0
- 7 Channels					1	1	2	2	0	0	0	0	1	1	0	0	0	1
-10 Channels					2	5	7	6	11	2	0	5	10	6	6	2	1	2
SHF Gateways																		
- 5 Channels					6	0	0	0	0	0	0	0	0	0	0	0	0	0
-10 Channels					6	0	1	5	6	1	0	5	5	4	3	2	1	1

Note: Add 10% for inventory

YEAR

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Substitution of Conventional Mobile Terminals: Mobile Radio					970	1569	1522	1155	833	356	350	972	1231	1224	985	762	920	411
Mobile Telephone					19	21	16	10	6	6	6	23	23	16	11	6	6	6
Paging					0	0	0	0	0	0	0	0	0	0	0	0	0	0
DACS					0	0	0	0	0	0	0	0	0	0	0	0	0	0
NOTE: Substitution is the reduction in the number of potential terrestrial mobile purchases due to the impact of MSAT on replacements and new demand.																		
2. Canada U/S Option																		
Terminals - Mobile Radio					1,835	4,670	6.621	7,467	5,378	-	-	8,892	11,597	11,621	11,957	2,900	1.122	6
- Mobile Telephone					665	1,580	2,129	2,533	2,123	-	-	3,520	4,067	4,244	4,144	3,164	404	-
- Paging					31,150	6,610	7,947	9,132	10,370	10,671	12,180	44,150	19,397	22,343	26,819	32,306	33,068	46,441
- DACS					1,800	2,100	2,600	2,100	1,900	1,800	1,700	3,500	3,700	4,200	3,600	3,400	3,200	3,100
Base Stations-																		
UHF - 1 Channels					32	86	119	162	102	0	0	183	141	120	91	59	23	0
SHF - 2 Channel					1	3	3	3	2	0	0	3	3	2	2	2	0	0
- 3 Channels					1	2	2	3	2	0	0	2	3	2	2	1	0	0
- 4 Channels					1	1	2	1	1	0	0	0	1	1	1	1	0	0
- 5 Channels					2	4	6	0	2	0	0	0	1	1	0	1	0	0
- 7 Channels					1	1	2	2	2	0	0	0	1	0	1	0	0	0
-10 Channels					2	5	7	6	6	0	0	5	9	8	6	4	2	0
SHF Gateways																		
- 5 Channels					6	0	0	0	0	0	0	1	1	0	0	0	0	0
-10 Channels					6	0	1	5	4	0	0	6	5	4	3	2	1	0
Note: Add 10% for inventory																		
Substitution of Conventional Mobile Terminals: Mobile Radio					970	1569	1522	1155	615	315	315	932	1259	1176	969	511	370	368
Mobile Telephone					19	21	16	10	6	6	6	23	23	16	11	6	6	6
Paging					0	0	0	0	0	0	0	0	0	0	0	0	0	0
DACS					0	0	0	0	0	0	0	0	0	0	0	0	0	0
NOTE: Substitution is the reduction in the number of potential terrestrial mobile purchases due to the impact of MSAT on replacements and new demand.																		
Central Control Station																		
Delivery Date-Canada Only				Jul.														
Delivery Date-Canada/US						Jan.												

YEAR

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Price Inflators/Deflators Constant to Current Dollars	1.0500	1.1025	1.1576	1.2155	1.2763	1.3401	1.4701	1.4775	1.5513	1.6289	1.7103	1.7959	1.8856	1.9799	2.0789	2.1829	2.2920	2.4066
Central Control Station (Wholesale Costs in Constant 1984 Dollars)																		
Canada Only Option (in $ million)			11.65									1.11						
Canada/US Option (in $ million)			11.65									1.11						
Assumes 2+2 MHz in Canada for first generation and 4+4 MHz in Canada for second generation. Includes 10% Federal Sales Tax																		
Base Stations (Wholesale Costs in Constant 1984 dollars)																		
UHF Private (Non-Redundant Half Duplex)																		
- 1 Channel					2450	2389	2329	2271	2214	2159	2105	2052	2052	2052	2052	2052	2052	2052
- 2 Channels					4050	3949	3850	3754	3660	3568	3479	3392	3392	3392	3392	3392	3392	3392
- 3 Channels					5616	5476	5339	5205	5075	4948	4825	4704	4704	4704	4704	4704	4704	4704
- 4 Channels					7250	7069	6892	6720	6552	6388	6228	6073	6073	6073	6073	6073	6073	6073
- 5 Channels					9250	9019	8793	8573	8359	8150	7946	7748	7748	7748	7748	7748	7748	7748
SHF Private (Non-Redundant Half Duplex)																		
- 1 Channel					83,290	82,984	82,679	82,347	82,071	81,769	81,468	81,168	81,168	81,168	81,168	81,168	81,168	81,168
- 2 Channels					88,009	87,424	86,842	86,265	85,691	85,121	84,555	83,993	83,993	83,993	83,993	83,993	83,993	83,993
- 3 Channels					92,728	91,836	90,953	90,078	89,211	88,553	87,503	86,661	86,661	86,661	86,661	86,661	86,661	86,661
- 4 Channels					99,870	98,710	97,563	96,430	95,310	94,203	93,109	92,027	92,027	92,027	92,027	92,027	92,027	92,027
- 5 Channels					107,111	105,554	104,118	102,701	101,303	99,924	98,564	97,223	97,223	97,223	97,223	97,223	97,223	97,223
SHF Common (Non-Redundant Half Duplex) - 5 Channels					109,345	107,857	106,389	104,941	103,513	102,104	100,715	99,344	99,344	99,344	99,344	99,344	99,344	99,344
- 7 Channels					122,312	120,165	118,056	115,984	113,949	111,949	109,984	108,054	108,054	108,054	108,054	108,054	108,054	108,054
- 10 Channels					135,278	132,371	129,526	126,743	124,019	121,354	118,746	116,194	116,194	116,194	116,194	116,194	116,194	116,194
Note-These are non-installed costs and include minimal non-recurring engineering. (Assumes gov't funding to cover cost of most non-recurring engineering.) 10% federal sales tax excluded.																		
Gateway Costs (Wholesale Costs in Constant 1984 dollars)																		
SHF Common (Non-Redundant)																		
- 5 Channels					126,000	124,000	122,000	121,000	119,000	117,000	115,000	114,000	114,000	114,000	114,000	114,000	114,000	114,000
- 7 Channels					141,000	139,000	136,000	134,000	131,000	129,000	126,000	124,000	124,000	124,000	124,000	124,000	124,000	124,000
- 10 Channels					156,000	152,000	149,000	146,000	142,000	139,000	136,000	133,000	133,000	133,000	133,000	133,000	133,000	133,000
Note-These are non-installed costs and include minimal non-recurring engineering. (Assume gov't funding to cover cost of most non-recurring engineering.) 10% federal sales tax excluded.																		

	YEAR																	
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Wholesale Cost of Mobile Terminals (Constant 1984 dollars)																		
Land Mobile Radio					2500	2461	2422	2385	2348	2312	2277	2242	2242	2242	2242	2242	2242	2242
Mobile Telephone					3250	3197	3139	3085	3032	2981	2931	2882	2882	2882	2882	2882	2882	2882
Mobile Paging					1600	1581	1562	1544	1526	1509	1492	1475	1475	1475	1475	1475	1475	1475
-in vehicle, tone only																		
-portable hand held using fixed link transmission, tone only					200	200	200	200	200	200	200	200	200	200	200	200	200	200
-in vehicle/portable hand held, tone only, using vehicle re-transmission					1800	1781	1762	1744	1726	1709	1692	1675	1675	1675	1675	1675	1675	1675
Mobile Data Terminal including display					4750	4660	4572	4486	4402	4320	4239	4161	4161	4161	4161	4161	4161	4161
Data Acquisition and Control (DACS)																		
- Alarm					3700	3626	3553	3482	3413	3345	3279	3214	3214	3214	3214	3214	3214	3214
- Polling					2000	1964	1929	1894	1861	1828	1796	1764	1764	1764	1764	1764	1764	1764
These include the antennas ($750 for mobile and $400 for fixed.) Excludes 10% Federal Sales Tax																		
Level of Non-recurring Engineering Required (Constant 1984 Dollars)																		
Earth Segment	500,000	500,000	500,000	500,000														
Space Segment	500,000	500,000	500,000	500,000														
Telesat Monthly Access Charge																		
Wholesale in Current Dollars																		
- Mobile Radio Service	-	-	-	30.00	30.00	30.00	30.00	34.00	34.00	34.00	34.00	39.50	39.50	39.50	44.50	44.50	44.50	44.50
- Mobile Telephone Service	-	-	-	30.00	30.00	30.00	30.00	34.00	34.00	34.00	34.00	39.50	39.50	39.50	44.50	44.50	44.50	44.50
- Mobile Paging (Fixed link)				30.00	30.00	30.00	30.00	34.00	34.00	34.00	34.00	39.50	39.50	39.50	44.50	44.50	44.50	44.50
- Mobile Paging (In-vehicle)	-	-	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
- DACS	-	-	-	10.00	10.00	10.00	10.00	11.35	11.35	11.35	11.35	13.15	13.15	13.15	14.85	14.85	14.85	14.85
Wholesale in Constant 1984 Dollars																		
- Mobile Radio Service	-	-	-	24.68	23.50	22.39	21.32	~~20.39~~	~~19.33~~	~~18.42~~	~~17.54~~	21.99	20.95	19.95	21.41	20.39	19.42	18.49
- Mobile Telephone Service	-	-	-	24.68	23.00	22.39	21.32	~~20.30~~	19.33	18.42	17.54	21.99	20.95	19.95	21.41	20.39	19.42	18.49
- Mobile Paging Service	-	-	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
- DACS	-	-	-	8.22	7.83	7.46	7.11	~~6.77~~	6.44	6.14	5.85	7.33	6.98	6.65	7.14	6.80	6.47	6.16
n/a = non-applicable																		
Retail in Constant 1984 Dollars																		
- Mobile Radio Service				30.85	29.38	28.00	26.65	25.38	24.16	23.03	21.93	27.50	26.18	24.99	26.76	25.49	24.28	23.11
- Mobile Telephone Service				30.85	29.38	28.00	26.65	25.38	24.16	23.03	21.93	27.50	26.18	24.99	26.76	25.49	24.28	23.11
- Mobile Paging (Fixed link)				30.85	29.38	28.00	26.65	25.38	24.16	23.03	21.93	27.50	26.18	24.99	26.76	25.49	24.28	23.11
- Mobile Paging (In-vehicle)				n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
- DACS				10.28	9.79	9.33	8.89	8.46	8.05	7.68	7.32	9.16	8.72	8.31	8.93	8.50	8.08	7.70
Example of a 25% Markup on Wholesale Costs in Constant 1984 Dollars																		

