

DEPARTMENT OF COMMUNICATIONS

USER REQUIREMENTS FOR A MOBILE SATELLITE
SYSTEM OPERATING IN THE 806-890MHz BAND

VOLUME II — TABLES AND APPENDICES

September 1981

A report from the
Marketing & Economics Group

Woods Gordon

Management Consultants

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KVA

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DEPARTMENT OF COMMUNICATIONS - OTTAWA - CANADA

SPACE PROGRAM

TITLE: ⁽²⁾ Study to Determine the User Requirements for a Mobile Satellite
System Operating In the 806-890 MHz Band *of a report*

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VOLUME II

TABLES AND APPENDICES
CONTENTS

APPENDIX A: SUPPORTING TABLES

<u>Table</u>	A.1	Canadian Population Growth, 1961-79
	A.2	Mobile Licence Data, March 1981
	A.3	Mobile Licence Data, 1973-81, by Industry Sector
	A.4	Mobile Licence Projections, 1986-2001, by Industry Sector
	A.5	Mobile Licence Data, 1973-81, by Region
	A.6	Mobile Licence Projections, 1986-2001, by Region
	A.7	Mobile Telephone Statistics
	A.8	User survey - Sample Data
	A.9	Estimated Mobiles in Systems with Non-Metropolitan Requirement, 1981
	A.10	Projected number of Mobiles in Systems with Non-Metropolitan Requirement, 1981-2001
	A.11	Airtime for Mobiles in Systems with Non-Metropolitan Requirement, 1981
	A.12	Non-metropolitan Wide-area Airtime, 1981
	A.13	Reduced Non-metropolitan Wide-area Airtime, 1981
	A.14	Mobile Communications Growth-Rates, by Industry Sector
	A.15	Mobile Communications Growth-rates, by Region
	A.16	MSat Potential Market - Airtime Projections
	A.17	Average Airtime per Mobile, 1981

- A.18 MSat Potential Market - Projection of Number of Mobiles
- A.19 Types of Mobile, 1981
- A.20 Projected Changes in Mix of Types of Mobile
- A.21 MSat Potential Market - Projection of Types of Mobile
- A.22 Years to System Replacement
- A.23 MSat Market Penetration - Projected Numbers of Mobiles
- A.24 MSat Market Penetration - Projected Number of Mobiles per Industry Sector
- A.25 MSat Market Penetration - Airtime Projections
- A.26 MSat Market Penetration - Projection of Types of Mobile
- A.27 Estimated Monthly Costs for Airtime and Total System for Potential MSat Systems, 1981
- A.28 Ranking of Technical Failings in 1981 Mobile Radio Systems
- A.29 Technical Failings in 1981 Mobile Radio Systems
- A.30 Ranking of Additional Features Desired for 1981 Mobile Radio Systems
- A.31 Additional Features Desired for 1981 Mobile Radio Systems.

- APPENDIX B: NON-USER INTERVIEW LIST
- C: SERVED-POPULATION CALCULATIONS
- D: DOC LICENCE CLASSES
- E: DOC REGIONS DEFINITIONS
- F: INDUSTRY SECTOR DEFINITIONS
- G: PROJECTION METHODS FOR ANALYZING EXPECTED GROWTH IN MOBILE COMMUNICATIONS
- H: THE WOODS GORDON USER SURVEY
 - H.1 User Survey Details

H.2 User Questionnaires

H.3 Definitions of Metropolitan Areas

H.4 The Non-metropolitan Mobile Population

J: MOBILE COMMUNICATIONS USERS INTERVIEWED IN STUDY

K: FACTORS INFLUENCING THE MIX OF TYPES OF COMMUNICATIONS UNITS
LIKELY TO BE UTILIZED IN THE FUTURE

L: MSAT PAGING POTENTIAL

M: DEVELOPMENT OF COST FORMULAE TO PROVIDE ESTIMATES OF
MOBILE RADIO SYSTEM OPERATING COSTS

N: MSat SERVICE CONCEPTS AND PRELIMINARY ESTIMATES OF
SERVICE COSTS

APPENDIX A

SUPPORTING TABLES

TABLE A.1
CANADIAN POPULATION GROWTH

1961 -1979

<u>1. Population (Millions)</u>	<u>1961</u>	<u>1966</u>	<u>1971</u>	<u>1976</u>	<u>1979</u>
Urban areas - metropolitan	*	10.7	12.0	12.8	13.1
- other	*	4.0	4.4	4.6	*
- total	<u>12.7</u>	<u>14.7</u>	<u>16.4</u>	<u>17.4</u>	<u>*</u>
Rural areas	5.5	5.3	5.2	5.6	*
Total Canada	<u>18.3</u>	<u>20.0</u>	<u>21.6</u>	<u>23.0</u>	<u>23.7</u>
(All non-metro areas	*	9.3	9.6	10.2	10.5)
<u>2. % of Canadian Population</u>					
Urban areas - metropolitan	*	53	56	56	55
- other	*	20	21	20	*
- total	<u>70</u>	<u>74</u>	<u>76</u>	<u>76</u>	<u>*</u>
Rural areas	30	26	24	24	*
Canada	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
(All non-metro areas	*	47	44	44	45)
<u>3. % Annual Growth-Rates</u>					
Urban areas - metropolitan		*	2.3	1.4	0.9
- other		*	1.8	0.7	*
- total		<u>3.0</u>	<u>2.2</u>	<u>1.1</u>	<u>*</u>
Rural areas		-0.9	-0.5	1.7	*
Canada		<u>1.9</u>	<u>1.5</u>	<u>1.3</u>	<u>0.9</u>
(All non-metro areas		*	0.6	1.3	1.1)

* data not available

Source: Census of Canada and Statistics Canada (91-207)

TABLE A.2
MOBILE LICENCE DATA, MARCH 1981
(number of units *)

Industry Sector	Province												
	Nfld.	N.B.	P.E.I.	N.S.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Canada
Agriculture and Fishing	41	219	217	173	1,303	2,385	2,874	2,405	2,610	690	11	19	12,947
Forestry	12	558	13	566	2,287	1,817	84	259	1,333	16,629	92	32	23,682
Minerals	154	135	4	62	1,391	2,101	266	1,103	15,103	3,403	491	767	24,980
Manufacturing	325	1,036	60	888	6,213	10,596	758	743	4,783	4,216	36	21	29,675
Construction	580	1,089	308	1,055	8,448	11,094	1,732	1,706	12,407	6,778	204	137	45,538
Trucking	132	136	27	226	3,902	5,757	896	511	6,306	4,613	200	72	22,778
Transport	1,107	2,408	338	2,345	15,280	19,976	3,416	2,460	9,093	10,828	284	299	67,834
Communications	243	393	76	745	2,705	4,566	327	1,346	3,445	2,440	63	19	16,368
Utilities	595	969	44	719	6,655	4,487	814	1,461	2,239	4,413	39	42	22,477
Trade and Finance	255	791	69	736	4,419	8,054	1,612	1,091	5,636	4,870	111	53	27,697
Services	334	374	118	761	6,684	8,711	1,356	993	10,553	4,662	220	206	34,972
Government	<u>1,653</u>	<u>2,585</u>	<u>355</u>	<u>2,335</u>	<u>12,702</u>	<u>28,791</u>	<u>3,824</u>	<u>4,783</u>	<u>10,787</u>	<u>11,670</u>	<u>773</u>	<u>817</u>	<u>81,075</u>
Land-based	5,431	10,693	1,629	10,611	71,989	108,335	17,959	18,861	84,295	75,212	2,524	2,484	410,023
Ships	963	507	113	1,317	2,018	6,445	86	0	14	12,532	4	112	24,111
Aircraft	<u>181</u>	<u>255</u>	<u>22</u>	<u>171</u>	<u>2,093</u>	<u>4,512</u>	<u>1,149</u>	<u>1,470</u>	<u>3,203</u>	<u>3,109</u>	<u>251</u>	<u>282</u>	<u>16,698</u>
	<u>6,575</u>	<u>11,455</u>	<u>1,764</u>	<u>12,099</u>	<u>76,100</u>	<u>119,292</u>	<u>19,194</u>	<u>20,331</u>	<u>87,512</u>	<u>90,853</u>	<u>2,779</u>	<u>2,878</u>	<u>450,832</u>

* Number of licences is equivalent to number of mobile communications units in use

Source: DOC Mobile Licence Data

TABLE A.3

MOBILE LICENCE DATA, 1973-81,
BY INDUSTRY SECTOR
(Thousands of units, at March)

<u>Industry Sector</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
Agriculture and Fishing	1.5	1.9	2.7	3.8	4.9	6.1	7.8	10.2	12.9
Forestry	12.7	14.2	15.5	16.4	17.6	19.0	20.9	22.0	23.7
Minerals	5.1	6.0	7.0	8.1	10.3	12.7	16.0	19.5	25.0
Manufacturing	11.4	12.9	14.8	17.1	19.5	21.5	24.1	27.1	29.7
Construction	13.7	17.3	22.3	27.2	32.0	35.4	39.0	41.9	45.5
Trucking	8.6	10.6	12.5	14.4	15.3	16.6	18.4	20.3	22.8
Transport	34.4	37.7	42.6	46.0	48.9	53.4	56.5	62.9	67.8
Communications	6.0	6.7	7.8	9.2	10.0	11.8	13.0	14.3	16.4
Utilities	11.0	11.6	12.6	14.6	15.7	16.9	18.7	20.5	22.5 ⁽³⁾
Trade and Finance	7.4	8.8	10.9	13.3	16.5	19.7	22.5	25.0	27.7
Services	10.0	13.1	16.6	20.5	23.0	25.5	27.8	30.8	35.0
Government	<u>32.1</u> ⁽¹⁾	<u>35.1</u>	<u>40.7</u>	<u>48.2</u>	<u>53.4</u>	<u>60.2</u> ⁽²⁾	<u>68.1</u>	<u>74.1</u>	<u>81.1</u>
Land-based Sub-total	153.9	176.0	205.8	238.6	267.1	298.6	332.8	368.6	410.0
Ships	10.4	10.9	12.0	13.1	14.2	16.1	17.8	20.5	24.1
Aircraft	<u>9.1</u>	<u>10.1</u>	<u>11.4</u>	<u>13.1</u>	<u>14.1</u>	<u>15.0</u>	<u>15.5</u>	<u>16.4</u>	<u>16.7</u>
Total	<u>173.4</u>	<u>197.0</u>	<u>229.2</u>	<u>264.7</u>	<u>295.5</u>	<u>330.7</u>	<u>366.0</u>	<u>405.5</u>	<u>450.8</u>

(1) Local Government component estimated - original data show number of licences instead of units.

(2) Local Fire and Police components estimated - original data out of line with surrounding years.

(3) Minor adjustment (-1.6) made for error in original data.

Source: DOC Mobile Licence Data

TABLE A.4

MOBILE LICENCE PROJECTIONS, 1986-2001,
BY INDUSTRY SECTOR

(Thousands of units, at March)

<u>Industry Sector</u>	<u>1986</u>	<u>1991</u>	<u>1996</u>	<u>2001</u>	<u>Projection Method*</u>
Agriculture and Fishing	28.0	43.7	56.3	65.9	Components
Forestry	34.1	48.0	65.3	86.1	Components
Minerals	56.5	98.5	135.9	158.6	Residual
Manufacturing	42.6	51.7	56.7	58.9	Logistic
Construction	53.0	55.8	56.8	57.1	Gompertz
Trucking	32.5	42.8	52.4	60.9	Gompertz
Transport	95.0	126.8	159.0	188.1	Logistic
Communications	23.5	28.7	31.4	32.8	Logistic
Utilities	32.1	41.7	49.6	55.1	Logistic
Trade and Finance	35.9	38.3	38.9	39.1	Logistic
Services	49.6	64.7	79.8	94.9	Straight Line
Government	<u>109.7</u>	<u>125.8</u>	<u>132.8</u>	<u>135.6</u>	Logistic
Land-based Sub-Total	592.5	766.6	914.9	1033.0	Gompertz
Ships	30.7	35.5	38.0	39.1	Logistic
Aircraft	<u>17.4</u>	<u>17.6</u>	<u>17.6</u>	<u>17.6</u>	Logistic
Total	<u>640.6</u>	<u>819.7</u>	<u>970.5</u>	<u>1089.7</u>	Sum of Land-based, Ships and Aircraft

* Usually consists of fitting the specified curve - for further details, see Appendix G. Otherwise, separate Components may be fitted and the results summed, or the projection may be simply a Residual. Both terms are explained further in Appendix G.

Source: Developed from growth in mobile population (Table A.3)

TABLE A.5

MOBILE LICENCE DATA, 1973-81,
BY REGION
 (Thousands of units, at March)

a) Land-based Users

	<u>B.C. + Yukon</u>	<u>Prairies + N.W.T.</u>	<u>Ontario</u>	<u>Quebec</u>	<u>Atlantic Provinces</u>	<u>Canada</u>
1973	29.9	33.0	49.2	31.3	10.5	153.9
1974	35.3	36.9	55.8	35.4	12.6	176.0
1975	41.7	44.6	63.7	40.8	15.0	205.8
1976	48.8	55.7	69.6	47.9	16.5	238.6
1977	52.2	65.3	77.4	53.1	19.1	267.1
1978	58.3	76.6	85.0	57.4	21.4	298.6
1979	63.6	90.1	91.6	63.8	23.6	332.8
1980	70.1	105.3	99.5	67.9	25.9	368.6
1981	<u>77.7</u>	<u>123.6</u>	<u>108.3</u>	<u>72.0</u>	<u>28.3</u>	<u>410.0</u>
1973-81 Growth	160%	275%	120%	130%	170%	166%

b) Ships and Aircraft*

1981	15.9	6.3	11.0	4.1	3.5	40.8
------	------	-----	------	-----	-----	------

c) Total

1976	59.0	59.7	76.6	50.6	18.8	264.7
1981	93.6	129.9	119.3	76.1	31.9	450.8

* It was not possible to obtain a geographic break-down of these numbers for other years. The 1976 total assumes the same regional distribution as 1981.