	YEAR																	
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Airtime Equivalent Cost/min in Current Dollars (Wholesale)																		
Mobile Radio																		
UHF-SHF				1.50	1.50	1.50	1.50	1.70	1.70	1.70	1.70	2.00	2.00	2.00	2.20	2.20	2.20	2.20
UHF-UHF				2.40	2.40	2.40	2.40	2.70	2.70	2.70	2.70	3.20	3.20	3.20	3.50	3.50	3.50	3.50
Mobile Telephone																		
UHF-SHF				1.50	1.50	1.50	1.50	1.70	1.70	1.70	1.70	2.00	2.00	2.00	2.20	2.20	2.20	2.20
Mobile Paging (fixed link)																		
UHF-SHF				1.50	1.50	1.50	1.50	1.70	1.70	1.70	1.70	2.00	2.00	2.00	2.20	2.20	2.20	2.20
UHF-UHF				2.40	2.40	2.40	2.40	2.70	2.70	2.70	2.70	3.20	3.20	3.20	3.50	3.50	3.50	3.50
Mobile Paging (in-vehicle)																		
UHF-SHF (4 sec. pkg.)				0.40	0.40	0.40	0.40	0.50	0.50	0.50	0.50	0.55	0.55	0.55	0.60	0.60	0.60	0.60
UHF-UHF (" ")				0.65	0.65	0.65	0.65	0.80	0.80	0.80	0.80	0.90	0.90	0.90	0.95	0.95	0.95	0.95
DACS																		
UHF-SHF (4 sec. pkg.)				0.40	0.40	0.40	0.40	0.50	0.50	0.50	0.50	0.55	0.55	0.55	0.60	0.60	0.60	0.60
Airtime Equivalent Cost/min in Wholesale in Constant 1984 Dollars																		
Mobile Radio																		
UHF-SHF				1.23	1.18	1.12	1.07	1.15	1.10	1.04	0.99	1.11	1.06	1.01	1.06	1.00	0.96	0.91
UHF-UHF				1.97	1.88	1.79	1.71	1.83	1.74	1.66	1.58	1.78	1.70	1.62	1.68	1.60	1.53	1.45
Mobile Telephone																		
UHF-SHF				1.23	1.18	1.12	1.07	1.15	1.10	1.04	0.99	1.11	1.06	1.01	1.06	1.00	0.96	0.91
Mobile Paging (fixed link)																		
UHF-SHF				1.23	1.18	1.12	1.07	1.15	1.10	1.04	0.99	1.11	1.06	1.01	1.06	1.00	0.96	0.91
UHF-UHF				1.97	1.88	1.79	1.71	1.83	1.74	1.66	1.58	1.78	1.70	1.62	1.68	1.60	1.53	1.45
Mobile Paging (in vehicle)																		
UHF-SHF (4 sec. pkg.)				0.33	0.31	0.30	0.28	0.34	0.32	0.31	0.29	0.31	0.29	0.28	0.29	0.27	0.26	0.25
UHF-UHF (" ")				0.53	0.51	0.49	0.46	0.54	0.52	0.49	0.47	0.50	0.48	0.45	0.46	0.44	0.41	0.39
DACS																		
UHF-SHF (4 sec. pkg.)				0.33	0.31	0.30	0.28	0.34	0.32	0.31	0.29	0.31	0.29	0.28	0.29	0.27	0.26	0.25
(Cost of a Paging Call was assumed comparable to DACS)																		
Airtime Equivalent Cost/min in Retail in Constant 1984 Dollars																		
Mobile Radio																		
UHF-SHF				1.54	1.48	1.40	1.34	1.44	1.38	1.30	1.24	1.39	1.33	1.26	1.33	1.25	1.20	1.14
UHF-UHF				2.46	2.35	2.24	2.14	2.29	2.18	2.08	1.98	2.24	2.14	2.03	2.09	2.00	1.92	1.81
Mobile Telephone																		
UHF-SHF				1.54	1.48	1.40	1.34	1.44	1.38	1.30	1.24	1.39	1.33	1.26	1.33	1.25	1.20	1.14
Mobile Paging (fixed link)																		
UHF-SHF				1.54	1.48	1.40	1.34	1.44	1.38	1.30	1.24	1.39	1.33	1.26	1.33	1.25	1.20	1.14
UHF-UHF				2.46	2.35	2.24	2.14	2.29	2.18	2.08	1.98	2.24	2.14	2.03	2.09	2.00	1.92	1.81
Mobile Paging (in-vehicle)																		
UHF-SHF (4 sec. pkg.)				0.41	0.39	0.38	0.35	0.43	0.40	0.39	0.37	0.39	0.36	0.35	0.36	0.34	0.33	0.31
UHF-UHF (" ")				0.66	0.64	0.61	0.58	0.68	0.65	0.61	0.59	0.63	0.60	0.56	0.55	0.55	0.51	0.48
DACS																		
UHF-SHF (4 sec. pkg.)				0.41	0.39	0.38	0.35	0.43	0.40	0.39	0.37	0.39	0.36	0.35	0.36	0.34	0.33	0.31
Example of a 25% Markup on Wholesale Costs in Constant 1984 Dollars																		

SECTION 17.0

TECHNOLOGY REVIEW

1.0 Technology Review

1.1 Trunked Mobile Radio System

Description

A trunked radio system is a method of operation in which a number of radio frequency pairs are assigned to mobiles and base stations in the system, for use as a trunk group. Trunking pools radio channels so all users have automatic access to all channels. This reduces waiting time and increases the channel capacity. Trunked systems also provide additional security, so users cannot monitor calls other than their own.

Trunking was developed in response to a number of needs, currently unmet by conventional mobile radio system design. These include:

- multiple use of mobile repeaters by a number of users
- spectrum efficiency
- improved channel loading and waiting times on shared access repeaters.

To ensure this new technology is implemented in a manner that will not introduce long range problems, a group of frequencies protected from interference from other licensees will be exclusively assigned to one licensee. This licensee must be capable of managing and coordinating a trunked system for all its users.

1.2 Cellular Mobile Telephone

Description

Cellular Mobile Telephone Systems are being developed to overcome the many problems associated with conventional mobile telephone service, which uses one centrally located set of high powered transmitters to communicate with all mobile units in the service area. Channels cannot be reused in the nearby service areas because the transmitted signals are strong enough to interfere with one another. The number of channels is limited and only a small number of simultaneous conversations can be handled. Thus the capacities of

these systems are extremely small, less than 1000 users per service area.

A cellular system divides the service area into subsections, or cells. Each cell is served by low-power transmitters, separate receivers and control systems. The available radio channels, in the 800 MHz band, are allocated among the cell sites. Channels assigned to one cell site can be reused if the sites are far enough apart to prevent interference.

Cell sites are linked to a switching office which is equipped with an electronic switching system. This switch directs the mobile unit to one of the cell sites available voice channels and passes the call on to the telephone network beyond the cellular system to be processed as a conventional call. The major advantages to a cellular system are that a mobile unit has continuous service as it travels through the cellular service area and that the number of simultaneous conversations possible is extremely high because of the re-use of frequencies and the number of frequencies available for each service area. Capacities of 100,000 per service area are realizable.

1.3 Mobile Data

Description

A typical mobile data terminal (MDT) system consists of the following elements, all of which are microprocessor based:

- host computer
- communication controller
- base station controller
- mobile data terminal (MDT)

The MDT is a computer terminal with a keyboard and display, located in the vehicle. The base station controller, which contains a radio modem and control equipment, is the interface between the radio transmitter and receiver. Acting as an interface between the host computer and MDTs, is the communications controller, which converts messages from the host computer protocol format to radio protocol format and vice versa. Dispatch type operations are the prime application for MDT systems. A dispatcher uses a computer terminal with a keyboard to view data transmissions from MDTs in the

field, and to enter dispatches to the computer and transmit them. Both dispatchers and MDTs may access information from the computer directly. The main benefits of digital communications include:

1] Speed - digital communication is much faster than voice transmission. A 2-3 minute voice transmission can be reduced to 10-20 seconds using MDTs.

2] Accuracy - in digital communication, accuracy is ensured through error detection techniques and automatic retransmission when necessary.

3] Privacy - digital communication is almost impossible to intercept and decode without highly sophisticated decoding equipment.

4] Direct Data Base Access - MDTs can gain direct access to a computer data base for routine queries without the assistance of a dispatcher.

Typical applications of MDT systems include:

- courier services
- taxicabs
- fire and emergency medical services
- police
- gas and utility companies

1.4 Vertical Blanking Interval (VBI) and FM Subcarrier

Description

Vertical Blanking Interval - the VBI of a TV transmission, is the period during which the TV picture starts over. It is part of every television signal but does not carry any part of the television picture. The VBI can thus be used to deliver information on consumer television sets. By encoding information into bit streams of digital data at a rate compatible with TV transmission, the bit stream can be multiplexed onto the TV transmission. This data is then broadcast on the unused lines of the VBI to the consumers television set. The information is continuously transmitted by the TV station.

FM Sub Carrier - A portion of the spectrum used for FM broadcast is not used for the transmission of voice or music. In this portion of the spectrum a subcarrier can be used for a variety of point-to-point special services

such as paging, electronic mail, electronic message service or other addressable services. The subcarrier is transmitted simultaneously with the main transmission. Further proposals have been made which would allow several subcarriers to be transmitted simultaneously with the main transmission. The subcarrier may be in operation even if the main channel is not being modulated.

1.5 Air to Ground - MTS

Description

Air to ground mobile telephone has been proposed for operation on commercial aircrafts. Such a system exists today for private business aircraft but the limited number of channels available has prevented introduction of the system on commercial aircraft. While the system concept is simple enough, being a service whereby a passenger can place a telephone call to any telephone through the communication of radio, ground stations and public switched telephone network, the regulatory issues to be addressed are extremely complex and include such items as:

- who should be the service provider
- interconnect agreements and rates
- ground station ownership.

In addition, the airlines have proposed that only calls from air to ground be allowed, since two way calling capability would likely require additional flight attendants.

1.6 Amplitude Compandored Sideband (ACSB) Pitch Excited Linear Predictive Coding /Diphase Minimum Shift Keying (PELPC/DMSK)

ACSB

Amplitude Compandored Sideband technology developed from the need to improve spectrum efficiency. Prior to development of ACSB technology, single sideband modulation techniques were known to be spectrum efficient, conveniently fitting into 5 KHz of bandwidth, but poor sound quality prevented SSB from

becoming popular in land mobile radio. ACSB technology was thus developed as an enhancement to SSB technology, the basic difference being the addition of a pilot tone that is transmitted near the top of the audio band pass at 3 KHz. This pilot tone overcomes many of the problems associated with SSB by:

1] providing a reference for automatic tuning. This eliminates frequency translation errors which cause "Donald Duck" effects.
2] providing a reference for automatic gain control. This prevents the gain from increasing when there is a pause in the speaker's voice. The rapid up and down variation in gain results in poor sound.
3] provides positive squelch action. SSB systems do not exhibit the capture effect, therefore, where two or more systems use the same frequency in nearby cities, undesired signals while weaker are still heard. With ACSB, the capture effect causes the desired signal to completely eliminate interference from the undesired one if it is more than 8 dB stronger.
4] allowing for tone squelch and tone signalling. ACSB eliminates the frequency translation errors which result in complete scrambling of tone squelch codes as well as the codes associated with other types of signalling such as DTMF.

Thus ACSB radios, while using only a fraction of the total spectrum space of FM, provide users with all the advantages of an FM radio system.

PELPC/DMSK

For speech to be digitized, the speech bandwidth must be in the order of 64,000 bits/second. This bandwidth cannot be transmitted over narrowband communication channels, which will typicaly support 2400 to 4800 bits/second with simple modems and 4800 to 9600 bits/second with more sophisticated modems.

To transmit digitized speech over narrowband channels, the 64,000 bits/second must be reduced to as much as 2400 bits/second. To accomplish this the speech bandwidth is compressed through analysis and synthesis techniques.

The analysis techniques extract a minimum of speech information. The

synthesis techniques such as PELPC and DMSK employ models of the speech production mechanism. From the minimum speech information obtained through analysis, synthesis can create synthetic speech almost as intelligible as natural speech.

1.7 Personal Radio Communications Systems (PRCS)

Description

Personal radio communication systems at 900 MHz have been designed to provide low cost mobile radio-telephone service for local area coverage and to complement existing or planned communication services. A subscribers system would generally consist of a base station and one (possibly more) mobile(s).

Each subscriber would have access to simplex channels for party-line communication with capabilities similar to CB service. In addition, full duplex local channels would provide a base-to-mobile or mobile-to-mobile communication range of approximately 5 miles. A subscriber would also have the option of becoming a paid subscriber to a repeater which may be privately owned. Repeater channels would operate in two-frequency simplex mode and repeater operation would extend the range of base-to-mobile and mobile-to-mobile communications up to 15 miles. Additional channels would provide system control of local and repeater talk channels. Control channels would assign a talk channel, which would be private, to each call.