Note: These numbers contain the same corrections as were applied in Table A.3.

Source: DOC Mobile Licence Data

TABLE A.6

MOBILE LICENCE PROJECTIONS, 1986-2001,
BY REGION

(Thousands of units, at March)

	<u>B.C. + Yukon</u>	<u>Prairies + N.W.T.</u>	<u>Ontario</u>	<u>Quebec</u>	<u>Atlantic Provinces</u>	<u>Canada</u>
1981	93.6	129.9	119.3	76.1	31.9	450.8
1986	124.1	214.8	162.9	93.5	45.2	640.6
1991	155.1	291.1	210.7	103.1	59.6	819.7
1996	185.2	340.1	262.1	108.1	75.0	970.5
2001	<u>214.7</u>	<u>355.5</u>	<u>317.4</u>	<u>110.5</u>	<u>91.6</u>	<u>1089.7</u>
1981-2001 Growth	129%	174%	166%	45%	187%	142%
*Projection method	Straight line	Residual	Parabola	Gompertz	Parabola	Gompertz

* This refers to the land-based portion only. Ship and aircraft units are distributed according to the 1981 proportions. For explanations of the actual methods see Appendix G.

Source: Developed from growth in mobile population (Table A.5)

TABLE A.7

MOBILE TELEPHONE STATISTICS
(Thousands of units)

	Source	
	<u>Statistics Canada</u>	<u>Motorola</u>
1961	3.1	2.0
1962	4.7	2.4
1963	3.7	3.0
1964	4.6	3.7
1965	5.9	4.8
1966	7.7	6.3
1967	8.9	6.9
1968	9.5	7.9
1969	12.4	9.2
1970	10.7	10.1
1971	12.3	11.5
1972	13.7	12.8
1973	12.8	15.5
1974	14.5	18.7
1975	18.5	23.4
1976	21.8	26.3
1977	23.2	N/A
1978	31.8	29.5
1979	39.1	N/A
1980	49.1	41.0
1981	N/A	48.7*

* Woods Gordon estimate for March 1981, based on partial data from Motorola. Includes estimates for Newfoundland, Yukon and NWT.

Notes

1. Both sources exclude Newfoundland, the Yukon and the Western Northwest Territories, which presently account for some 2600 units.
2. Statistics Canada data
 - i) are from publications 56-203 and 56-002
 - ii) exclude user-owned units
 - iii) are full of errors and inconsistencies, apparently caused by bad reporting to StatsCan.
3. Motorola data
 - i) were found, by careful checking with telcos for 1961-76, to show good consistency
 - ii) rely on unsubstantiated numbers from the telcos and TCTS thereafter, and show poor consistency.

TABLE A.8

USER SURVEY - SAMPLE DATA

N.B. This table includes only those systems where sufficient numerical data were obtained to use the results directly in computations.

Regions ⁽³⁾	Metropolitan Systems ⁽¹⁾		Non-Metropolitan Systems ⁽²⁾	
	Systems	Mobiles Licenced ⁽⁶⁾	Systems	Mobiles In Use ⁽⁶⁾
BC + Yukon	27	1394	85	13696
Prairies + NWT	43	2529	149	21815
Ontario	79	5793	67	34760
Quebec	53	2561	85	15495
Atlantic Provinces	24	944	32	5627
National ⁽⁴⁾	-	-	8	33420
	<u>226</u>	<u>13221</u>	<u>426</u>	<u>124813</u>
<u>Industry Sectors⁽⁵⁾</u>				
Agriculture and Fishing	7	100	14	430
Forestry	-	-	27	9901
Minerals	6	61	55	5971
Manufacturing	31	2532	33	1989
Construction	28	586	49	1052
Trucking	16	501	27	1079
Transport	34	3846	47	37338
Communications	9	154	5	8161
Utilities	1	9	23	18991
Trade and Finance	19	148	24	633
Services	28	504	37	3384
Government	47	4780	68	35386
Ships	-	-	8	293
Aircraft	-	-	9	205
	<u>226</u>	<u>13221</u>	<u>426</u>	<u>124813</u>
<u>System Types</u>				
Mobile Telephone	12	47	65	4821
Private Radio	157	12667	299	117377
Common-Carrier Radio	46	367	37	1547
Paging	9	81	4	102
CB	2	59	4	468
Ships	-	-	8	293
Aircraft	-	-	9	205
	<u>226</u>	<u>13221</u>	<u>426</u>	<u>124813</u>

- (1) Systems whose usage is restricted to one metropolitan area as defined in Appendix H.
- (2) Non-Metropolitan systems are all those whose users have some non-metropolitan usage requirement or involve communication between metropolitan areas.
- (3) As defined in Appendix E.
- (4) Distributed below by industry sector as described in Appendix H4. Distributed to regions in other tables according to interview data.
- (5) Defined in Appendix F.
- (6) For non-metropolitan systems, actual number of mobiles in use rather than licenced number is used for analysis of survey results.

TABLE A.9

ESTIMATED MOBILES IN SYSTEMS
WITH NON-METROPOLITAN
REQUIREMENT, 1981

<u>Industry Sector</u>	<u>Nfld</u>	<u>NB</u>	<u>PEI/NS</u>	<u>Que</u>	<u>Ont</u>	<u>Man</u>	<u>Sask</u>	<u>Alta</u>	<u>BC</u>	<u>Yukon</u>	<u>NWT</u>	<u>Total Canada</u>
Agriculture and Fishing	33	219	390	1,057	1,936	2,332	2,405	2,610	691	9	15	11,697
Forestry	12	559	579	2,370	1,817	84	259	1,332	16,597	92	32	23,733
Minerals	115	134	66	1,391	2,096	263	1,111	15,190	3,402	486	768	25,022
Manufacturing	143	1,025	528	5,545	1,203	63	327	4,719	3,810	16	9	17,388
Construction	580	73	1,260	4,795	9,411	1,155	1,096	8,884	5,788	204	88	33,334
Trucking	76	79	147	783	3,943	896	511	5,184	2,724	116	42	14,501
Transport	933	3,804	2,468	9,705	18,757	4,702	3,148	7,849	11,496	237	250	63,349
Communications	239	386	806	2,655	4,890	321	1,321	3,893	2,394	62	18	16,985
Utilities	596	967	765	6,656	4,468	810	1,465	2,239	4,366	39	42	22,413
Trade and Finance	125	791	652	4,260	1,381	269	884	4,263	4,001	111	43	16,780
Services	249	281	659	4,016	6,788	102	747	9,543	2,910	184	163	25,642
Government	966	2,509	2,842	10,097	26,059	4,114	4,792	8,442	7,148	749	780	68,496
Ships	963	507	1,430	2,018	6,445	86	0	14	12,532	4	112	24,111
Aircraft	181	255	193	2,093	4,512	1,149	1,470	3,203	3,109	251	282	16,698
	<u>5,211</u>	<u>11,589</u>	<u>12,785</u>	<u>57,441</u>	<u>93,706</u>	<u>16,346</u>	<u>19,536</u>	<u>77,365</u>	<u>80,968</u>	<u>2,560</u>	<u>2,644</u>	<u>380,151</u>

Source: Based on Table A.2 and Woods Gordon User Survey data. Note: Numbers in this table do not match exactly with Table A.2 data, since it is based on number of units reported to be in use by respondents (which in some cases differ from the licence data) and some adjustments have been made in the allocation of mobiles to industry sector (see Appendix H.4 for details).

TABLE A.10

PROJECTED NUMBER OF MOBILES IN SYSTEMS WITH
NON-METROPOLITAN REQUIREMENT, 1981-2001
('000 units)

<u>Industry Sector</u>	<u># of Mobiles 1981</u>	<u>Annual % Growth Rate 1981-1986</u>	<u># of Mobiles 1986</u>	<u>Annual % Growth Rate 1986-1991</u>	<u># of Mobiles 1991</u>	<u>Annual % Growth Rate 1991-1996</u>	<u># of Mobiles 1996</u>	<u>Annual % Growth Rate 1996-2001</u>	<u># of Mobiles 2001</u>
Agriculture and									
Fishing	11.7	16.6	25	9.3	39	5.2	51	3.1	59
Forestry	23.7	7.6	34	7.1	48	6.4	66	5.7	87
Minerals	25.0	17.8	57	11.8	99	6.6	136	3.1	159
Manufacturing	17.4	7.5	25	4.0	30	1.8	33	0.8	35
Construction	33.3	3.1	39	1.0	41	0.3	41	0.1	42
Trucking	14.5	7.4	21	5.6	27	4.1	33	3.0	38
Transport	63.3	7.1	89	5.9	119	4.6	149	3.4	176
Communication	17.0	7.5	24	4.1	30	1.8	33	0.9	34
Utilities	22.4	7.4	32	5.4	42	3.5	49	2.1	55
Trade and Finance	16.8	5.3	22	1.4	23	0.3	24	0.1	24
Services	25.6	7.1	36	5.5	47	4.3	58	3.5	69
Government	68.5	6.3	93	2.8	107	1.1	113	0.4	115
Sub Total	<u>339.3</u>		<u>497</u>		<u>653</u>		<u>786</u>		<u>893</u>
Ships	24.1	4.9	31	2.9	35	1.4	38	0.6	39
Aircraft	<u>16.7</u>	<u>0.9</u>	<u>17</u>	<u>0.1</u>	<u>18</u>	<u>0.0</u>	<u>18</u>	<u>0.0</u>	<u>18</u>
Total	<u>380.1</u>	<u>7.4</u>	<u>545</u>	<u>5.3</u>	<u>706</u>	<u>3.6</u>	<u>842</u>	<u>2.4</u>	<u>950</u>
Region									
Atlantic	29.6	7.2	42	5.7	57	4.7	71	4.1	87
Quebec	57.4	4.2	71	2.0	79	0.9	84	0.4	85
Ontario	93.7	6.4	128	5.3	167	4.5	209	3.9	255
Prairies + NWT	115.9	10.6	192	6.3	262	3.2	310	0.9	326
BC + Yukon	83.5	5.8	111	4.6	140	3.6	168	3.0	197
Total	<u>380.1</u>	<u>7.4</u>	<u>545</u>	<u>5.3</u>	<u>706</u>	<u>3.6</u>	<u>842</u>	<u>2.4</u>	<u>950</u>

Source: Developed from Table A.9 and industry-sector growth curves (Tables A.4 and A6)

AIRTIME FOR MOBILES IN SYSTEMS
WITH NON-METROPOLITAN
REQUIREMENT, 1981
('000 minutes per average month)

Industry Sector	Nfld	NB	PEI/NS	Que	Ont	Man	Sask	Alta	BC	Yukon	NWT	Total Canada
Agriculture and Fishing	7	47	39	228	172	504	1,588	1,164	319	2	2	4,074
Forestry	3	125	125	12	393	41	56	115	1,995	20	7	2,890
Minerals	49	29	65	459	200	57	31	3,813	692	108	187	5,690
Manufacturing	31	1,501	72	6,200	204	19	71	957	547	4	2	9,607
Construction	83	8	253	2,345	730	73	237	1,571	886	186	19	6,391
Trucking	16	17	32	98	339	61	102	3,989	241	25	9	4,930
Transport	376	1,074	565	2,157	4,492	782	837	2,389	1,674	51	54	14,452
Communications	52	83	174	574	56	69	285	106	517	13	4	1,934
Utilities	68	65	35	23	272	164	334	183	859	8	11	2,023
Trade and Finance	25	347	141	1,308	315	114	191	3,378	1,336	3	9	7,167
Services	55	64	148	899	910	46	177	11,531*	221	40	52	14,142
Government Sub Total	<u>255</u> 1,020	<u>274</u> 3,634	<u>996</u> 2,645	<u>1,824</u> 16,127	<u>14,153</u> 22,236	<u>1,228</u> 3,158	<u>1,247</u> 5,156	<u>1,252</u> 30,448	<u>7,009</u> 16,296	<u>81</u> 541	<u>150</u> 506	<u>28,469</u> 101,769
Ships	52	28	78	110	351	5	0	1	682	0	6	1,312
Aircraft Total	<u>22</u> 1,094	<u>30</u> 3,692	<u>23</u> 2,746	<u>250</u> 16,487	<u>539</u> 23,126	<u>137</u> 3,300	<u>176</u> 5,332	<u>382</u> 30,831	<u>371</u> 17,349	<u>30</u> 571	<u>34</u> 546	<u>1,994</u> 105,075

* Airtime in this sector is high due to high activity rate associated with oil and gas service companies which account for a large proportion of airtime in this sector.

TABLE A.12

NON-METROPOLITAN WIDE-AREA
AIRTIME, 1981*
 (Thousands of minutes per average month)

<u>Industry Sector</u>	<u>Airtime</u>	<u>Region</u>	<u>Airtime</u>
Agriculture and Fishing	436	Nfld.	663
Forestry	1,635	NB	3,197
Minerals	3,851	PEI/NS	1,924
Manufacturing	8,394	Que.	10,102
Construction	3,127	Ont.	20,562
Trucking	1,406	Man.	2,693
Transport	12,970	Sask.	3,060
Communications	425	Alta.	9,394
Utilities	1,882	BC	13,210
Trade and Finance	557	Yukon	400
Services	1,897	NWT	450
Government	25,769		<u>65,655</u>
Ships	1,312		
Aircraft	1,994		
	<u>65,655</u>		

* Systems a) are not confined to one metropolitan area
 b) have range over 100 miles, if linear, or over 50 miles,
 if area.

Source: Woods Gordon User Survey

TABLE A.13

REDUCED NON-METROPOLITAN WIDE-AREA
AIRTIME, 1981*
 (Thousands of minutes per average month)

<u>Industry Sector</u>	<u>Airtime</u>	<u>Region</u>	<u>Airtime</u>
Agriculture and Fishing	436	Nfld.	598
Forestry	1,635	NB	3,197
Minerals	3,851	PEI/NS	1,924
Manufacturing	8,394	Que.	10,064
Construction	3,089	Ont.	20,210
Trucking	1,030	Man.	2,436
Transport	12,395	Sask.	3,060
Communications	369	Alta.	9,298
Utilities	1,701	BC	12,412
Trade and Finance	557	Yukon	400
Services	1,897	NWT	450
Government	25,389		<u>64,049</u>
Ships	1,312		
Aircraft	1,994		
	<u>64,049</u>		

- * Systems
- a) are not confined to one metropolitan area
 - b) have range over 100 miles, if linear, or over 50 miles, if area
 - c) have under 25% of their traffic volume in one metropolitan area

Source: Woods Gordon User Survey

TABLE A.14

MOBILE COMMUNICATIONS GROWTH-RATES, BY INDUSTRY SECTOR
(based on reported airtime usage)

<u>Industry Sector</u>	<u>Five-Year Compound Growth Rates</u> (% per year)			
	<u>1976-1981</u>	<u>1981-1986</u>	<u>1986-1991</u>	<u>1986-1991*</u>
Agriculture and Fishing	6.3	7.3	3.2	3.2
Forestry	5.6	5.2	3.5	4.8
Minerals	11.0	10.6	3.1	4.4
Manufacturing	11.4	11.7	11.1	11.3
Construction	8.2	9.3	7.0	19.2
Trucking	18.7	12.9	0.3	6.1
Transport	21.5	16.2	7.7	8.9
Communications	4.7	2.1	1.4	2.0
Utilities	8.0	8.2	5.0	8.3
Trade and Finance	5.8	4.4	1.6	2.5
Services	13.6	6.2	4.9	13.2
Government	<u>8.3</u>	<u>7.0</u>	<u>6.1</u>	<u>10.9</u>
All Land-Based Mobiles	10.9	9.3	6.0	10.1
Ships	16.9	4.3	3.7	13.3
Aircraft	<u>12.4</u>	<u>5.5</u>	<u>0.0</u>	<u>3.0</u>
All Mobiles	<u>11.0</u>	<u>9.2</u>	<u>5.9</u>	<u>10.0</u>

* Including increased traffic volume that users estimate would result from correcting all major faults in their present systems.

Source: Woods Gordon User Survey

TABLE A.15

MOBILE COMMUNICATIONS GROWTH-RATES, BY REGION
(based on reported airtime usage)

<u>Region</u>	<u>Five-Year Compounded Growth Rates</u> (% per year)			
	<u>1976-1981</u>	<u>1981-1986</u>	<u>1986-1991</u>	<u>1986-1991*</u>
Atlantic	11.3	11.0	5.1	6.6
Quebec	12.0	10.8	9.2	9.7
Ontario	7.5	6.5	4.7	9.7
Prairies + NWT	12.9	9.9	5.2	11.9
BC + Yukon	<u>10.9</u>	<u>8.7</u>	<u>5.7</u>	<u>7.3</u>
Total Canada	<u>11.0</u>	<u>9.2</u>	<u>5.9</u>	<u>10.0</u>

* Including increased traffic volume that users estimate would result from correcting all major faults in their present systems.

Source: Woods Gordon User Survey

TABLE A.16

MSat POTENTIAL MARKET
AIRTIME PROJECTIONS
(Thousands of minutes per average month)

<u>Industry Sector</u>	<u>Airtime</u> <u>1981</u>	<u>Annual</u> <u>Growth</u> <u>Rate %</u> <u>1981-86</u>	<u>Airtime</u> <u>1986</u>	<u>Annual</u> <u>Growth</u> <u>Rate %</u> <u>1986-91</u>	<u>Airtime</u> <u>1991</u>	<u>Annual</u> <u>Growth</u> <u>Rate %</u> <u>1991-96</u>	<u>Airtime</u> <u>1996</u>	<u>Annual</u> <u>Growth</u> <u>Rate %</u> <u>1996-2001</u>	<u>Airtime</u> <u>2001</u>
Agriculture and									
Fishing	436	16.6	939	9.3	1,465	5.2	1,888	3.1	2,199
Forestry	1,635	7.6	2,358	7.1	3,323	6.4	4,531	5.7	5,978
Minerals	3,851	17.8	8,735	11.8	15,257	6.6	21,001	3.1	24,464
Manufacturing	8,394	7.5	12,050	4.0	14,661	1.8	16,029	0.8	16,680
Construction	3,089	3.1	3,598	1.0	3,782	0.3	3,839	0.1	3,858
Trucking	1,030	7.4	1,472	5.6	1,933	4.1	2,363	3.0	2,739
Transport	12,395	7.1	17,466	5.9	23,263	4.6	29,129	3.4	34,429
Communications	369	7.5	530	4.1	648	1.8	708	0.9	740
Utilities	1,701	7.4	2,431	5.4	3,162	3.5	3,755	2.1	4,166
Trade and Finance	557	5.3	721	1.4	773	0.3	785	0.1	789
Services	1,897	7.1	2,673	5.5	3,493	4.3	4,311	3.5	5,120
Government	<u>25,389</u>	6.3	<u>34,460</u>	2.8	<u>39,562</u>	1.1	<u>41,786</u>	0.4	<u>42,628</u>
Sub-Total	<u>60,743</u>		<u>87,433</u>		<u>111,322</u>		<u>130,125</u>		<u>143,790</u>
Ships	1,312	4.9	1,666	2.9	1,922	1.4	2,060	0.6	2,122
Aircraft	1,994	0.9	2,085	0.1	2,095	0.0	2,095	0.0	2,095
Total	<u>64,049</u>	<u>7.3</u>	<u>91,184</u>	<u>4.8</u>	<u>115,339</u>	<u>3.1</u>	<u>134,280</u>	<u>2.0</u>	<u>148,007</u>
<u>Region*</u>									
Atlantic	5,719	7.2	8,182	5.7	10,666	4.7	13,112	4.1	15,572
Quebec	10,064	4.2	12,493	2.0	13,628	0.9	13,926	0.4	13,801
Ontario	20,210	6.4	27,851	5.3	35,624	4.5	43,377	3.9	51,021
Prairies + NWT	15,244	10.6	25,494	6.3	34,187	3.2	39,102	0.9	39,726
BC + Yukon	<u>12,812</u>	<u>5.8</u>	<u>17,164</u>	<u>4.6</u>	<u>21,235</u>	<u>3.6</u>	<u>24,763</u>	<u>3.0</u>	<u>27,887</u>
Total Canada	<u>64,049</u>	<u>7.3</u>	<u>91,184</u>	<u>4.8</u>	<u>115,339</u>	<u>3.1</u>	<u>134,280</u>	<u>2.0</u>	<u>148,007</u>

* Regional projections adjusted to match totals from industry sector projections.

Source: Developed from Woods Gordon User Survey

TABLE A.17

AVERAGE AIRTIME PER MOBILE, 1981

<u>Industry Sector</u>	<u># of Mobiles</u>	<u>Total Airtime</u> (000 min./month)	<u>Airtime/Mobile</u>	
			(min./month)	(min./day*)
Agriculture and Fishing	11,697	4,074	348	17.4
Forestry	23,733	2,890	122	6.1
Minerals	25,022	5,690	227	11.3
Manufacturing	17,388	9,607	552	27.6
Construction	33,334	6,391	192	9.6
Trucking	14,501	4,930	340	17.0
Transport	63,349	14,452	228	11.4
Communications	16,985	1,934	114	5.7
Utilities	22,413	2,023	90	4.5
Trade and Finance	16,780	7,167	430	21.5
Services	25,642	14,142	551	27.5
Government	<u>68,496</u>	<u>28,469</u>	<u>416</u>	<u>20.8</u>
Sub Total	339,341	101,769	300	15.0
Ships	24,111	1,312	54	2.7
Aircraft	<u>16,698</u>	<u>1,994</u>	<u>119</u>	<u>6.0</u>
Total	<u>380,151</u>	<u>105,075</u>	<u>276</u>	<u>13.8</u>

* Based on 20 days operation per month.

Sources: Developed from Tables A.9 and A.11

TABLE A.18

MSat POTENTIAL MARKETPROJECTION OF NUMBER OF MOBILES
('000 units)

<u>Industry Sector</u>	<u>Estimated</u>	<u>Projected Number of Mobiles</u>			
	<u>1981</u>	<u>1986</u>	<u>1991</u>	<u>1996</u>	<u>2001</u>
Agriculture and Fishing	1.2	2.7	4.2	5.4	6.3
Forestry	13.4	19.3	27.2	37.1	49.0
Minerals	17.0	38.5	67.2	92.5	107.8
Manufacturing	15.2	21.8	26.6	29.0	30.2
Construction	16.1	18.7	19.7	20.0	20.1
Trucking	3.0	4.3	5.7	7.0	8.1
Transport	54.4	76.6	102.0	127.7	151.0
Communications	3.2	4.6	5.7	6.2	6.5
Utilities	18.9	27.0	35.1	41.7	46.3
Trade and Finance	1.3	1.7	1.8	1.8	1.8
Services	3.4	4.8	6.3	7.8	9.3
Government	61.0	82.8	95.1	100.4	102.5
Sub Total	<u>208.1</u>	<u>302.8</u>	<u>396.6</u>	<u>476.6</u>	<u>538.9</u>
Ships	24.3	30.8	35.6	38.1	39.3
Aircraft	16.8	17.5	17.6	17.6	17.6
Total	<u>249.2</u>	<u>351.1</u>	<u>449.8</u>	<u>532.3</u>	<u>595.8</u>

Source: Developed by sector from Tables A.16 and A.17. Assumes no change over time in amount of airtime per mobile for each industry sector (reasons for this discussed in section 6.3 of report).

TABLE A.19

TYPES OF MOBILE, 1981

Industry Sector	Number of Units					Percentage Distribution			
	In-vehicle	Personal Portable	Field Portable	Transportable	Total	In-Vehicle %	Personal Portable %	Field Portable %	Transportable %
	Agriculture and Fishing	116	3	-	-	119	97.5	2.5	-
Forestry	7,391	1,903	377	370	10,041	73.6	19.0	3.7	3.7
Minerals	5,537	866	137	290	6,830	81.1	12.7	2.0	4.2
Manufacturing	1,574	150	20	12	1,756	89.6	8.6	1.1	0.7
Construction	1,088	98	10	2	1,198	90.8	8.2	0.8	0.2
Trucking	1,079	-	-	-	1,079	100.0	-	-	-
Transport	26,514	8,605	50	50	35,219	75.4	24.4	0.1	0.1
Communications	4,774	3,000	-	-	7,774	61.4	38.6	-	-
Utilities	11,690	1,858	170	26	13,744	85.1	13.5	1.2	0.2
Trade and Finance	377	15	-	-	392	96.2	3.8	-	-
Services	1,152	143	25	6	1,326	86.9	10.8	1.9	0.4
Government	16,025	17,030	642	753	34,450	46.5	49.4	1.9	2.2
Sub Total*	77,317	33,671	1,431	1,509	113,928	75.8	21.9	1.2	1.1
Ships	293	-	-	-	293	100.0	-	-	-
Aircraft	203	-	-	-	203	100.0	-	-	-
Total*	77,813	33,671	1,431	1,509	114,424	78.4	19.6	1.0	1.0

* Percentage distribution for totals based on grossing-up the individual industry sectors using numbers of mobiles from Table A.17.

Source: Woods Gordon User Survey (not grossed-up). Covers all mobiles utilized by survey respondents with some non-metropolitan area mobile communications requirement.

TABLE A.20

PROJECTED CHANGES IN MIX OF TYPES OF MOBILE

<u>Type of Mobile</u>	Grossed-Up Number of Units 1981 (000's)	Percentage Distribution				
		<u>1981</u> %	<u>1986</u> %	<u>1991</u> %	<u>1996</u> %	<u>2001</u> %
In-Vehicle:						
Mobile Telephone (1)	41.1	10.8	11.5	12.0	13.0	14.0
Mobile Radio	256.9	67.6	66.3	64.6	62.4	60.2
Personal Portable (2)	74.5	19.6	20.0	21.0	22.0	23.0
Field Portable (3)	3.8	1.0	1.1	1.2	1.3	1.4
Transportable	3.8	1.0	1.1	1.2	1.3	1.4
Total	<u>380.1</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>

(1) Total Mobile Telephone population estimated at 48,700 in 1981. We assume the same proportion in the non-metropolitan mobile population presented here as in the total mobile population.

(2) Excludes pagers.

(3) As defined by users. Given the small number of units specifically intended for civilian use, we assume the definition to depend on application rather than hardware.

Source: Projected percentage distribution developed from the background factors affecting mix of units discussed in Appendix K. Grossed-up number of units for 1981 developed from Tables A.19 and A. 17.