Each station (mobile or base) would have a unique identification code and could only be contacted by another station knowing the code and entering it (by keypad or dialer). In addition, each station would have a unique transmitter identification number, automatically transmitted by the radio at the beginning of a transmission, thus allowing access to the system.

The PRCS system may also allow for automatic interconnection to the public switched telephone network (PSTN). Interconnection would be accomplished automatically through the subscribers base station. Enhanced interconnect features could include call forwarding from base to mobile after a designated number of rings or remote activation of a base station from a mobile unit.

1.8 Links

Description

For quite some time, radio links have been used to extend area coverage for both paging and radio services. In many urban areas, congestion has led to the unavailability of radio link frequencies in both the 150 MHz and 450 MHz bands. As a result, links above 890 MHz may be the only future option for service providers wishing to extend coverage through links. Link applications include:

1) Extension of radio paging operations through:

   i) radio linking into neighbouring areas to provide complete coverage over a subscribers travelled territory
   ii) simulcasting (simultaneous in-phase activation of all linked transmitters) to provide "city-wide" coverage.

2) Extension of mobile radio operations into rural areas through radio links to RCC MRS operation in a nearby area.

SECTION 18.0

MSAT SERVICE DESCRIPTION AND COMPETITIVE ENVIRONMENT

MSAT Service Description and Competitive Environment

Competitive Environment/Service Provisioning Scenario

The profitability and market share of the various services will depend on the competitive environment within which the RCC must operate. For the purposes of the MSAT study, the following competitive scenario was considered:

Both the RCCs and Telcos can provide end-user services. Telesat is restricted primarily to selling MSAT services through the end-user service providers but may sell directly to large nationwide users.

Mobile Radio Service

1. RCC provides a system whereby a UHF private base station or an SHF private base station communicates with one or more MSAT mobile terminals. The base station could be located in an urban area with careful site selection. The mobile terminals would obtain some urban radio coverage though it may not be very reliable in certain areas, due to shadow effects of large buildings or structures.

2. RCC provides a system whereby a private system dispatcher has access to his MSAT mobile terminals through the RCCs common base station via the satellite. Two configurations are possible:

   a) The dispatcher is connected via a dedicated telephone line or autodial capabilities via switched PSTN lines to the common RCC base station.

b) The dispatcher uses selective signalling on his existing terrestrial private radio channel or he can be offered access to a specified RCC MRS channel for connection by radio to the RCCs common site where the RCC has an equivalent station on the user's frequencies and connects this to the appropriate circuit on his MSAT common base station. This latter function could be manual or automatic. This provides replacement of land lines by radio links.

3. The user could be in one of three categories:

(i) a first time radio user, probably because no terrestrial system meets his needs;

(ii) a private system operator with a requirement for a few vehicles to roam extensively beyond his terrestrial coverage. This user may be an existing customer of the RCC, or a totally new business opportunity.

(iii) operators on an existing RCC MRS channel with a requirement for a few vehicles to roam outside the RCC MRS coverage area.

4. UHF-to-UHF Communications paths will require a double hop connection, where mobile to mobile or UHF base to mobile communications are required.

Mobile Paging Service

1. RCC provides a system whereby a pager can be signalled through MSAT by repeating the signal in a distant location through an MSAT mobile. The paging unit could be 150, 450 or 900 MHZ operating on the existing terrestrial RCC service. The MSAT mobile or Hybrid Terminal would be equipped with an 800 MHZ MSAT receiver and a 150 or 450 MHZ paging transmitter.

2. Extended area coverage of existing systems could be achieved by connecting existing systems together through MSAT links. Existing paging base repeater equipment and units could be used. A base station would be required to allow receive and transmit capability to MSAT and would provide the interface to the paging terminal and the public switched telephone network (PSTN).

3. RCC provides a system whereby a pager is designed for operation on a single dedicated MSAT paging channel. There is some doubt that direct paging from MSAT to personal paging receivers is feasible. This service could be restricted to Vehicle-Based receivers only. It is also possible that the receiver could be transportable. In urban areas where MSAT signals may not be satisfactorily received, an RCC could enhance system coverage by establishing repeaters. The system would require a base station to allow access to MSAT and to the PSTN through the paging terminal.

Mobile Telephone Service

1. RCC provides a system whereby a mobile telephone is signalled through MSAT. An SHF gateway is required to allow access to MSAT and to provide connection to the public switched telephone network (PSTN). A mobile telephone switch provides an interface to the SHF gateway and the PSTN, and enables the SHF gateway to have access to many circuits. Each mobile would use one circuit through the SHF gateway for the duration of a call.

   a) All calls from an MSAT mobile telephone will be received downlink from MSAT by the nearest gateway to the destination as determined by the called party telephone number. This gateway will provide access to the local calling area or access to long distance circuits for which a toll charge will apply.

b) All calls from a fixed location (telephone) will enter the PSTN at the telephone serving office as determined by the originating telephone number and will be routed on to the PSTN

Mobile Data Service

RCC provides a system allowing the following data services access to MSAT through an established base station:

1. DACS - Data Acquisition and Control Service

a) Polling

Remote points are equipped with DACS terminals that send data when polled. These remote points send the data to the RCC's SHF base station which routes the information to the user's location by a choice of paths which might include common carrier packet switched networks, private user radio channels, dedicated telephone lines or autodial connection via the public switched telephone network. In this application regular data collection cycles will be initiated by the main central control station (CCS) and the data can be sent to the RCC for distribution to his customer.

b) Alarm

Event-triggered data reporting could be sent over the MRS channels to the RCC base for distribution to the end user (not under CCS initiation).

2a) Data Enhancement of MRS/MTS Terminals

The subscriber MRS or MTS terminal would be enhanced to provide data communication. Users can establish a two-way data communications path to the base station location using any of the same choices given in 1).

2b) Store and Forward MDS to MRS/MTS Terminals

Users can establish a data communications path to the RCC's base station and leave messages to be forwarded to mobile data terminals, either individually or as a group. These messages,

which could take numerous forms such as written communications, coded commands, control sequences etc., will be batched by the RCC and transmitted so as to optimize use of MSAT airtime and minimize charges to the users.

Communication paths between base stations and MSAT mobile data terminals will have the same bandwidth as voice circuits and can carry data at speeds up to 2.4 kb/s. It is envisioned that communication paths through MSAT to MDS terminals will not be set up to carry very brief 1 or 2 second messages. Such messages will be combined onto an already established circuit by a number of techniques which include store and forward at the SHF base station, polling of remote stations, random access to an established UHF frequency being assigned by DAMA or a periodic basis known to the MDS terminals.

SECTION 19.0

CANADIAN DISTRIBUTION OF RCCs

CANADIAN DISTRIBUTION OF RCCs

The total population of RCCs in Canada as compiled from DOC licensing data was 587 in December 1982. Table 1.0 shows the national distribution based on the number of licensed base stations.

TABLE 1.0

Size Distribution of Base Station Licensees in the Restricted Public Commercial Service - December 1982

	NUMBER OF LICENSEES (1)	% TOTAL LICENSEES	NUMBER OF LIC. FREQ. (1)	% TOTAL LIC. FREQ.
1 Base Station (2)	324	55.2%	597	13.6%
2 - 5 "	191	32.5	1131	25.8
6 - 10 "	35	6.0	597	13.6
11 - 20 "	29	4.9	949	21.7
> 20 "	8	1.4	1104	25.2
TOTAL	587	100	4378	100

(1) Paging plus mobile radio.

(2) A base station licensed for both paging and mobile radio is counted twice.

- Source DOC -

Table 2.0 provides a list of the major RCCs ranked by the number of base stations. Due to the confidential nature of the numbers of licensed base stations and licensed frequencies for each of the listed RCCs, actual numbers cannot be provided in this report.

TABLE 2.0

Major Licensees of Base Stations in the Restricted Public Commercial Service - December 1982

Shown below are the licensees operating more than 10 base stations, ranked by the number of base stations. Province or territory of operation is shown in brackets. Individual statistics are confidential and not public information.

	Number of Lic. Base Sta. (1)	Number of Lic. Freq. (2)
MOTOROLA CANADA (BC, Alta, Sask, Man, Ont, Que, NS)		
PAGETTE AIRSIGNALS (Alta, Sask, Man, Ont, Que)		
MACLEAN HUNTER COMMUNICATIONS (Ont)		
TIME COMMUNICATIONS (Ont)		
OXFORD COMMUNICATIONS (Ont)		
CANADIAN GENERAL ELECTRIC (BC, Alta, Sask, Man, Ont, Que)		
MILLMAN'S COMMUNICATIONS SERVICES (Alta, Sask)		
CANADIAN MARCONI (all provinces except NB)		
CHRISTIE AND WALTHER ELECTRONICS (Ont)		
HARRISON-NOWELL MOBILE RADIO SERVICES (BC, Man)		
PACIFIC COMTEL (BC, Yukon)		
MESSAGE CENTRE (Ont)		
ABICOM (Que)		
JACK FRENCH LTD. (Ont)		
YORK TELECOMMUNICATIONS (Ont)		
AIR-PAGE COMMUNICATIONS (PEI, NB, NS)		
COMMUNICATION SERVICES (ROYAL) (Que)		
SCOTCOMM RADIO (Ont, Que)		
CAPITAL COMMUNICATIONS (NB)		
COLCOM COMMUNICATIONS (Que)		
TRANS-PROVINCIAL COMMUNICATIONS (Ont)		

	Number of Lic. Base Sta. (1)	Number of Lic. Freq. (2)
M. LEDUC LTEE (Que)		
BRANTFORD TELEPHONE ANSWERING (Ont)		
TILL COMMUNICATIONS (Alta, Sask)		
HASTINGS RADIO & TV SERVICE (BC)		
SYSTEL ELECTRONICS (Alta)		
KARTRONIX (Alta)		
WESTERN 2-WAY RENTALS (Man)		
BEEPER PEOPLE (Ont)		
COMMUNICATIONS SR (Que)		
JET COMMUNICATIONS (Ont)		
GORDON E. FREW LTD. (Ont)		
TOOMBS & SONS LTD. (BC)		
ESP ELECTRONIC DEVICES (Alta)		
TASCO COMMUNICATIONS (BC, Alta, Sask)		
MAYFLEX LTD. (Alta)		
CHECKPOINT COMMUNICATIONS (Ont)		
Licensees with more than 10 base sta. (37)	781	2053
TOTAL LICENSEES (587)	1912	4378
% TOTAL (6.3%)	40.8%	46.9%

(1) A base station licensed for both paging and mobile radio is counted twice

(2) Paging plus mobile radio

(P) Paging

- Source DOC -

The fact that about 41% of all RCC licensed base stations and about 47% of all RCC licensed frequencies are concentrated within the operations of the 37 major RCCs is indicative of the make-up of the industry.

The distribution of the licensed RCC base stations and frequencies is provided in Table 3.0.

TABLE 3.0

Number of Base Stations (3) and Frequencies Licensed in the Restricted Public Commercial Service - December 1982

PROVINCE	PAGING			MOBILE RADIO		
	NUMBER OF LIC. BASE STATIONS (1)	NUMBER OF LIC. FREQ.	% TOTAL FREQ.	NUMBER OF LIC. BASE STATIONS (1)	NUMBER OF LIC. FREQ. (2)	% TOTAL FREQ.
BRITISH COLUMBIA	124	161	14.1%	171	445	13.8%
ALBERTA	94	110	9.6	170	588	18.2
SASKATCHEWAN	19	20	1.7	66	176	5.4
MANITOBA	21	24	2.1	37	134	4.1
ONTARIO (4)	378	571	49.9	344	1073	33.2
QUEBEC	149	210	18.4	244	699	21.6
NEW BRUNSWICK	16	18	1.6	23	56	1.7
PRINCE EDWARD ISLAND	2	2	0.2	1	2	0.1
NOVA SCOTIA	16	17	1.5	11	26	0.8
NEWFOUNDLAND	3	3	0.3	8	20	0.6
YUKON & NWT	8	8	0.7	7	15	0.5
TOTAL CANADA	830	1144	100.0%	1082	3234	100.0%

(1) A base station licensed for both paging and mobile radio is counted twice.