TABLE A.21

MSat POTENTIAL MARKET

PROJECTION OF TYPES OF MOBILE
(000's of units)

<u>Type of Mobile Unit</u>	<u>1981</u>	<u>1986</u>	<u>1991</u>	<u>1996</u>	<u>2001</u>
In-Vehicle:					
Mobile Telephone	26.9	40.4	54.0	69.2	83.4
Mobile Radio	168.5	232.9	290.5	332.2	358.8
Personal Portable	48.8	70.2	94.5	117.1	137.0
Field Portable	2.5	3.8	5.4	6.9	8.3
Transportable	2.5	3.8	5.4	6.9	8.3
	<u>249.2</u>	<u>351.1</u>	<u>449.8</u>	<u>532.3</u>	<u>595.8</u>

Sources: Developed from Tables A.18 and A.20

TABLE A.22

YEARS TO SYSTEM REPLACEMENT
(MSat Potential Market)

<u>Years to Replacement</u>	<u># of Systems</u>	<u>1981 # of Mobiles</u>	<u>Total 1981 Airtime</u> (000 min/month)
1	8	3,053	230
2	8	2,544	44
3	7	1,179	188
4	1	18,000	5,475
5	23	16,575	8,761
7	2	1,094	462
8	4	2,993	797
9	1	1,422	324
10	17	6,113	1,117
12	4	4,043	142
15	4	17,158	3,808
20	2	993	378
25	1	1,400	532
Don't Know	76	22,792	2,504
	<u>158</u>	<u>99,359</u>	<u>24,760</u>

Average Years to Replacement = 8.3
(Weighted by the number of mobiles for which an answer was given)

Source: Woods Gordon User Survey

TABLE A.23

MSat MARKET PENETRATIONPROJECTED NUMBER OF MOBILES

<u>Year</u>	(1) Mobiles in Potential Market ('000)	(2) MSat Candidate Mobiles ('000)	(3) Estimated MSat Share %	(4) Projected MSat Units Put Into Service ('000)	(5) Cumulative MSat Subscribers ('000)
1987	371.5	22.3	3	0.7	0.7
1988	391.9	23.5	5	1.2	1.9
1989	411.9	24.7	7	1.7	3.6
1990	431.3	25.9	10	2.6	6.2
1991	449.8	27.0	15	4.1	10.2
1992	467.8	28.1	20	5.6	15.8
1993	485.1	29.1	25	7.3	23.1
1994	501.6	30.1	30	9.0	32.1
1995	517.1	31.0	35	10.9	43.0
1996	532.3	31.9	40	12.8	55.8
1997	546.5	32.8	45	14.8	70.5
1998	560.8	33.6	50	16.8	87.4
1999	572.8	34.4	50	17.2	104.5
2000	584.6	35.1	50	17.5	122.1
2001	595.8	35.7	50	17.9	140.0

- Notes:
- (1) - From Table A.18 and interpolations
 - (2) - Calculated on the basis of those mobiles which are expected to be replaced as part of a system replacement or major upgrading. This is 6% of (1), based on a 16.6 year average system life (see Volume I, section 7.1). For this calculation the new mobiles in any year resulting from market growth are not considered as prime MSat candidates (in the early years of the system) since they will be working within existing radio systems. The impact of new mobile telephone units which might go straight onto MSat is not significant in this context.
 - (3) - See section 7.2.4 of text
 - (4) - (2) x (3)
 - (5) - (4) cumulated.

Source: Developed from market penetration scenario - see notes above.

TABLE A.24

MSat MARKET PENETRATION

PROJECTED NUMBER OF MOBILES PER INDUSTRY SECTOR
('000 Units)

<u>Industry Sector</u>	<u>1996</u>	<u>2001</u>
Agriculture and Fishing	0.6	1.5
Forestry	3.9	11.5
Minerals	9.7	25.3
Manufacturing	3.0	7.1
Construction	2.1	4.7
Trucking	0.7	1.9
Transport	13.4	35.5
Communications	0.6	1.5
Utilities	4.4	10.9
Trade and Finance	0.2	0.4
Services	0.8	2.2
Government	10.5	24.1
Ships	4.0	9.2
Aircraft	<u>1.8</u>	<u>4.1</u>
	<u>55.8</u>	<u>140.0</u>

Source: Developed from Table A.23 by allocation in the same proportions as Table A.18

TABLE A.25

MSat MARKET PENETRATION

AIRTIME PROJECTIONS
('000 minutes per average month)

<u>Industry Sector</u>	<u>1981 Airtime Per Mobile (min/month)</u>	<u>Total Airtime</u>			
		<u>1987*</u>	<u>1991*</u>	<u>1996</u>	<u>2001</u>
Agriculture and Fishing	348	-	-	197	515
Forestry	122	-	-	474	1,405
Minerals	227	-	-	2,201	5,750
Manufacturing	552	-	-	1,678	3,917
Construction	192	-	-	403	907
Trucking	340	-	-	249	647
Transport	228	-	-	3,052	8,090
Communications	114	-	-	74	174
Utilities	90	-	-	393	979
Trade and Finance	430	-	-	81	182
Services	551	-	-	451	1,204
Government	416	-	-	4,378	10,019
Ships	54	-	-	216	499
Aircraft	119	-	-	220	492
	<u>276</u>	<u>185</u>	<u>2,821</u>	<u>14,067</u>	<u>34,780</u>

* Traffic volumes too low to split among industry sectors.

Source: Developed from Tables A.17 and A.24

TABLE A.26

MSat MARKET PENETRATION

PROJECTION OF TYPES OF MOBILE
('000's of units)

<u>Type of Mobile</u>	<u>1987</u>	<u>1991</u>	<u>1996</u>	<u>2001</u>
In-Vehicle:				
Mobile Telephone	0.1	1.2	7	20
Mobile Radio	0.4	6.6	35	84
Personal Portable	0.1	2.1	12	32
Field Portable	0.0	0.1	1	2
Transportable	0.0	0.1	1	2
Total	<u>0.7</u>	<u>10.2</u>	<u>56</u>	<u>140</u>

Source: Developed from Tables A.20 and A.23.

TABLE A.27
ESTIMATED MONTHLY COSTS FOR AIRTIME
AND TOTAL SYSTEM FOR POTENTIAL MSAT SYSTEMS⁽¹⁾

Industry Sector	Unweighted Sample Data						Grossed-up Estimates		
	Airtime Only			Total System			'000 minutes airtime	¢ Per Minute	
	\$ '000 costs	'000 mins. airtime	¢ per minute	\$ '000 costs	'000 mins. airtime	¢ per minute		Airtime only	Total system
	A	B	C	D	E	F	G	H	J
Agriculture and Fishing	5	145	3	4	2	156	436		
Forestry	1382	625	221	1941	625	311	1635		
Minerals	930	831	112	1223	799	153	3819		
Manufacturing	479	1098	44	554	1098	50	8394		
Construction	833	187	445	858	187	458	3089	Same as Col. C	Same as Col. F
Trucking	33	12	271	49	12	400	1030		
Transport	1283	3852	33	2664	3852	69	6859	Col. C	Col. F
Communications	107	92	117	376	92	410	369		
Utilities	1758	915	192	3056	915	334	1701		
Trade and Finance	58	66	89	72	66	110	557		
Services	576	83	692	635	83	763	1112		
Government	1757	6741	26	2908	6728	43	21662		
TOTAL	9202	14648	63	14341	14459	99	50663	95	127

(1) Not comparable with earlier tables--excludes National, Ship, and Aircraft systems as atypical.

Notes: Col. A - Costs arising from fixed installations only, calculated according to Appendix M.
 B - For systems where Column A costs could be developed.
 C - Col. A / Col. B.
 D - Costs including those arising from mobiles, calculated according to Appendix M.
 E - For systems where Column D costs could be developed.
 F - Col. D / Col. E.
 G - From Table A.13, less Ships, Aircraft and Nationals.
 H, J - Totals are weighted averages of the separate industry-sector ¢-per-minute numbers in Cols. C and F, applying as weights the airtimes shown in Col. G.

Source: Developed from Woods Gordon User Survey and the cost formula detailed in Appendix M.

TABLE A.28

RANKING OF TECHNICAL FAILINGS
IN 1981 MOBILE RADIO SYSTEMS
(thousands of minutes of monthly airtime
associated with responses)

<u>Fault</u>	<u>Mentioned Without Prompting</u>			<u>Mentioned After Prompting</u>	<u>All Mentions</u>
	<u>First Mention</u>	<u>Second Mention</u>	<u>Third/Fourth Mention</u>		
Noise/interference/distortion:					
- airtime	17158	8317	5648	27446	58569
- % of total*airtime	18	9	6	28	60
Inadequate range:					
- airtime	34525	1242	1119	13977	50862
- % of total*airtime	35	1	1	14	52
No link with associated systems:					
- airtime	1172	18029	4020	14437	33638
- % of total* airtime	1	18	4	15	34
Excessive maintenance time:					
- airtime	4575	609	-	9635	14819
- % of total*airtime	5	1	-	10	15
Delay in getting through:					
- airtime	6669	212	11	1263	8156
- % of total*airtime	7	0	0	1	8
Other deficiencies:**					
- airtime	7652	8189	53	3816	19710
- % of total*airtime	8	8	0	4	20

* Total estimated airtime associated with all land-based non-metropolitan systems, adjusted allowing for non-responses. (This amounted to 97.6 million minutes per average month.)
The percentages become the 'importance ratings' shown in Table 37 of the report.

** Other deficiencies include: poor voice procedures, lack of channels and frequencies, lack of power, congestion, lack of privacy, lead time to install systems, lack of universality and compatability (MTS), coverage, waiting time to obtain a frequency.

Note: We rank all faults mentioned by respondents without prompting as major failings as far as those individuals are concerned. Minor faults are those where the respondent agreed they were problems only after they were specifically suggested to him.

Source: Woods Gordon User Survey

TABLE A.29

TECHNICAL FAILINGS IN
1981 MOBILE RADIO SYSTEMS
(Unweighted numbers of responses and associated mobiles)

<u>Fault</u>		<u>Mentions</u>		
		<u>Unprompted</u>	<u>Prompted</u>	<u>Total</u>
Noise/interference/distortion	- responses	122	84	206
	- mobiles	48,290	24,886	73,176
Inadequate range	- responses	92	72	164
	- mobiles	49,200	14,140	63,340
Delay in getting through	- responses	38	19	57
	- mobiles	19,461	1,014	20,475
No link with associated systems	- responses	15	28	43
	- mobiles	30,937	5,189	36,126
Excessive maintenance time	- responses	17	24	41
	- mobiles	2,377	2,413	4,790
Other deficiencies*	- responses	67	15	82
	- mobiles	34,819	9,901	44,720

* Other deficiencies include: poor voice procedures, lack of channels and frequencies, lack of power, congestion, lack of privacy, lead time to install systems, lack of universality and compatability (MTS), coverage, waiting time to obtain a frequency.

TABLE A.30

RANKING OF ADDITIONAL FEATURES
DESIRED FOR 1981 MOBILE RADIO SYSTEMS
(thousands of minutes of monthly airtime
associated with responses).

Feature	Mentioned without Prompting			Mentioned After Prompting	All Mentions
	First Mention	2nd/3rd Mentions	Subsequent Mentions		
Data transmission from terminal:					
- airtime	8849	3865	1376	33428	47518
- % of total airtime	9	4	1	34	49
Access to an emergency channel:					
- airtime	74	653	-	45047	45774
- % of total airtime	0	1	-	46	47
Automatic vehicle location:					
- airtime	669	837	1441	42501	45447
- % of total airtime	0	1	1	44	47
Automatic vehicle identification:					
- airtime	335	1266	1441	41780	44822
- % of total airtime	0	1	1	43	46
Connection to the phone system:					
- airtime	2426	21884	6987	12619	43917
- % of total airtime	2	22	7	13	45
Selective signalling to mobiles:					
- airtime	1792	14272	1691	25402	43157
- % of total airtime	2	15	2	26	44
Facsimile					
- airtime	-	53	-	36823	36875
- % of total airtime	-	0	-	38	38
Teletype					
- airtime	-	629	-	35607	36236
- % of total airtime	-	1	-	36	37
Computer input to vehicle:					
- airtime	1341	3823	67	27538	32770
- % of total airtime	1	4	0	28	34
Computer retrieval from vehicle:					
- airtime	-	1468	3448	24168	29084
- % of total airtime	-	2	4	25	30
Computer-assisted dispatch:					
- airtime	502	2068	3584	21010	27164
- % of total airtime	1	2	4	22	28
Voice security					
- airtime	4349	982	2828	17190	25349
- % of total airtime	4	1	3	18	26
Privacy					
- airtime	4651	1	-	462	5113
- % of total airtime	5	0	-	0	5
Other features*- airtime	35225	7469	-	8374	51068
- % of total airtime	36	8	-	9	52

* eg. more power, more frequencies, channel guard, restricted message length, auto-dialling, touch-tone, acknowledgement/message received signal, paging, portability

Notes: 1. All definitions, etc., as Table A.28.
2. 'Voice' was listed as a feature (for paging systems), but there were no mentions.

Source: Woods Gordon User Survey

TABLE A.31

ADDITIONAL FEATURES DESIRED
 FOR 1981 MOBILE RADIO SYSTEMS
 (Unweighted numbers of responses and associated mobiles)

Feature	Mentions		
	Unprompted	Prompted	Total
Automatic vehicle location	- responses 12	126	138
	- mobiles 7,361	31,734	39,095
Automatic vehicle identification	- responses 12	107	119
	- mobiles 34,432	26,652	61,084
Voice security	- responses 37	75	112
	- mobiles 4,735	23,572	28,307
Selective signalling to mobiles	- responses 23	87	110
	- mobiles 15,501	25,186	40,687
Access to an emergency channel	- responses 7	98	105
	- mobiles 960	35,332	36,292
Connection to the phone system	- responses 26	78	104
	- mobiles 37,640	15,318	52,958
Data transmission from terminal	- responses 14	64	78
	- mobiles 24,243	25,082	49,325
Computer retrieval from vehicle	- responses 9	64	73
	- mobiles 14,216	13,922	28,138
Computer input to vehicle	- responses 12	59	71
	- mobiles 14,989	24,467	39,456
Computer-assisted dispatch	- responses 13	48	61
	- mobiles 9,296	7,097	16,393
Teletype	- responses 2	43	45
	- mobiles 650	26,299	26,949
Facsimile	- responses 1	33	34
	- mobiles 150	24,447	24,597
Privacy	- responses 10	8	18
	- mobiles 13,895	321	14,216
Other features*	- responses 61	38	99
	- mobiles 59,190	5,109	64,299

* as Table A.30

Source: Woods Gordon User Survey

NON-USER INTERVIEW LIST
(Users are listed in Appendix J)

Legend: (P) indicates a personal interview. All other contacts were by phone.
(D) indicates an organization wishing to take part in the demonstration.

CONTACT

A. Telephone Companies*

Newfoundland Tel., St. John's	R. Tom Tulk, Market Planner, Mobile Communications (P) Wayne D. Rowsell, Supervisor, Market Planning (P)
Terra Nova Tel., Gander	Frazer Clark
Maritime T and T, Halifax	Ivan Duvar, V.P. Planning (P)
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Manitoba Tel., Winnipeg	L.M. Bunio, Manager, Planning Studies (P) Bill Bracegirdle, Mobile Communications Product Manager (P)
Saskatchewan Tel, Regina	Al R. Schaefer, Supervisor, Mobile Services (P) Brien P. Charlton, Planner, Technology (P) Dennis R. Jones, Planner, Basic Services (P) John Weingardner, Product Manager (P)
AGT, Edmonton	Bob Reid, Supervisor, Public Mobiles (P) Harry Dej, Consultant (P)
North West Tel., Whitehorse	Val C. Boorse, Planning Manager Radio (P) Bill Woloshyniuk, Director of Planning and Plant Extension (P)

* All the telephone companies are interested in the MSat program, although their interest in the demonstration phase depends largely on the role they would play in providing MSat services and on receiving more details of the MSat development program.

CONTACT

TransCanada Telephone System,
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Liz J. Perkin, Market Research
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Don A. Bruce, Manager Radio
Facilities (P)

Hugh J. Horwood, Manager, New
Product Development

B. Radio Common Carriers

TAS Communications, St. John's

Tom Ryan, President (P)

Colcom Communications, Montreal

Christopher E. Lax, President (P)

Time Communications, Ottawa

Botho von Hampeln, President (P)

Pagette Airsignals, Toronto

Gerry Izzard, Chief Engineer

(D) Harrison-Nowell Mobile Radio
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(D) Total North Communications,
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Gordon A. Duncan, General
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Roy E. Anderson

D. Miscellaneous

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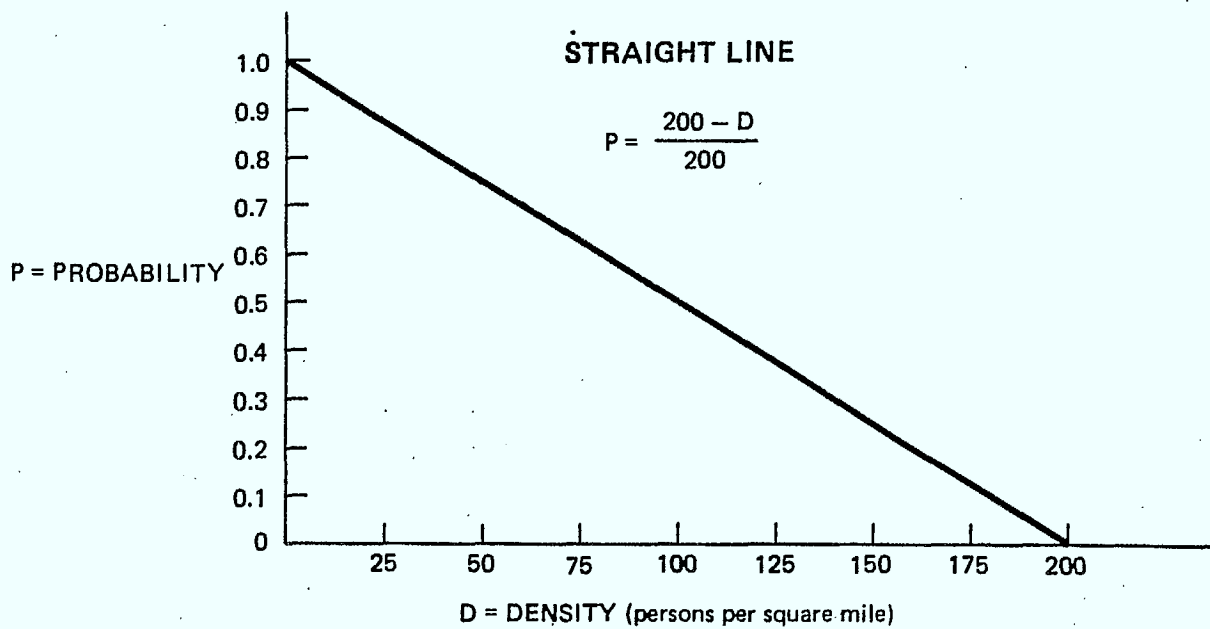
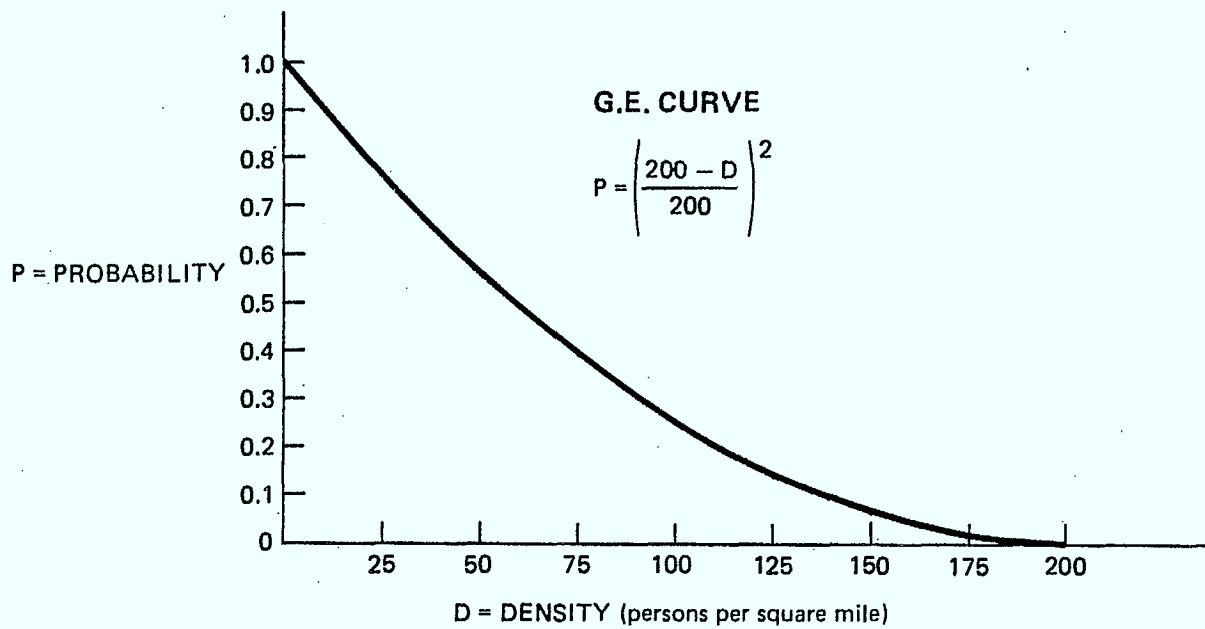
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PROBABILITY FACTOR FORMULAE

APPENDIX C

SERVED-POPULATION CALCULATIONS

C.1 Urban Areas

General Electric (G.E.), in its 1979 study for NASA, chose to define an urban area as any metropolitan area with over 200,000 inhabitants. This was partly for convenience, 200,000 being the limit set by the Bureau of the Census for Standard Metropolitan Statistical Areas (SMSA's). It is also a number fully consistent with G.E.'s wide experimental and operational experience in the field, as well as technical calculations by Ecosystems International and others. G.E. acknowledge, however, that a range of other cut-offs (including 100,000, which is the Canadian limit for the Census Metropolitan Areas defined in Appendix H) would be equally plausible. To cover the full range of minimum population concentrations we wished to examine, we went further down the scale and included Census agglomerations down to the 50,000 population level.

C.2 Probability Factors

G.E. argue that, since the population densities of SMSA's run from about 200 people per square mile upwards, it is reasonable to run the sliding scale from zero probability of using a satellite at that density to 100% at very low densities. Further, it is desirable to use a formula that would yield estimates on the conservative side. Accordingly, they fixed on the following formula, in which P is the probability and D the population density:

$$P = \left(\frac{200 - D}{200} \right)^2$$

The function produced by this formula is shown in the upper diagram opposite.

The population densities of Canada's Census Metropolitan Areas also start at around the 200 people per square mile level. We therefore see no objection from that point of view to using the same formula.

It may, however, be too conservative to use such a curve. The actual function might even approach a straight line. The alternative formula tested, therefore, was:

$$P = \frac{200 - D}{200}$$

This function is shown in the lower diagram.

C.3 Sample Calculations

The tables on the two following pages show the complete calculations, data sources, etc. for the basic cases referred to in the report text.

THEORETICAL POPULATION TO BE SERVED BY SATELLITE

	--- TOTAL ---		URBAN AREAS		----- REMAINDER -----				SERVED POP.	
	AREA	POP.	AREA	POP.	AREA	POP.	DENSITY	FACTOR	DENSITY	'000
	A	B	C	D	E	F	G	H	I	J
NEWFOUNDLAND	41.0	540	.0	0	41.0	540	13.2	.87	11.5	471
LABRADOR	102.5	34	.0	0	102.5	34	.3	1.00	.3	33
	143.5	574	.0	0	143.5	574				505
PEI	2.2	123	.0	0	2.2	123	56.3	.52	29.1	64
NOVA SCOTIA	20.4	848	1.0	273	19.4	575	29.6	.73	21.5	417
NEW BRUNSWICK	27.6	701	.0	0	27.6	701	25.4	.75	19.3	534
S. QUEBEC	106.3	5899	2.8	3559	103.5	2340	22.5	.79	17.8	1841
N. QUEBEC	418.0	385	.0	0	418.0	385	.9	.99	.9	381
	524.3	6284	2.8	3559	521.5	2725				2222
S. ONTARIO	95.3	8169	4.6	5072	91.8	3097	33.8	.69	23.3	2140
N. ONTARIO	257.9	334	.0	0	257.9	334	1.3	.99	1.3	330
	354.2	8503	4.6	5072	349.7	3432				2470
S. MANITOBA	42.9	955	.9	590	42.0	354	8.7	.92	7.9	333
N. MANITOBA	168.5	78	.0	0	168.5	78	.5	1.00	.5	77
	211.5	1032	.9	590	210.6	442				410
S. SASKATCHEWAN	122.7	935	.0	0	122.7	935	7.6	.93	7.1	865
N. SASKATCHEWAN	97.5	24	.0	0	97.5	24	.2	1.00	.2	24
	220.1	959	.0	0	220.1	959				889
S. ALBERTA	102.4	1825	1.7	1118	100.7	707	7.0	.93	6.5	658
N. ALBERTA	144.1	188	.0	0	144.1	188	1.3	.99	1.3	185
	246.4	2013	1.7	1118	244.8	895				844
S. B.C.	145.0	2420	1.3	1400	143.8	1020	7.1	.93	6.6	949
N. B.C.	199.8	150	.0	0	199.8	150	.7	.99	.7	148
	344.8	2570	1.3	1400	343.6	1170				1098
YUKON	205.3	22	.0	0	205.3	22	.1	1.00	.1	22
N.W.T.	1253.4	43	.0	0	1253.4	43	.0	1.00	.0	43
CANADA	3553.8	23671	12.1	12012	3541.7	11659				9518

- SOURCES - A, C, E - 1976 CENSUS
 - B - S.C.CAT.NO.91-201, JUNE 1979, FOR PROVINCIAL TOTALS
 - S.C.CAT.NO.91-206, JUNE 1978, FOR NORTHERN SECTIONS
 - TOTAL LESS NORTH FOR SOUTHERN SECTIONS
 - D - S.C.CAT.NO.91-207, JUNE 1979
 - F - B-D
 - G - F/E
 - H - $[(200-G)/200]^2$
 - I - C*H
 - J - F*H

- NOTES - 1. POPULATIONS IN '000
 - 2. AREAS IN '000 SQ. MILES, LAND ONLY
 - 3. URBAN AREAS INCLUDE ALL OVER 200,000 POPULATION
 - 4. FORMULA FOR USE FACTOR (COL.H) TAKEN FROM G.E. STUDY FOR N.A.S.A.
 - 5. NORTHERN AREAS CONSIST OF -
 QUEBEC - CHICOUTIMI, LAC ST. JEAN OUEST, NOUVEAU QUEBEC, SAGUENAY
 ONTARIO - COCHRANE, KENORA, RAINY RIVER, THUNDER BAY
 MANITOBA - DIVISIONS 19, 21, 22, 23
 SASKATCHEWAN - DIVISION 18
 ALBERTA - DIVISIONS 12, 15
 B.C. - BULKLEY-NECHAKO, CENTRAL COAST, KITIMAT-STIKINE,
 PEACE RIVER-LIARD, SKEENA-QUEEN CHARLOTTE, STIKINE