(2) A small number of mobile radio base stations are licensed for one frequency simplex operation, the great majority being licensed for two frequency operation -- simplex or duplex. The number of two-way radio channels is approximately one-half of the figure shown in the table.

(3) The mobile radio and dispatch stations associated with a base station are licensed in the private commercial service and cannot be identified in the licensing data. Paging receivers are not licensed.

(4) The Ontario count includes a small number of stations in Hull, Quebec and surrounding area that are administered by the Ottawa District Office.

- Source DOC -

The distribution of RCCs by province and by major MA is listed in Table 4.0. This tabulation was derived from the records of 587 licensees provided by DOC. It is important to note that many of the RCCs have operations in a number of Canadian MAs and, as such, are counted a number of times in accordance with their areas of operation. It should further be noted that the majority of major RCCs who represent almost 50% of the RCC business interests are members of the CRCCA and were included in the 130 members contacted for this study.

TABLE 4.0

Distribution of RCCs by Province and Major Metropolitan Areas

Province/City	Population	No. of (1) Major RCCs	No. of Minor RCCs
CANADA	24,646 K	223	558
MARITIMES	2,263 K	7	24
Halifax	550 K	2	2
St. John's, Nfld.	110 K	2	4
Saint John, N.B.	100 K	1	2
Rural	1,303 K	2	16
QUEBEC	6,315 K	30	143
Montreal	2,800 K	6	32
Quebec	600 K	4	16
Chicoutimi	100 K	1	2
Rural	2,815 K	19	93
ONTARIO	8,800 K	90	187
Hamilton	550 K	6	10
Toronto	3,000 K	8	23
St. Catharines	300 K	1	2
Kitchener	345 K	6	11
Oshawa	125 K	1	2
Ottawa	700 K	6	9
Sudbury	175 K	2	5
London	275 K	7	12
Windsor	250 K	2	8
Thunder Bay	115 K	-	3
Rural	2,965 K	14	107
SASKATCHEWAN	990 K	12	37
Saskatoon	150 K	4	8
Regina	160 K	4	8
Rural	680 K	4	21
MANITOBA	1,045 K	5	19
Winnipeg	580 K	5	6
Rural	465 K	-	13

ALBERTA	2,345	K	17	100
Calgary	500	K	7	21
Edmonton	600	K	7	17
Rural	1,245	K	3	62
BC	2,818	K	13	48
Vancouver	1,200	K	6	32
Victoria	220	K	5	5
Rural	1,398	K	2	11

1) The major RCCs as listed in Table 2.0 are listed in this column. The classification of "major" is based on national size of over 10 base stations.

- Source KVA -

Section 20.0

RCC MSAT Provincial Forecast Data & Financial Figures

RCC Provincial MSAT Forecasts - MRS, MTS, MPS and DACS

Provincial forecasts for the years 1989 to 2002 are shown on Graphs 1 to 7. As these graphs show, the RCCs MSAT forecast projections for MRS, MPS and MTS are highest for Ontario and Quebec. These two provinces have the largest concentration of RCCs and currently, the highest demand for RCC services, primarily due to the heavy traffic corridor that extends from Windsor to Quebec city. This trend is not expected to change and it is estimated that approximately 70% of the total MSAT demand for MRS, MPS and MTS will originate in these two provinces. It is estimated that the majority of MSAT users will be existing terrestrial users who require extended coverage beyond that already provided by terrestrial systems.

British Columbia and Alberta also contribute significantly to the MSAT forecast projections for MRS, MPS and MTS. Together they account for approximately 20% of the RCC forecasted demand. It is expected that the oil and gas exploration industry in Alberta and offshore drilling and fisheries industries in BC will have the largest requirements for MSAT services in these provinces.

RCC DACS service forecasts are composed of both an alarm and a polling component. Polling demand accounts for over 2/3 of the total DACS forecast. Because offshore exploration and environmental monitoring, ie. ice movement, fisheries, are expected to generate the greatest demand for DACS polling units, DACS forecasts are highest for British Columbia and the Atlantic provinces.

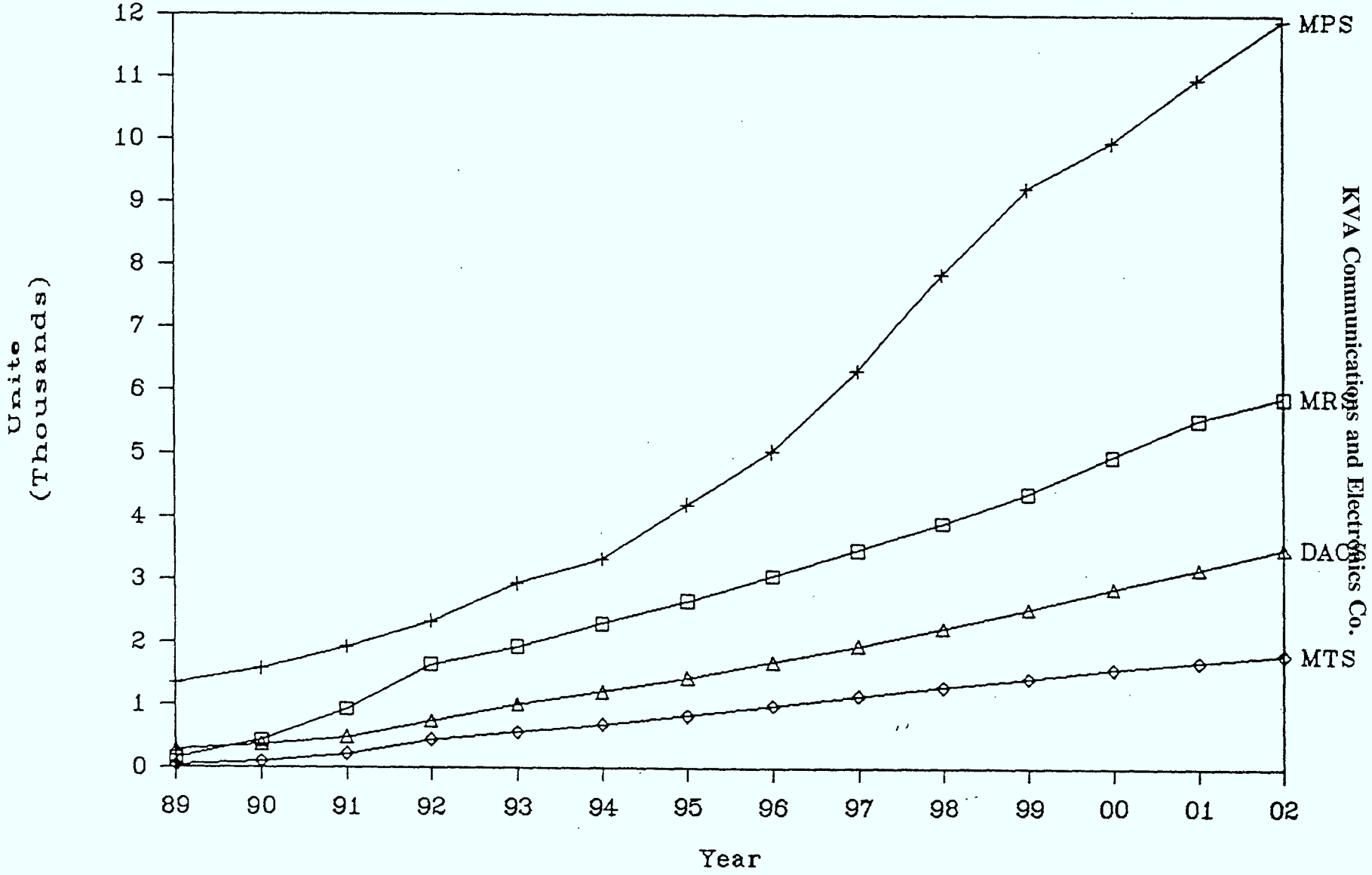
MSAT paging services will primarily be provided by the RCCs, who historically, have been major service providers of paging on terrestrial systems. In fact, it is expected that MSAT will primarily provide link frequencies between terrestrial paging systems. The paging units themselves, will therefore be the same or similiar to those units that exist or will exist for terrestrial paging and would therefore operate in VHF or UHF (450, 800 or 900 MHz) bands.

DACS is envisioned to be a relatively new service offering for the RCCs and one that they have little experience with today. It is expected that DACS will be extremely competitive but that the RCCs will still achieve over 50% of the total market.

Graph 1

MSAT RCC Forecast

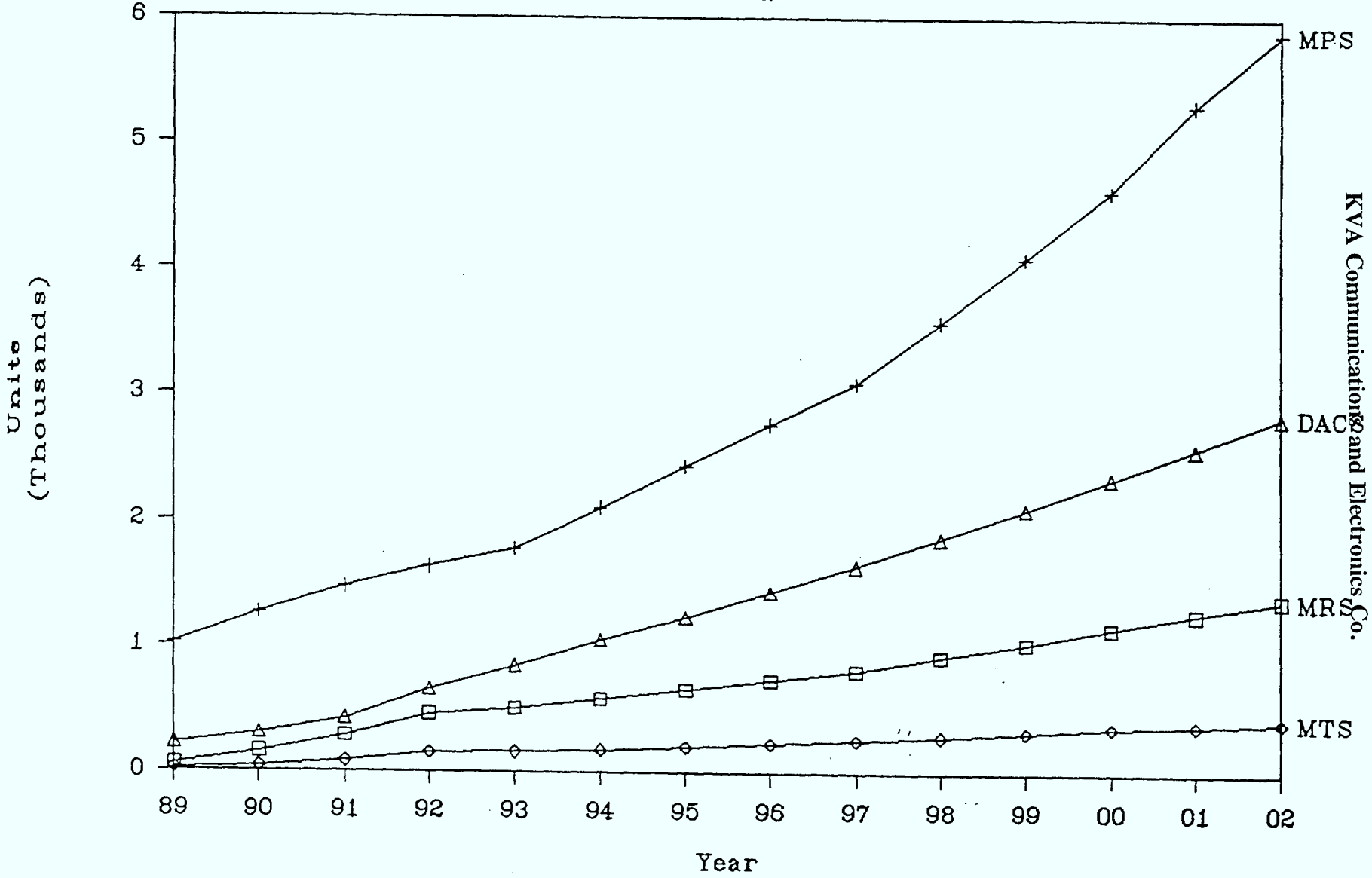
British Columbia



Graph 2

MSAT RCC Forecast

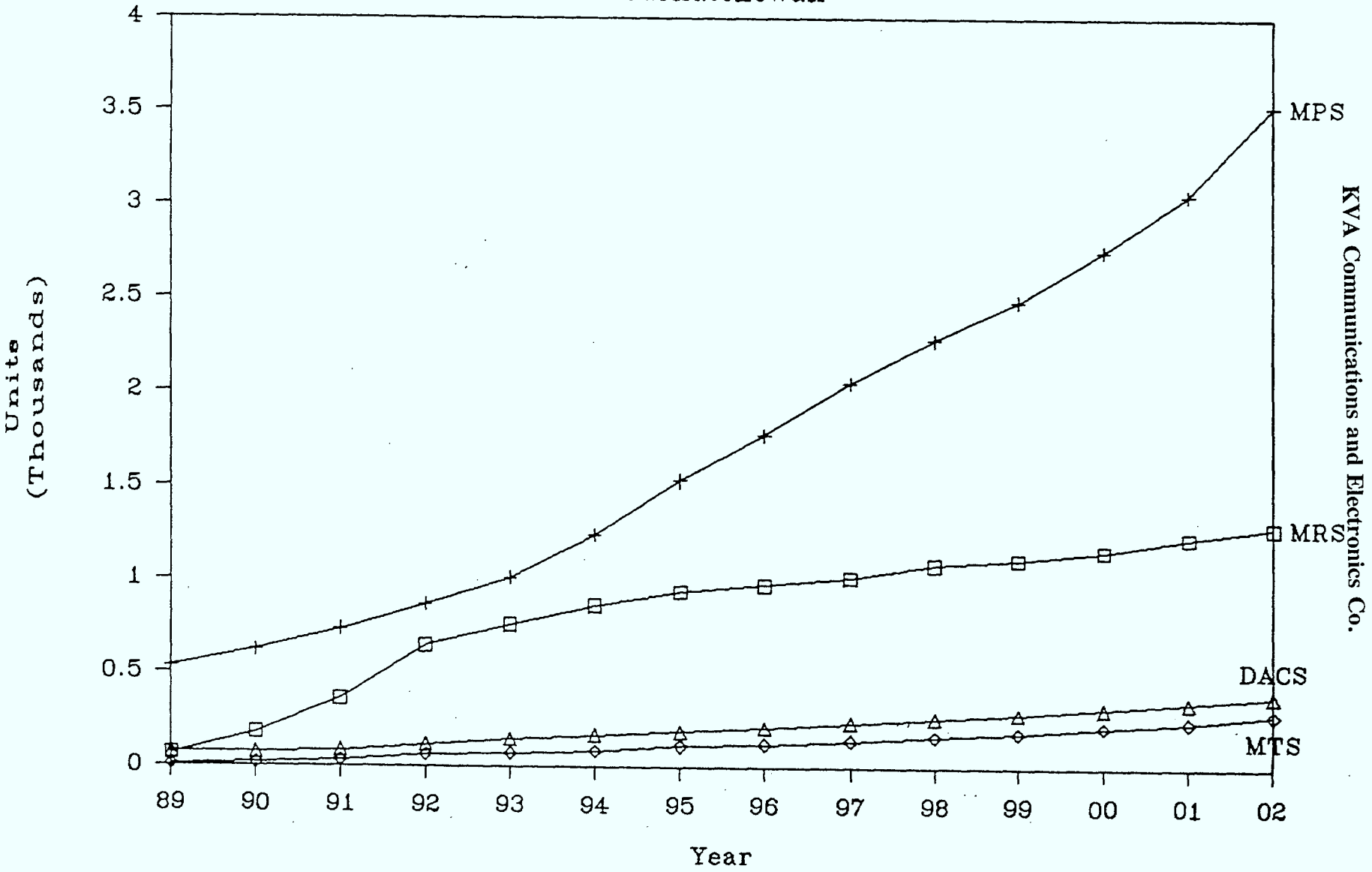
Alberta



Graph 3

MSAT RCC Forecast

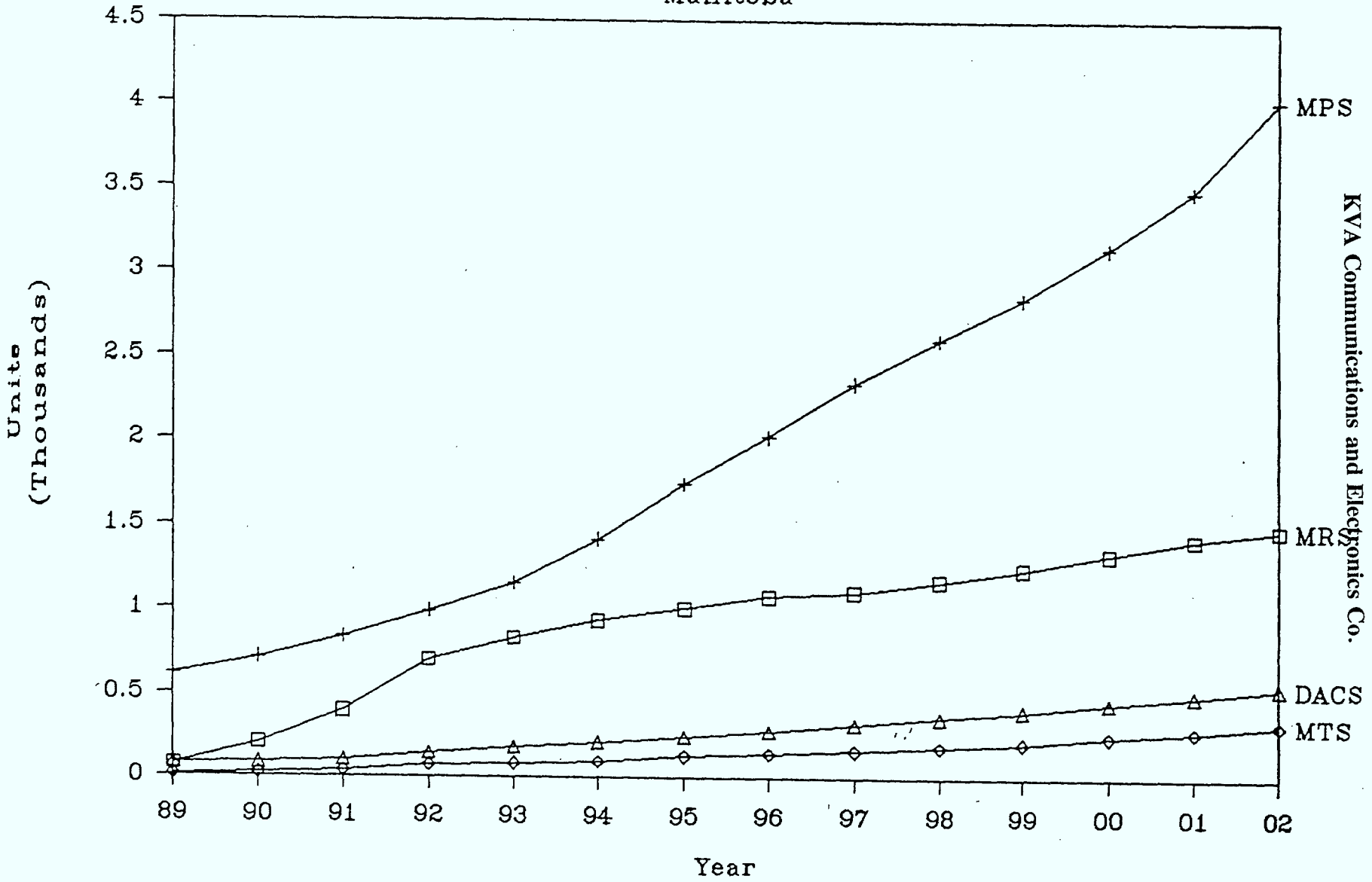
Saskatchewan



Graph 4

MSAT RCC Forecast

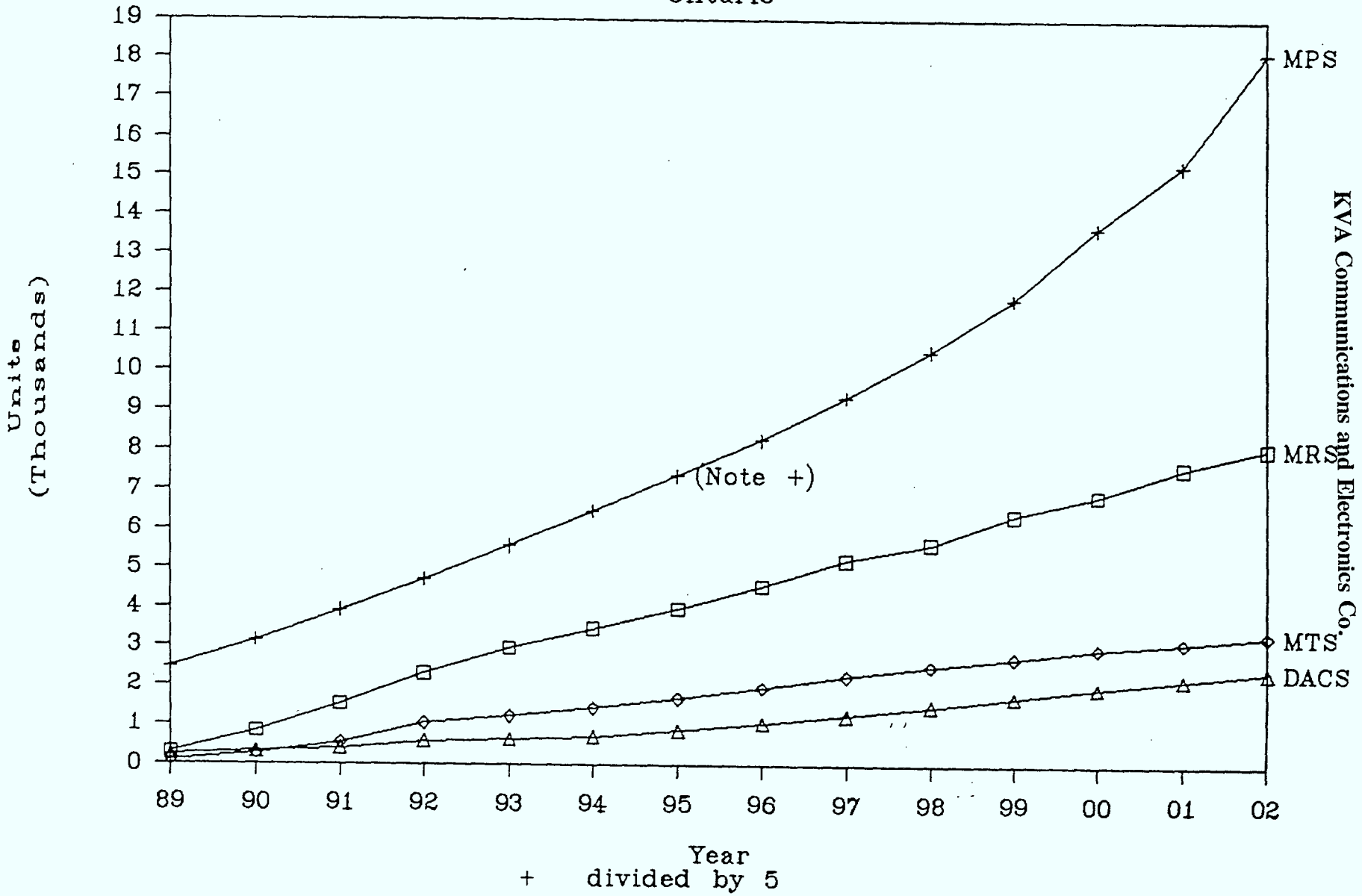
Manitoba



Graph 5

MSAT RCC Forecast

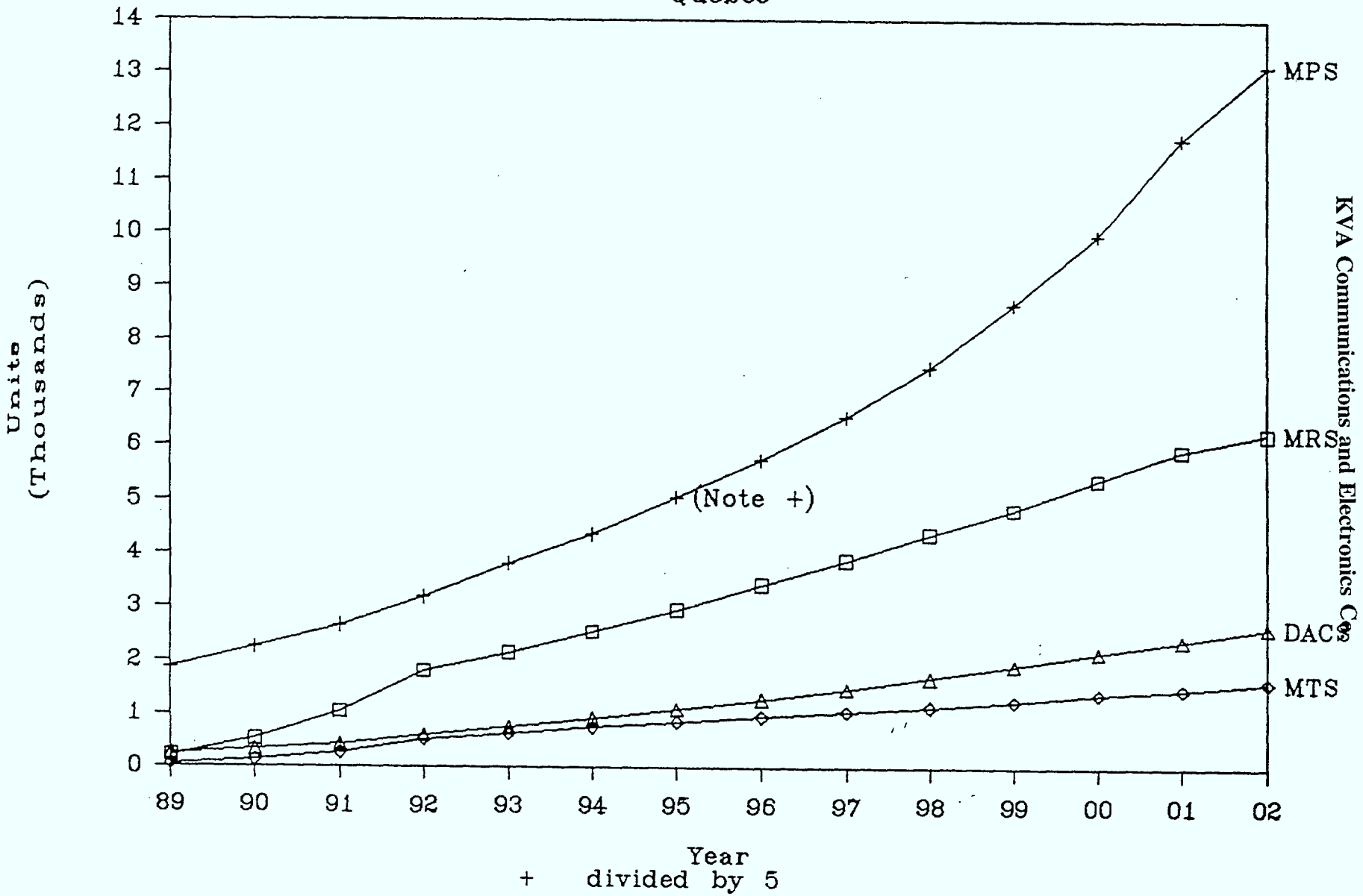
Ontario



Graph 6