THEORETICAL POPULATION TO BE SERVED BY SATELLITE

	--- TOTAL ---		URBAN AREAS		----- REMAINDER -----				SERVED POP.	
	AREA	POP.	AREA	POP.	AREA	POP.	DENSITY	FACTOR	DENSITY	'000
	A	B	C	D	E	F	G	H	I	J
NEWFOUNDLAND	143.5	574	.0	0	143.5	574	4.0	.96	3.8	551
PEI	9.2	123	.0	0	2.2	123	56.3	.52	29.1	64
NOVA SCOTIA	20.4	848	1.0	273	19.4	575	29.6	.73	21.5	417
NEW BRUNSWICK	27.6	701	.0	0	27.6	701	25.4	.76	19.3	534
QUEBEC	524.3	6284	2.8	3559	521.5	2725	5.2	.95	5.0	2584
ONTARIO	354.2	8503	4.6	5072	349.7	3432	9.8	.90	9.9	3103
MANITоба	211.5	1032	.9	590	210.6	442	2.1	.98	2.1	432
SASKATCHEWAN	220.1	959	.0	0	220.1	959	4.4	.96	4.2	918
ALBERTA	246.4	2013	1.7	1118	244.8	895	3.7	.96	3.5	862
B.C.	344.8	2570	1.3	1400	343.6	1170	3.4	.97	3.3	1130
YUKON	205.3	22	.0	0	205.3	22	.1	1.00	.1	22
N.W.T.	1253.4	43	.0	0	1253.4	43	.0	1.00	.0	43
 CANADA	 3553.8	 23671	 12.1	 12012	 3541.7	 11659				 10661

- SOURCES - A,C,E - 1976 CENSUS
 - B - S.C.CAT.NO.91-201, JUNE 1979
 - D - S.C.CAT.NO.91-207, JUNE 1979
 - F - B-D
 - G - F/F
 - H - $[(200-G)/200]^2$
 - I - C*H
 - J - F*H

- NOTES - 1. POPULATIONS IN '000
 - 2. AREAS IN '000 SQ. MILES, LAND ONLY
 - 3. URBAN AREAS INCLUDE ALL OVER 200,000 POPULATION
 - 4. FORMULA FOR USE FACTOR (COL.H) TAKEN FROM G.F. STUDY FOR N.A.S.A.

APPENDIX D

DOC MOBILE LICENCE CLASSES

The DOC mobile licence classes and sub-classes (known as service categories) we are concerned with in this study are as follows:

<u>Class</u>	<u>Service Category</u>	<u>Licences Feb. 81*</u>
<u>Land-Based Mobiles Included in Study</u>		
Mobile	A Public Commercial	14
	B Private Commercial	322,101
	D Provincial Government	46,944
	E Municipal	44,820
		<u>413,879</u>
<u>Land-Based Mobiles Excluded From Study</u>		
Mobile	F Experimental	663
	G Public Commercial Receiving	1
	H Private Commercial Receiving	488
	J Aircraft Navigational	4
		<u>1,156</u>
<u>Other Categories Included in Study</u>		
Mobile	K Aeronautical	17,077
Ship	All	24,146

* Latest available totals. These differ from the March 1981 numbers utilized in the industry sector and regional analyses of mobile communications usage. This is believed to be because the February data had not been updated for non-renewed licences.

APPENDIX E

DOC REGIONS DEFINITIONS

DOC's District Offices are organized into regions as

follows:

<u>#</u>	<u>Location</u>	<u>#</u>	<u>Location</u>
112	Vancouver*	436	Thunder Bay
113	Victoria	437	Kenora
114	Prince Rupert	442	Toronto*
115	Kelowna	443	Hamilton
116	Prince George	444	London
117	Cranbrook	445	Kitchener
118	Langley	446	Sault Ste. Marie
125	Whitehorse	447	North Bay
<u>Region 1</u>	<u>B.C. + Yukon</u>	448	Kingston
		449	Ottawa**
		471	Windsor
		<u>Region 4</u>	<u>Ontario</u>
222	Edmonton		
223	Calgary		
224	Grande Prairie		
226	Yellowknife	552	Montreal*
232	Winnipeg*	553	Sherbrooke
233	Regina	554	Chicoutimi
234	Saskatoon	555	Quebec
<u>Region 2</u>	<u>Prairies + N.W.T.</u>	556	Trois-Rivieres
		557	Sept-Iles
		558	Noranda
		559	Rimouski
		<u>Region 5</u>	<u>Quebec</u>
	<u>#</u>	<u>Location</u>	
	662	Moncton*	
	663	Halifax	
	664	Sydney	
	665	Saint John	
	666	St. John's	
	667	Bathurst	
	668	Corner Brook	
	669	Summerside	
	<u>Region 6</u>	<u>Atlantic Provinces</u>	

* There are separate Regional offices in these cities, but all licence data are coded to District offices.

** Includes Hull. Data from survey questionnaires were re-coded to appear in Quebec.

*** There is no DOC Region 3.

APPENDIX F

INDUSTRY SECTOR DEFINITIONS

DOC uses Statistics Canada's Standard Industrial Classification to code every organization that holds a mobile licence. The normal breakdown is into 12 Divisions, each Division into up to 20 Major Groups, and each Major Group into up to 21 SIC classes, for a total of about 260 SIC classes.

This scheme is inappropriate for use in analysing the study results, so we have used a breakdown into 12 industry sectors, generally a regrouping of complete Major Groups:

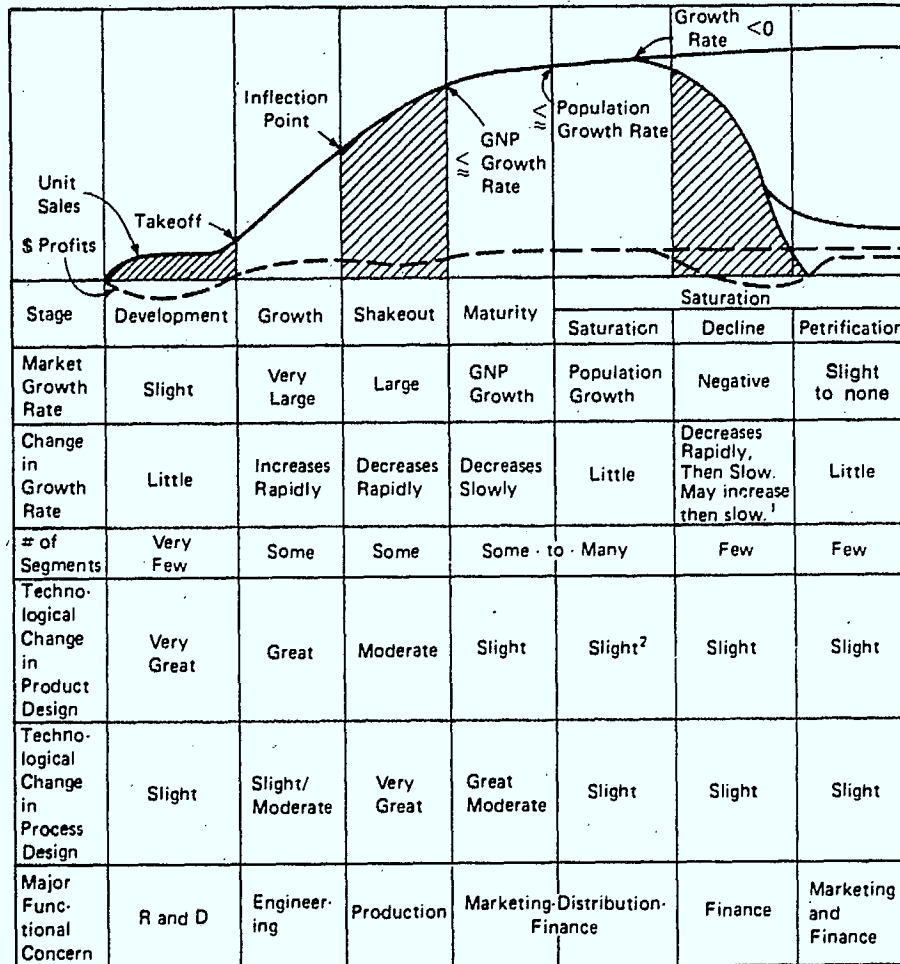
<u>Industry Sector</u>	<u>SIC Classes</u>	<u>Contents</u>
Agriculture and Fishing	001-019 021 041, 045 047	Farms Agricultural Services Fishing Hunting and Trapping
Forestry	031 039	Logging Forestry Services
Minerals	051-059 061, 064 071-087 096-099	Metal Mines Coal, Oil and Gas Non-Metal Mines, etc. Mining Services
Manufacturing	101-399	All Manufacturing
Construction	404 406 409 421	Building Highways, Bridges, Streets Other General Contracting Special Trades
Trucking	507	(excludes Moving and Storage)
Transport	501-505 506 508-512 515 516 517, 519 524, 527	Air, Rail and Water Moving and Storage Buses, Transit, Taxis Pipelines Highway and Bridge Maintenance Services and Miscellaneous Storage

<u>Industry Sector</u>	<u>SIC Classes</u>	<u>Contents</u>
Communications	543-548	Radio, TV, Phone, etc.
Utilities	572-579	Electricity, Gas, Water, etc.
Trade and Finance	602-629	Wholesalers
	631-699	Retailers
	701-777	Finance, Insurance and Real Estate
Services	801-809	Education
	821-828	Health and Welfare
	831	Religious
	841-849	Amusement and Recreation
	851-869	Business
	871-879	Personal
	881-886	Accommodation and Food
Government	891-899	Miscellaneous
	902, 909	Federal
	931*	Provincial
	951*	Local
	991	Miscellaneous

* DOC splits these to Administration, Police and Fire. For the purposes of this study the codes used were:

	<u>Provincial</u>	<u>Local</u>
Administration	931	951
Police	932	953
Fire	933	952

The Fundamental Stages of Product/Market Evolution



¹ The rate of change of the market growth rate usually only increases during the decline stage for these products that do not die, i. e., that enter the petrification stage of evolution.

² Although the rate of technological change in the basic design of the product is usually low during these stages of market evolution, the probability of a major breakthrough to a different kind of product that performs the same function increases substantially during these stages of evolution.

SOURCE: C. W. Hofer, "Conceptual Constructs for Formulating Corporate and Business Strategy," (Boston: Intercollegiate Case Clearing House. #9-378-754, 1977), p. 7.

APPENDIX G

PROJECTION METHODS FOR ANALYSING EXPECTED GROWTH IN MOBILE COMMUNICATIONS

G.1 Curve-Fitting

Markets and similar data series most often grow slowly at first, then faster and faster until an "inflection" point is reached. Thereafter the growth-rate declines until eventually it approaches zero, when the series nears its theoretical limit or "asymptote". To this point the curve has a stretched S shape. This is the initial portion of the 'product life cycle' illustrated opposite.

Two of the commonest of these curves are:

- the logistic, whose formula is $1/y = a + br^t$
- the Gompertz $\log y = a + br^t$,

where y is a number from the original series
a represents the asymptote
b is a constant
r is a growth factor
t is the time-period.

Most of the mobile radio series belonging to the industry sectors defined in Appendix F fit one of these two curves, which promotes confidence in the results.

Where a series is still on the lower part of the S-curve, it may not be possible to decide which curve it will develop into. In

this case, another curve, such as the parabola, may have to be used, i.e.

$$y = a + bt + ct^2$$

where y, b and t have the same definitions as above, and a and c are constants.

In other situations, especially when the whole series is in the middle of the S, it may be necessary to resort to the straight line as a means of projecting future growth, i.e.

$$y = a + bt$$

where a and b are constants, and y and t are defined as above.

G.2 Components

Two of the industry series defined for this study are too irregular to fit curves. This is because they consist of a number of components with widely differing growth patterns. In these cases, we have projected the components separately and summed the results.

These specific cases are:

- o Agriculture and Fishing = Farms, which follows a Gompertz curve plus Agricultural Services (logistic) plus Fishing, Hunting and Trapping, (parabola)
- o Forestry = Logging (parabola) plus Forestry Services (logistic).

G.3 Residual

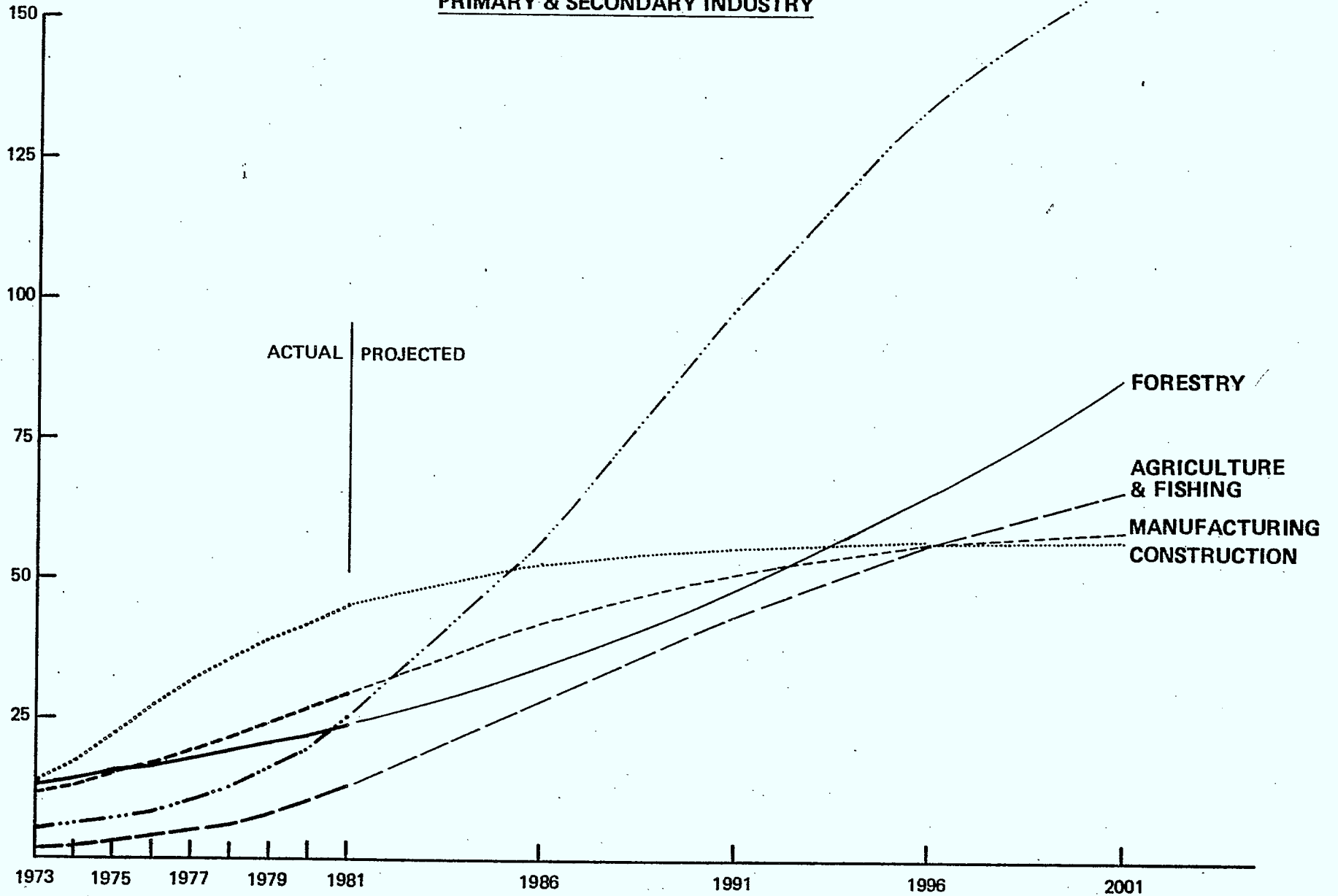
As a last resort, a series which will not project reasonably by either method above can simply be calculated as what is left over after all other sectors are subtracted from a projection of the grand total. This occurs only with the Minerals industry, which contains the Oil and Gas sector, whose numbers are so dynamic as to be (statistically) unmanageable; and with the Prairies and NWT region, to which the same remark applies.

G.4 Comment

Although the curves are generally of the expected types, it must be borne in mind that we are making a 20-year projection (1982-2001) from a 9-year base (1973-1981). Under such conditions, the resulting projections should be considered to be broad indications only.

Number of
Mobile Licences
(000's)

MOBILE LICENCES, 1973 - 2001
PRIMARY & SECONDARY INDUSTRY



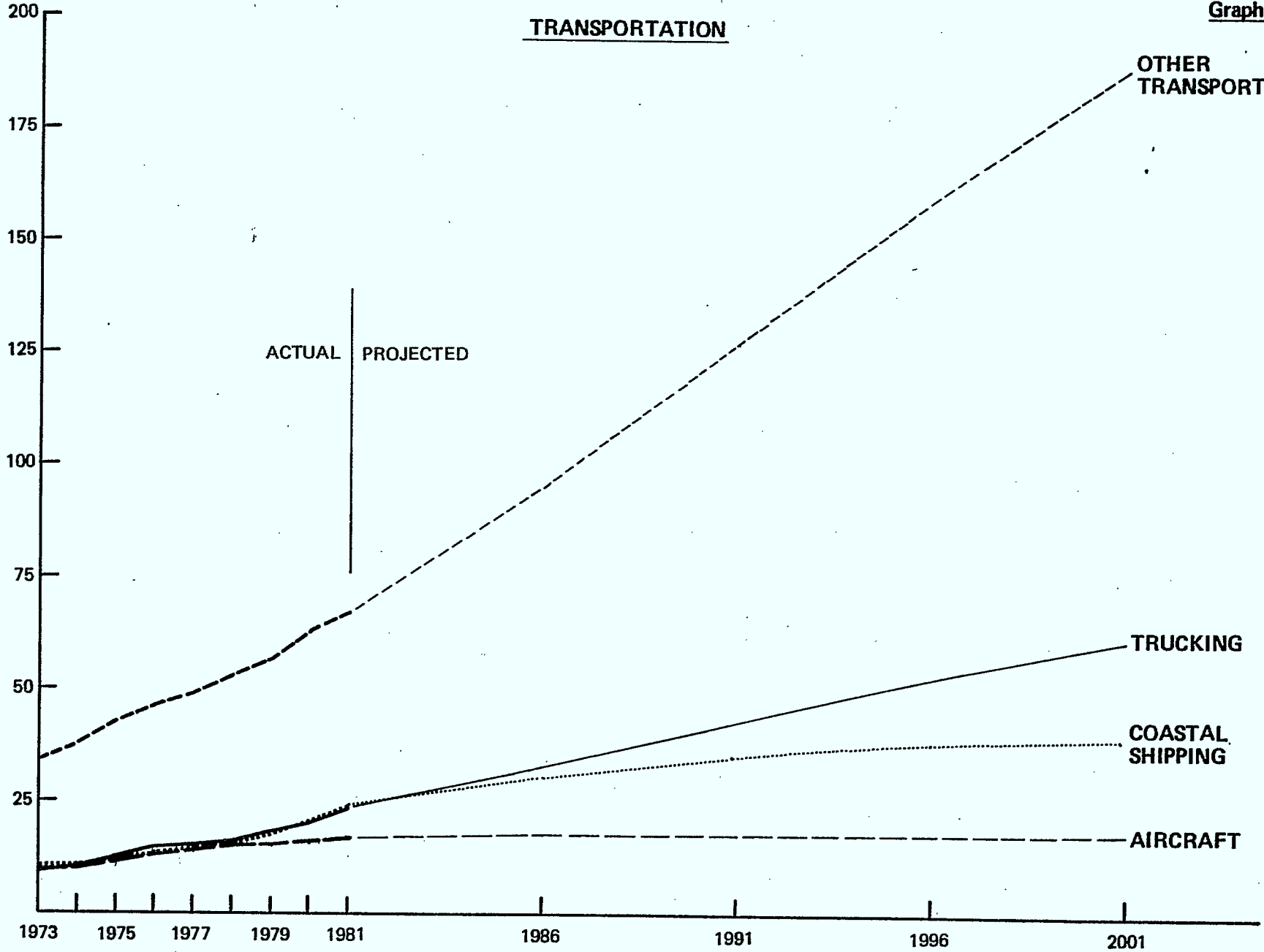
SOURCE: Developed from Tables A3 and A4

Number of
Mobile Licences
(000's)

MOBILE LICENCES, 1973 - 2001

Appendix G
Graph 2

TRANSPORTATION



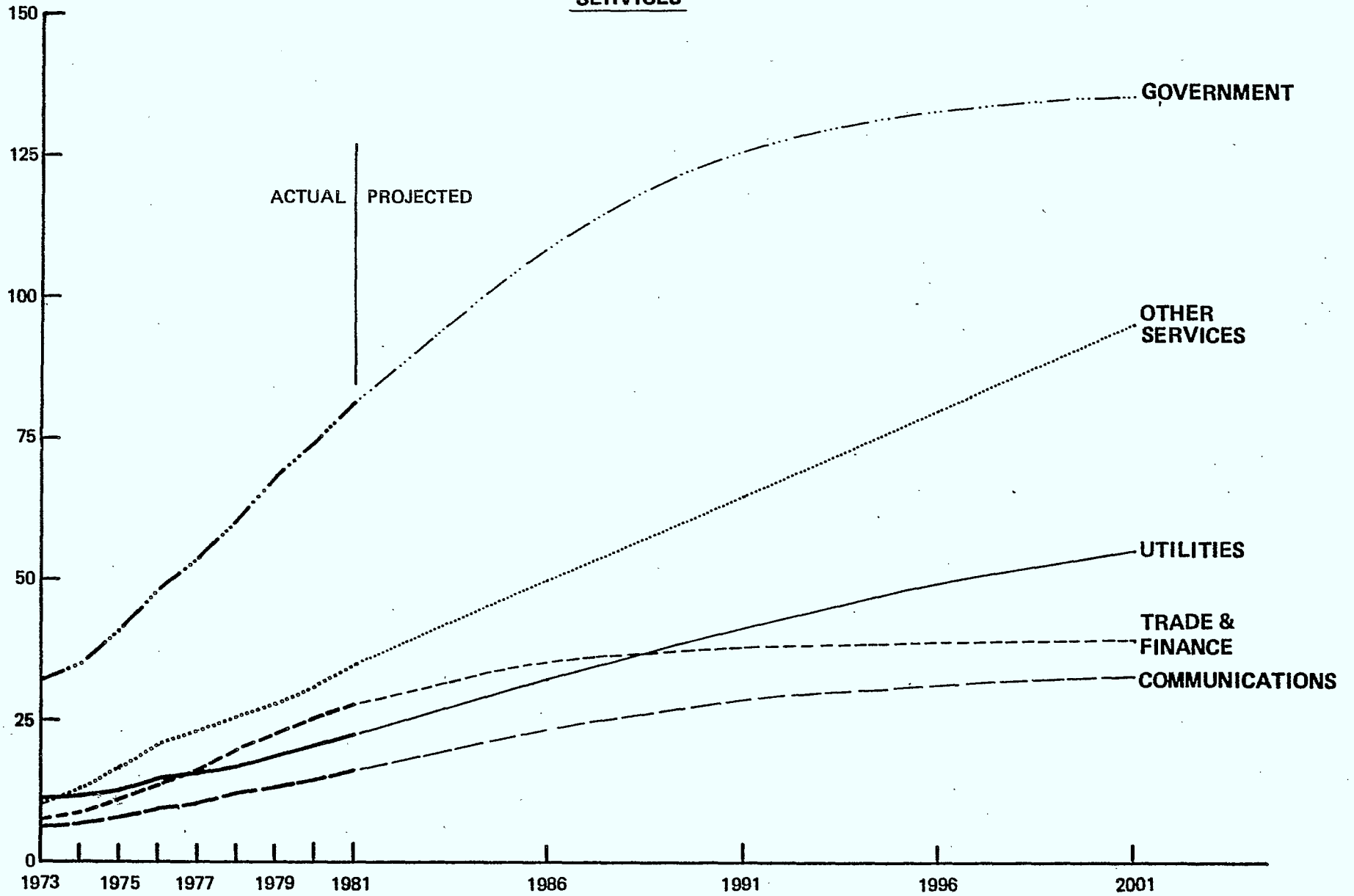
SOURCE: Developed from Tables A3 and A4

Number of
Mobile Licences
(000's)

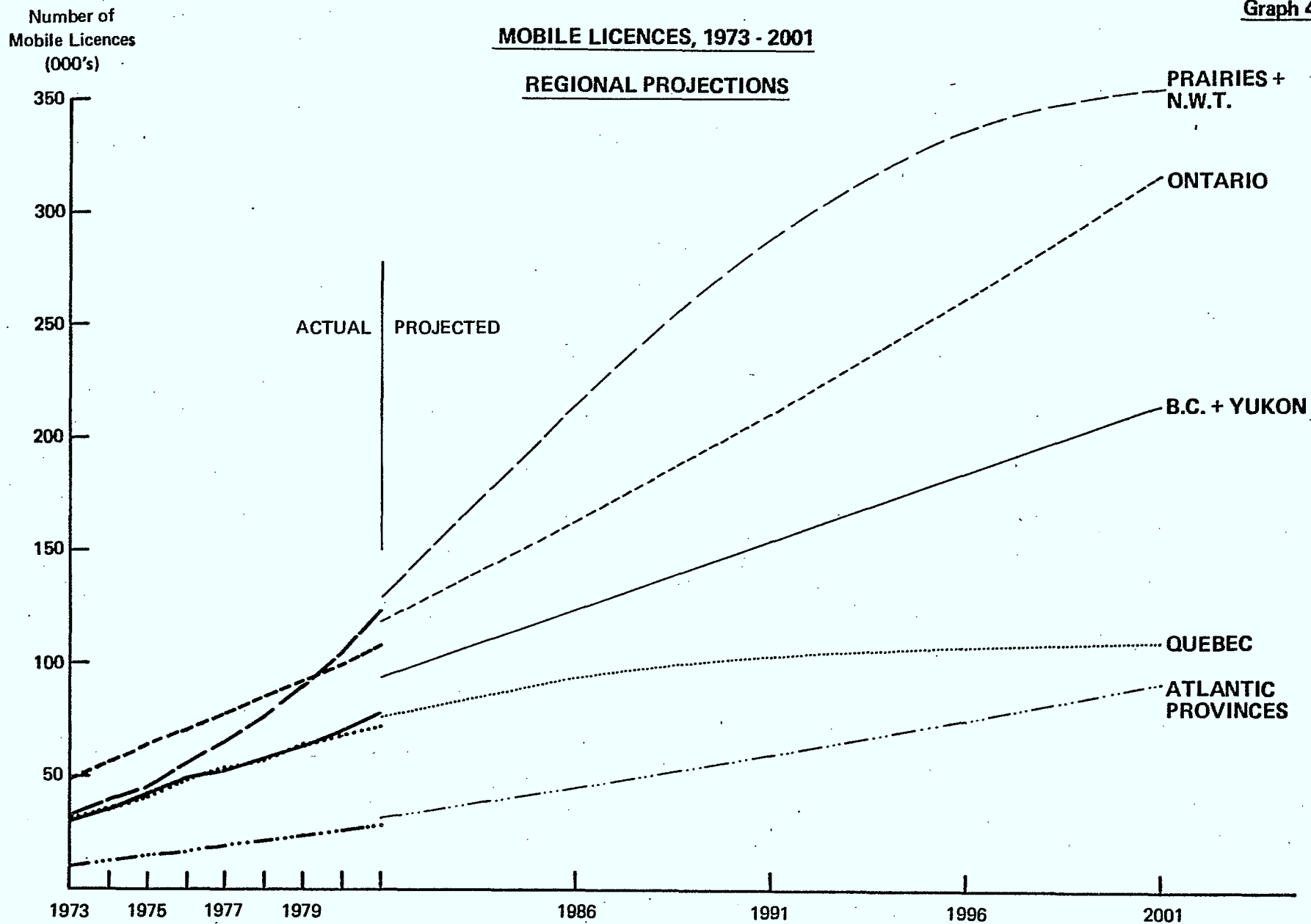
MOBILE LICENCES, 1973 - 2001

Appendix G
Graph 3

SERVICES



SOURCE: Developed from Tables A3 and A4



SOURCE: Developed from Tables A5 and A6. Historical data excludes ship and aircraft mobiles, resulting in discontinuity of lines in 1981.