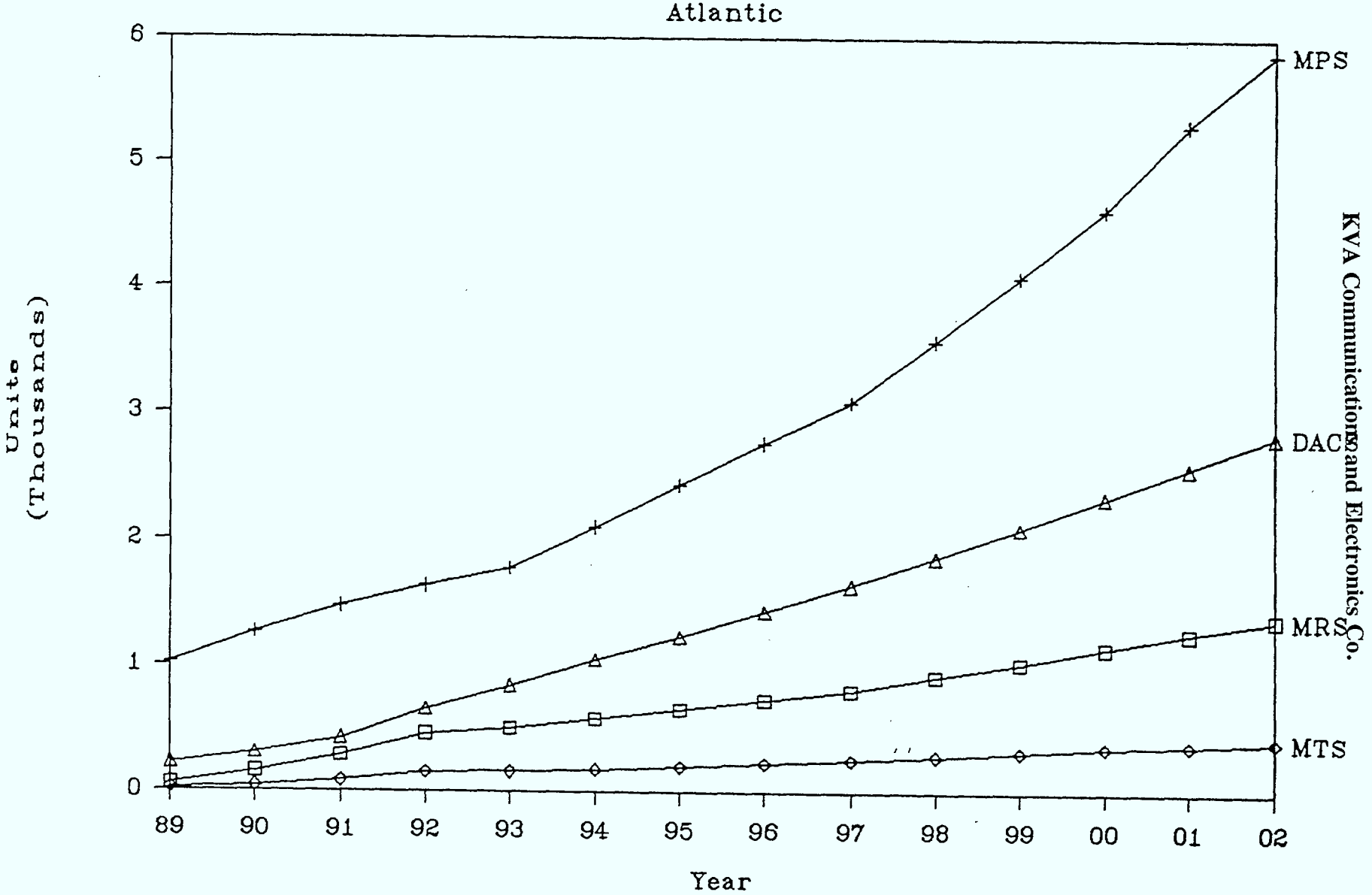
MSAT RCC Forecast

Quebec



Graph 7

MSAT RCC Forecast



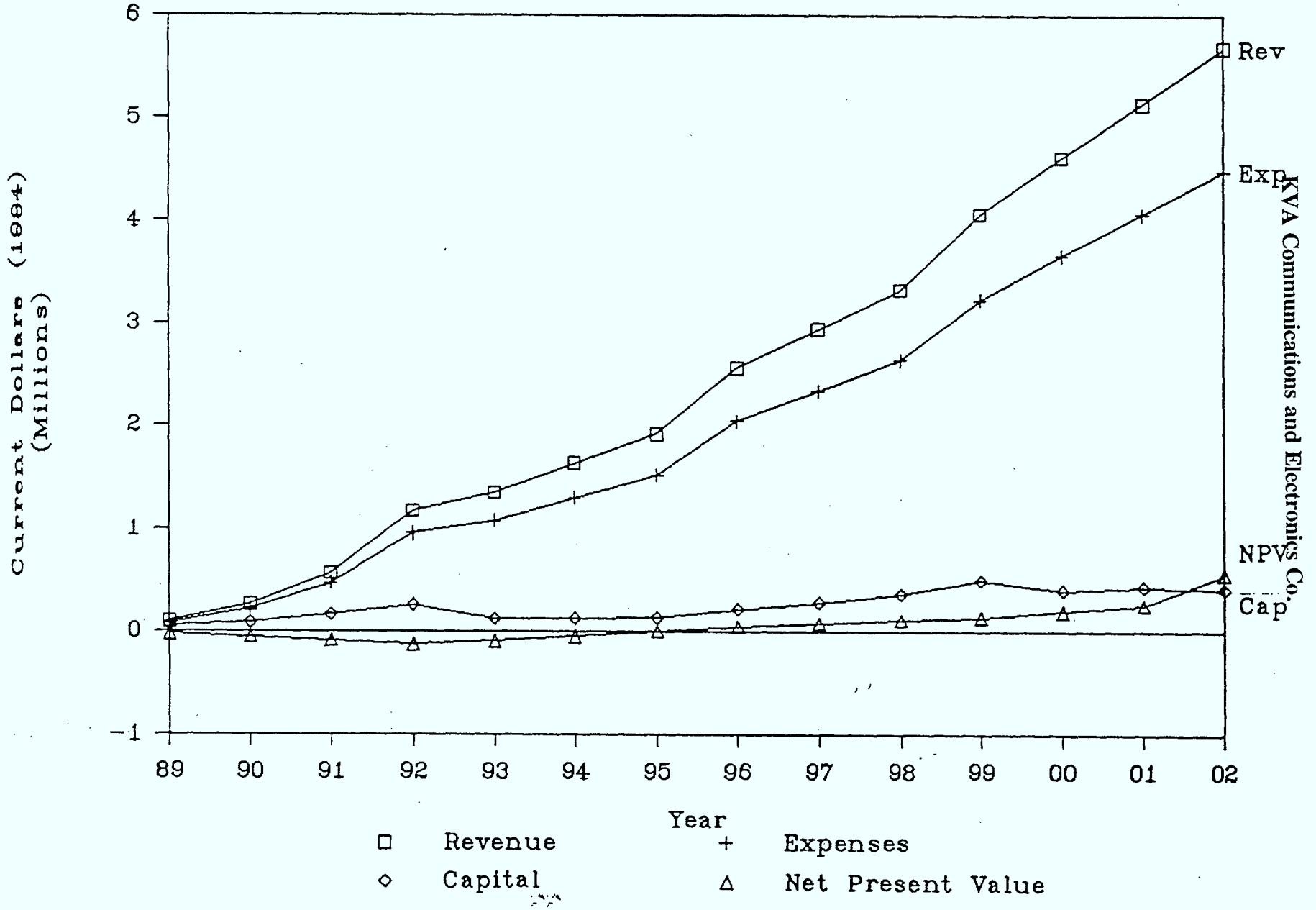
RCC Provincial MSAT Financial Results

The provincial distribution of the revenue, expense and investment components resulting from MSAT, as well as the cumulative NPV's are illustrated in Graphs 8 to 14. These financial components are in current dollars and the NPV is dicounted to the year 1984.

Graph 8

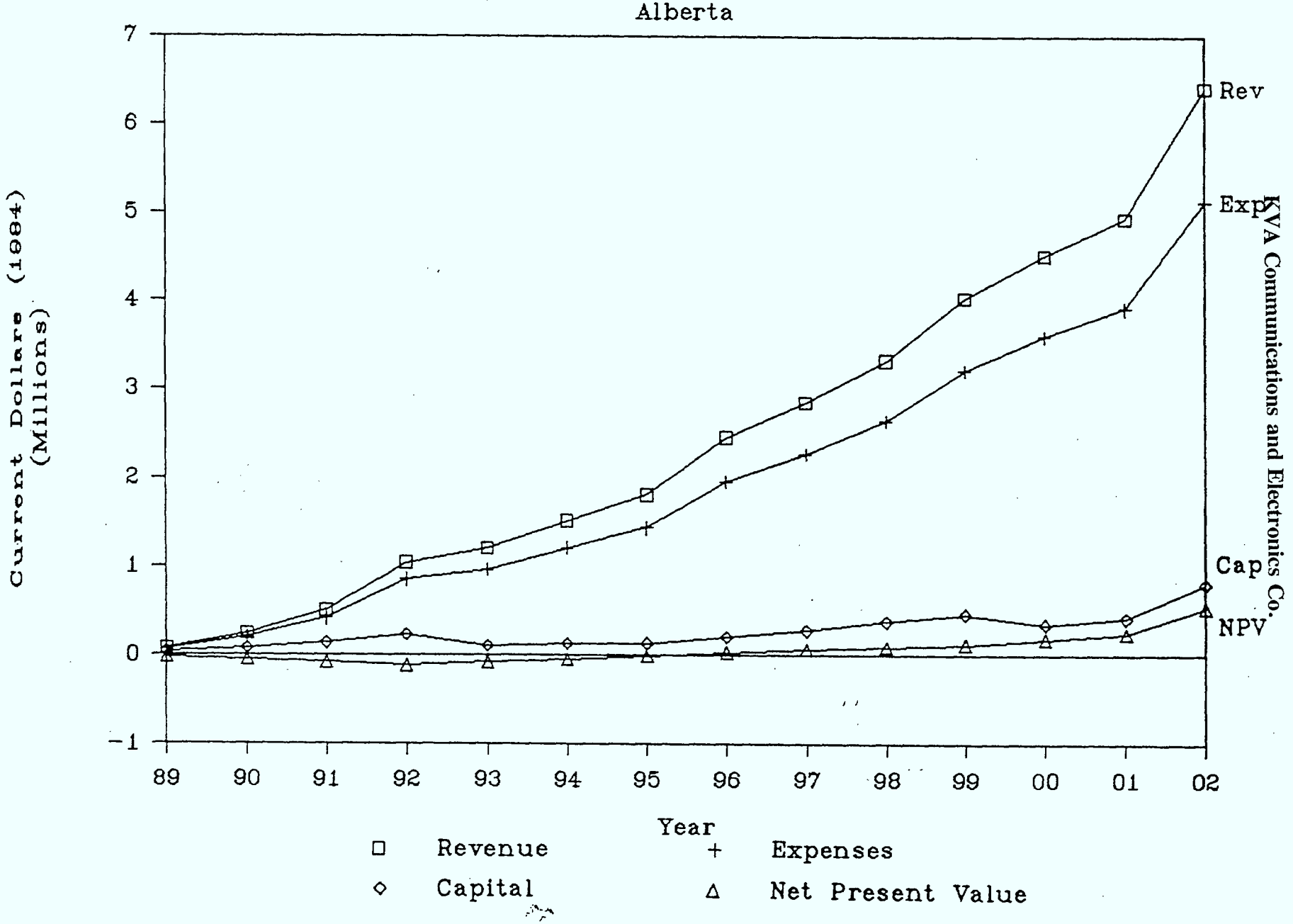
MSAT RCC Economic Results

British Columbia



Graph 9

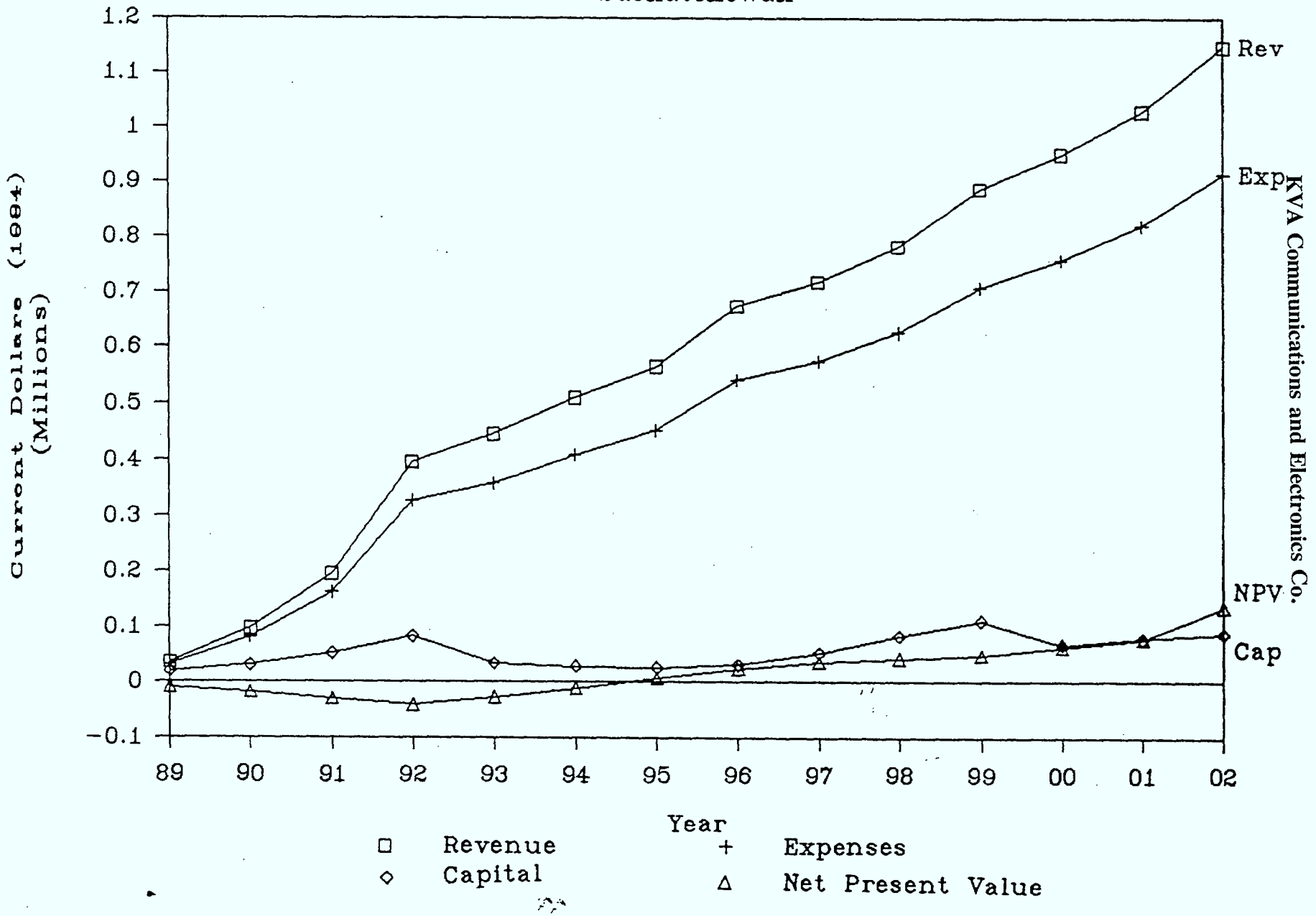
MSAT RCC Economic Results



Graph 10

MSAT RCC Economic Results

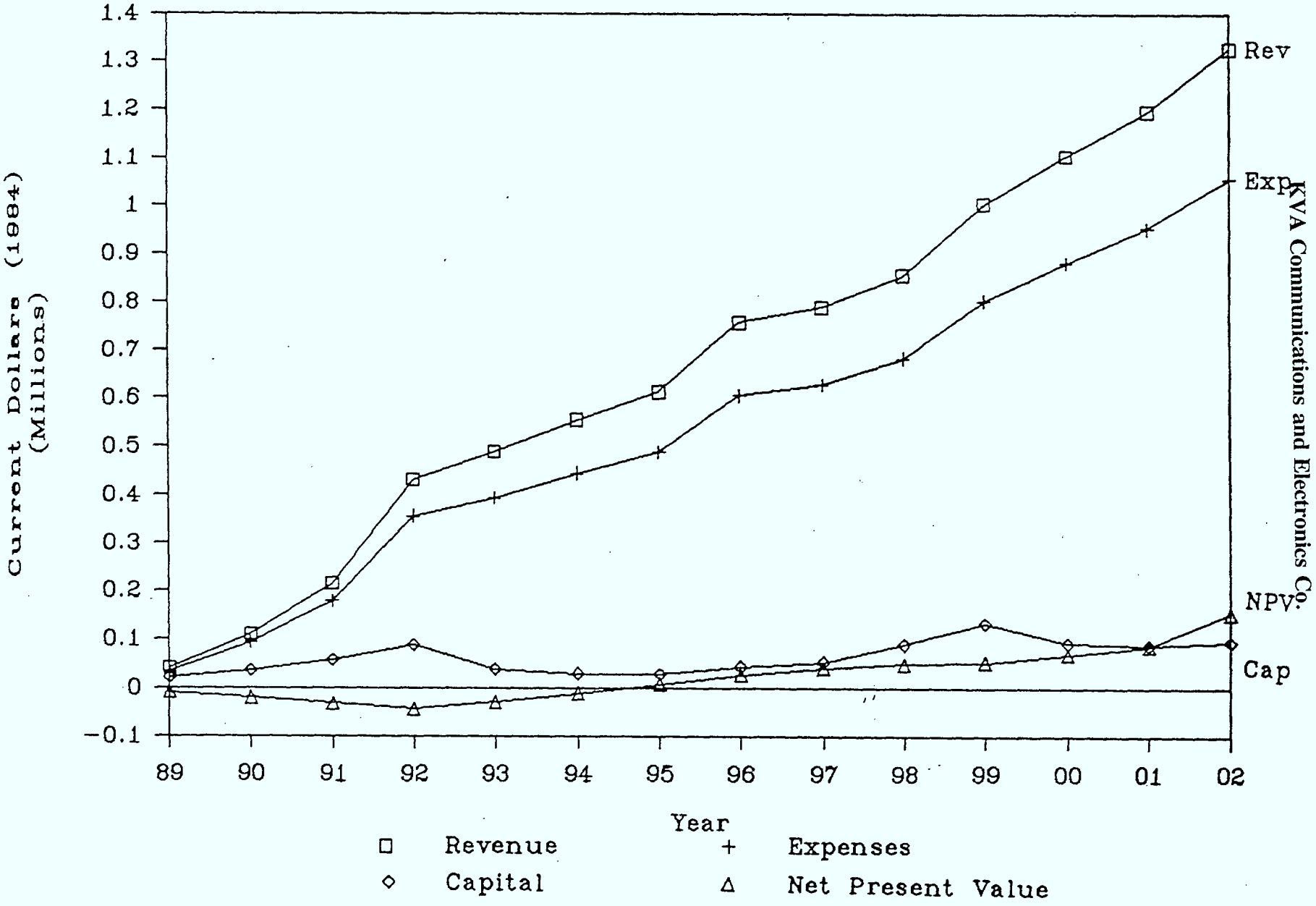
Saskatchewan



Graph 11

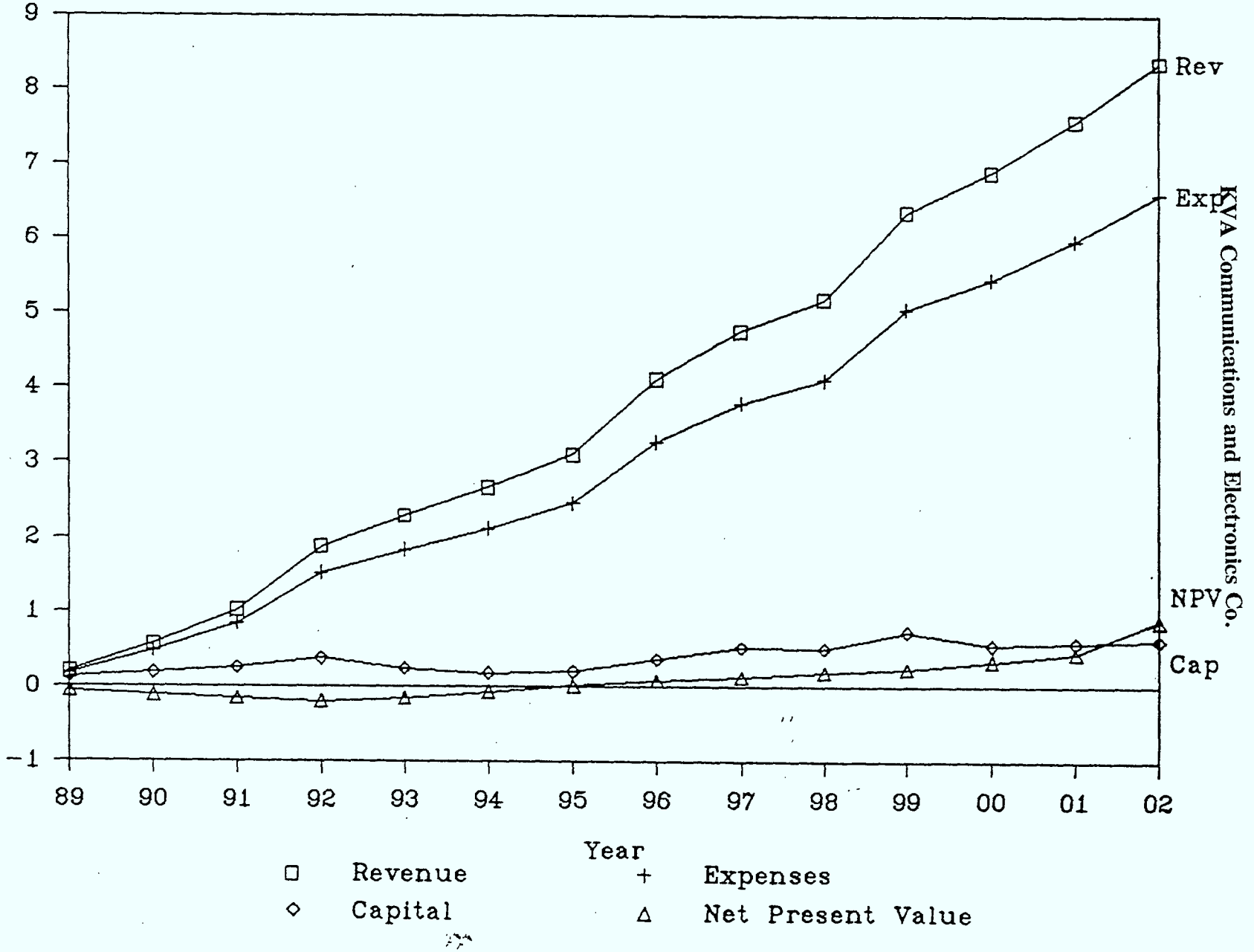
MSAT RCC Economic Results

Manitoba



MSAT RCC Economic Results

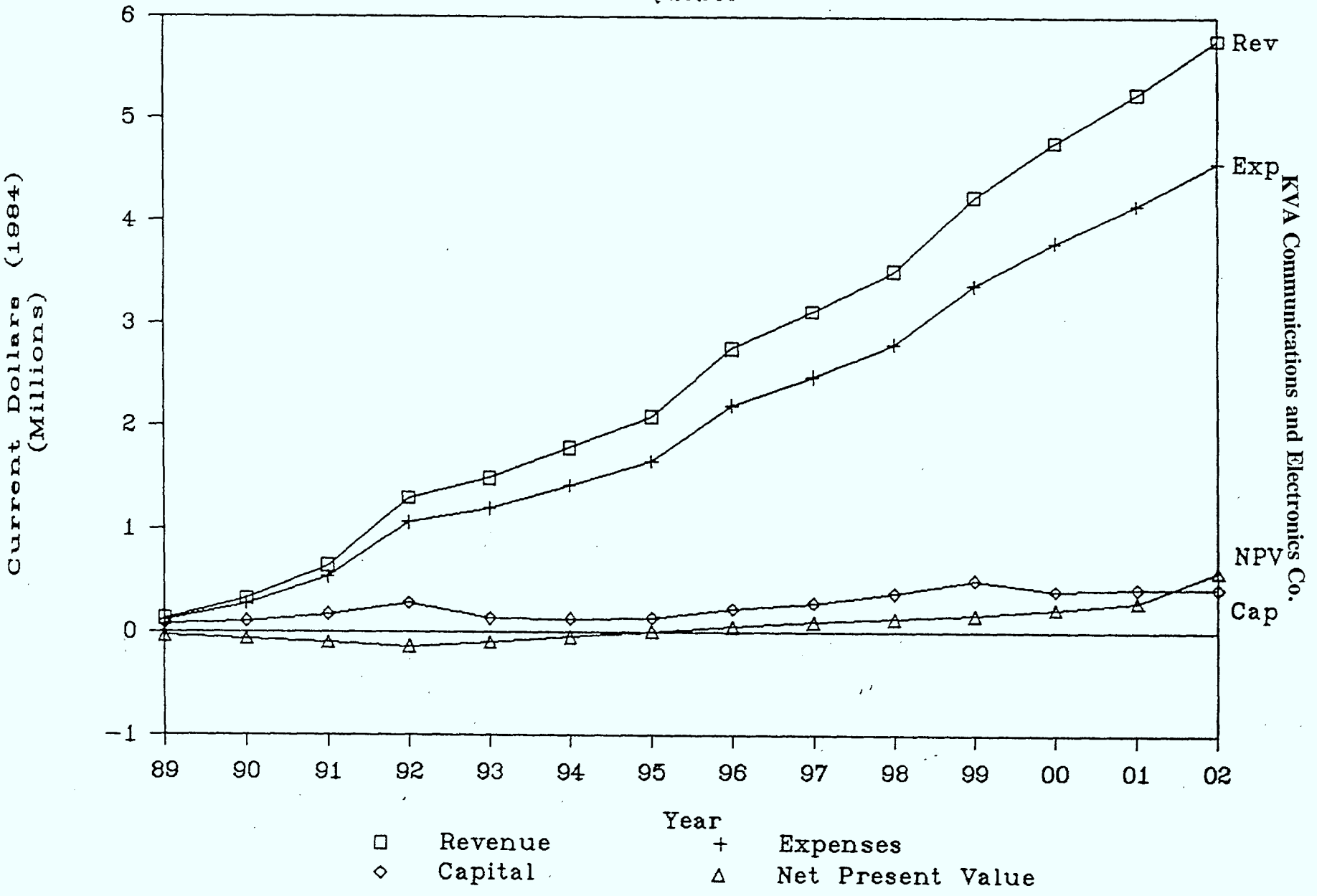
Ontario



Graph 13

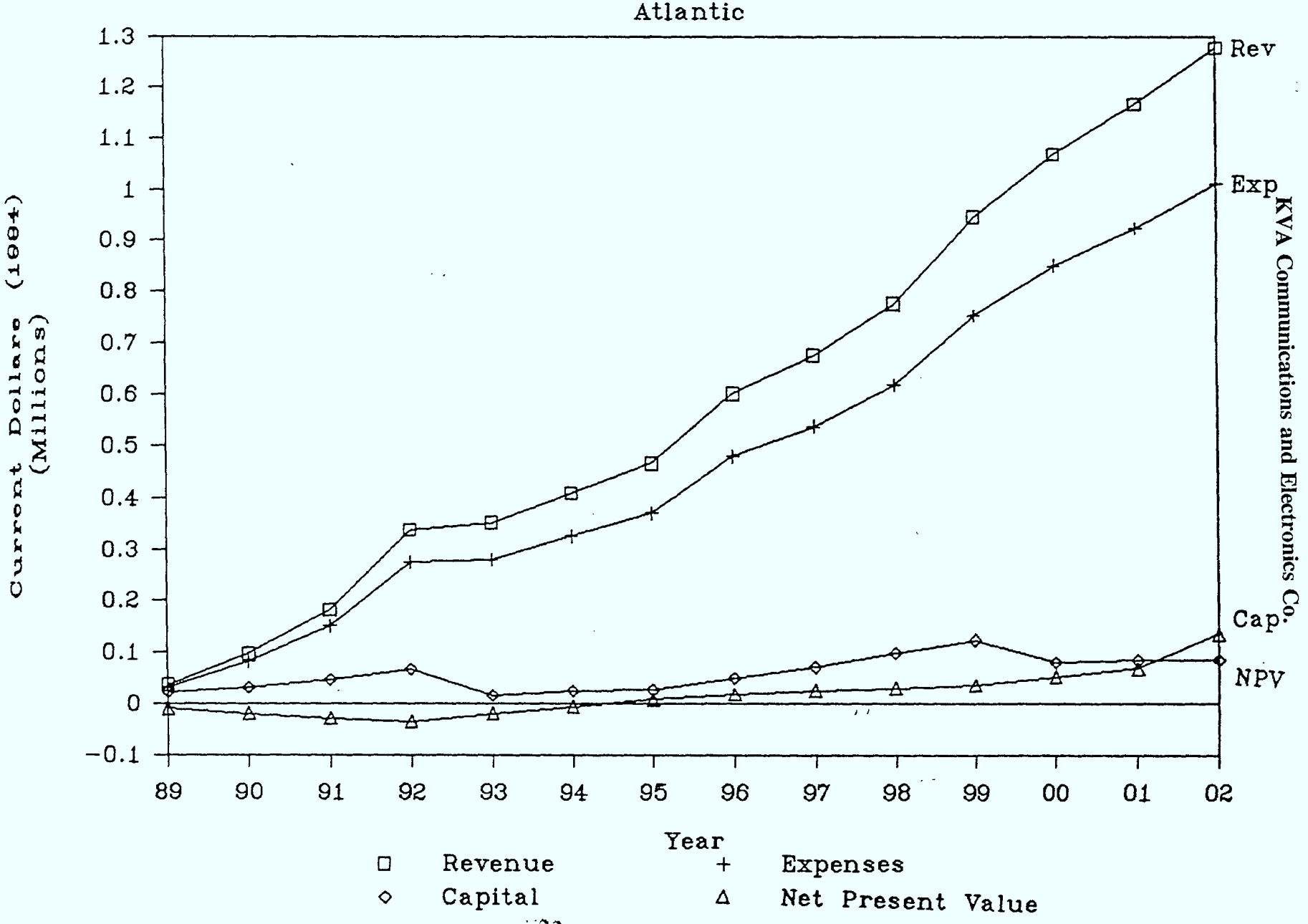
MSAT RCC Economic Results

Quebec



Graph 14

MSAT RCC Economic Results



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--The impact of MSAT on the radio common carrier industry : final report

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