APPENDIX H

THE WOODS GORDON USER SURVEY

H.1 User Survey Details

DOC provided a complete listing of licencees of land-based mobiles (defined in Appendix D), broken down by SIC class. Within each SIC class, all licences held by any one organization in a given DOC District Office's area were consolidated into one entry, showing:

- name and address
- company code
- District Office
- number of mobiles licenced, by service category (see Appendix D).

The entries were also arranged in ascending order of number of mobiles.

From this list, every 375th mobile (not entry) was selected, to give a sample of about 1,100 users, providing an ample margin to account for non-response and inability to contact during the survey. This procedure ensured that all large users (i.e. everybody with 375 mobiles or more in one area) were in the sample but that small users, including the thousands with only one or two mobiles, were also fairly represented.

Of this sample, 110 were selected for personal interviews. This selection did not ignore the question of getting representation from all industries and all areas, but was deliberately biased towards the larger and/or more interesting users. This approach ensured that we got the best insights in the most important areas,

without distorting the final results, since the same questionnaires were used for both the personal and supporting telephone interviews.

A similar procedure was followed for the Ship and Aircraft categories, whose licence data were supplied later and in a slightly different format, without SIC classes.

The whole interview program was concentrated in March and April 1981, but call-backs to check details, as well as additional interviews to strengthen under-represented categories, went on until mid-May.

The questionnaire used for the user survey is described and reprinted in Section H.2 of this appendix. The organizations and individuals interviewed are listed in Appendix J. The distribution by industry sector, region and system type of the systems discussed with these individuals and of the mobiles associated with them are detailed in Appendix Table A.8.

All staff involved only in the interview program were Woods Gordon or KVA professionals with considerable experience in this type of assignment. All were supplied with an information package containing:

- o Project background, including the proposal, a glossary of relevant terminology, and extracts from various other studies in the field
- o Interview material, including sample questionnaires, guidelines on conducting the interviews, and appropriate classification definitions (DOC office locations, metropolitan areas, SIC classes), etc.
- o Project administration and control procedures.

Finally, all were thoroughly briefed for several hours in groups of no more than four before making their first contacts. For the

first few days, all completed questionnaires were returned daily to Toronto, so that project management could monitor results in detail and take any necessary corrective action.

H.2 User Questionnaires

Interviews with the mobile radio user sample were carried out using slight variations of the 'Shared Radio' questionnaire reprinted in this Appendix. The variations were:

- | | | | |
|----------|----|---|---|
| Question | 3 | - | Omitted for Mobile Telephone (MTS), CB, Private Radio (PRS) |
| | 4 | | Omitted for CB |
| | 6 | | Omitted for Paging |
| | 7A | | Substituted by 7B for Paging, CB, PRS:
'On an average day, how many messages would go over your system?'
and (for CB and PRS only):
'Taking long, short and normal messages all into account, what would be the average length of a message? (minutes).... Just to check, that works out to about _____ minutes a day, or _____ minutes a month. Does that sound about right?' |
| | 14 | | 'Delay in getting through' omitted for Paging, CB, PRS |
| | 16 | | 'Voice' added for Paging
'Privacy' omitted for MTS, PRS
'Selective signalling to mobiles' omitted for MTS, Paging
'Connection to the phone system' omitted for MTS |
| | 17 | | Omitted for MTS, CB |

After these questionnaires were produced, interviewers were asked, in light of early interviewing experience and specific requests by DOC, to make certain changes:

- to note any shared PRS systems and any using SSB (Single Side Band) units (both to be recorded on PRS questionnaires), in order to provide for better cost estimates.
- to note whether pagers were tone-only or tone-and-voice, for the same reason.

- to clarify 'size of operation' in question 2 as meaning radius of an area/block system and total length of a linear/ribbon system, for the same reason again.
- add notes on periods of zero use in questions 8-10, for special computer coding at the editing stage.
- add 'extended range' and 'keyboard with display' to question 16.
- the mix of types of mobile currently utilized (in-vehicle, personal portable, field portable, transportable, pager or other).
- specifically emphasize additional points in the concluding free discussion (question 22) -
 - types of unit envisaged for future use (transportables, etc.) and proportion of each.
 - respondents' interest in participating in the demonstration phase.*
 - the expected voice/data split of future usage, where appropriate.
 - the direct and indirect benefits foreseen of MSat.
 - novel applications foreseen for MSat.

These questionnaires were used only as guides to the large amount of data that had to be collected and to provide a framework within which computer analysis of the data would be possible. It was essential for our interviewers to use their experience and judgement, in view of the complexity of the subject and the great variety of respondents, in varying the wording and even order of individual questions. On occasion (notably at question 7) they had to improvise entirely new approaches to extract essential information.

* List submitted separately to DOC.

DOC USER INTERVIEW

Organization - name
- address
- phone

Contact - name
- position

Interviewer -

Date -

Serial No.

SIC

DO

No. of mobiles

Personal

Phone

(2-4)

(5-7)

(8-10)

(11-14)

1 (15)

2

Notes on call-backs, etc.

1. Could we start with the basic details of your present system: What kind or kinds of mobile communications do you have at the moment? (READ LIST IF NECESSARY)

- | | | | |
|--|-------------|---|------|
| - Mobile telephone | (A - buff) | 1 | (16) |
| - Wide-area paging | (B - blue) | 2 | |
| - CB radio | (C - gold) | 3 | |
| - Private radio system | (D - white) | 4 | |
| - Shared (common carrier) radio system | (E - green) | 5 | |

SELECT APPROPRIATE QUESTIONNAIRE(S) _____

IF MORE THAN ONE, ASK: Which one has the most mobile units?
AND START WITH THAT ONE. COME BACK TO THE OTHERS IF CONTACT SEEMS WILLING.

E

SHARED RADIO

Serial No.

--	--	--

2. Please describe generally what your system does - the job it does, the area where it operates, the department using it, and so on

DETAIL AT LEAST - TOWN(S)/AREA(S) OF OPERATION

- % OF OPERATION IN -

- ONE METROPOLITAN AREA*
- OTHER TOWNS
- RURAL/REMOTE AREAS

* IF 100%, CLOSE INTERVIEW ON THIS SYSTEM

- SHAPE OF AREA OF OPERATION -

- LINEAR/RIBBON (E.G. ROAD, PIPELINE)
- AREA/BLOCK (E.G. FORESTRY CONCESSION)

- SIZE OF AREA OF OPERATION - MILES RANGE FROM BASE

(17-19)
(20-22)
(23-25)

1 (26)
2

--	--	--	--

(27-30)

3. Is the service provided by the phone company?

Yes
No

1 (31)
2

4. Are the mobile units owned by your company?

Yes
No

1 (32)
2

5. How many mobile units are there in this system?
CHECK WITH LISTED DATA AND RECONCILE IF NECESSARY.

--	--	--	--

(33-36)

6. Calls may be between mobiles or between base and mobile. What % of the messages on this system are between mobiles?

--	--	--

(37-39)

Now we need to look at how much the system is used.

7A. What is your average monthly bill for calls/airtime? \$ (40-43)

Roughly how many minutes of calls/airtime per month does that cover? (44-47)

8. Is the system much busier at some times of the year than others? Yes 1 (55)
GO TO Q. 9 ← No 2

Which are the busy times? →
Which are the slack times? →

	Slack	Busy	
Jan.	1	2	(56)
Feb.	1	2	(57)
Mar.	1	2	(58)
Apr.	1	2	(59)
May	1	2	(60)
Jun.	1	2	(61)
Jul.	1	2	(62)
Aug.	1	2	(63)
Sept.	1	2	(64)
Oct.	1	2	(65)
Nov.	1	2	(66)
Dec.	1	2	(67)

CIRCLE ALL THAT APPLY

If an average month's traffic is 100, about how much traffic would there be in a typical busy month?

(68-70)

And in a typical slack month?

(71-72)

9. Is your system much busier on some days than others? Yes 1 (73)
SKIP TO Q. 10 ← No 2

Which are the busy days? →
Which are the slack days? →

	Slack	Busy	
Mon.	1	2	(74)
Tues.	1	2	(75)
Wed.	1	2	(76)
Thurs.	1	2	(77)
Fri.	1	2	(78)
Sat.	1	2	(79)
Sun.	1	2	(80)
Summer public holidays	1	2	(81)
Winter public holidays	1	2	(82)

CIRCLE ALL THAT APPLY

If an average day's traffic is 100, about how much would there be on a busy day?

(83-85)

And on a slack day?

(86-87)

10. Are some parts of the day much busier than others on your system?

Yes 1 (88)
GO TO Q. 11 ← No 2

Which are the busy periods?
Which are the slack periods?

CIRCLE ALL THAT APPLY

A.M.

P.M.

		Slack	Busy	
A.M.	Midnight - 1	1	2	(89)
	1 - 2	1	2	(90)
	2 - 3	1	2	(91)
	3 - 4	1	2	(92)
	4 - 5	1	2	(93)
	5 - 6	1	2	(94)
	6 - 7	1	2	(95)
	7 - 8	1	2	(96)
	8 - 9	1	2	(97)
	9 - 10	1	2	(98)
	10 - 11	1	2	(99)
11 - Noon	1	2	(100)	
P.M.	Noon - 1	1	2	(101)
	1 - 2	1	2	(102)
	2 - 3	1	2	(103)
	3 - 4	1	2	(104)
	4 - 5	1	2	(105)
	5 - 6	1	2	(106)
	6 - 7	1	2	(107)
	7 - 8	1	2	(108)
	8 - 9	1	2	(109)
	9 - 10	1	2	(110)
	10 - 11	1	2	(111)
11 - Midnight	1	2	(112)	

If an average hour's traffic is 100, about how much traffic would there be in a busy hour?

(113-115)

And in a slack hour?

(116-117)

11. Over the last 5 years, has use of the system

- increased
- decreased
- SKIP TO NEXT QUESTION ← - or stayed about the same?
- SKIP TO Q. 14 ← - (Don't know)

Last 5	Next 5	5 after	
1	1	1	(118-120)
2	2	2	(121-123)
3	3	3	(124-126)
4	4	4	(127-129)

By what % per year roughly, on average?
(PROBE FOR AN ANSWER)

										(130-138)
--	--	--	--	--	--	--	--	--	--	-----------

Has this been mainly because of changes in

- the number of mobile units
- the amount of traffic per mobile
- or a combination of the two?
- (don't know)

1	1	1	(139-141)
2	2	2	(142-144)
3	3	3	(145-147)
4	4	4	(148-150)

12. Are you expecting an increase in use, a decrease or no change over the next 5 years? →

By what % per year roughly, on average? →

Is that because of changes in the number of mobiles, traffic per mobile, or a combination? →

13. Are you expecting an increase in use, a decrease or no change over the 5 years after that? →

By what % per year roughly, on average? →

Is that because of changes in the number of mobiles, traffic per mobile, or a combination? →

9. The main improvements you need in your system, then, are (AS APPROPRIATE) to get rid of (READ ITEMS CHECKED IN Q. 14) and to add (READ ITEMS CHECKED IN Q. 16)
What is the maximum you would be willing to pay extra for that improved system, as a percentage increase on your present costs? (195-197)
0. If you had your improved system, it might well be used more than the present system. Roughly what % increase would you expect? % (198-200)
Don't know 1 (201)
1. How long do you expect it to be before you need to replace your present system or drastically upgrade or expand it? (years) (202-203)
Don't know 1 (204)

2. What other comments do you have on, for instance, your need for dedicated channels, your future mobile communications needs, new applications or facilities, current problems, rent-or-buy, etc.?

Additional comments by interviewer:

H.3 Definitions of Metropolitan Areas

- Newfoundland: St. John's - includes Mount Pearl, Wedgwood Park, Pouch Cove, Kelligrews, Torbay, Conception Bay South, Flatrock, Goulds, Hogan's Pond, Lawrence Pond, Paradise, Petty Harbour, Maddox Cove.
- Nova Scotia: Halifax - includes Dartmouth, Sackville, Windsor Junction, St. Margaret's Bay, Peggy's Cove, Sambro, Porter's Lake.
- Sydney - includes Sydney Mines, Big Pond, Dominion, Glace Bay, New Waterford, North Sydney, Grand Narrows.
- New Brunswick: St. John - includes Grand Bay, Renforth, Fairvale, Hampton, Rothesay, East Riverside, Kingshurst, Gondola Point, Musquash, Quispamsis, Simonds, Westfield.
- Quebec: Montreal - includes Anjou, Baie d'Urfe, Beaconsfield, Blainville, Bois des Filion, Boisbriand, Boucherville, Brossard, Candiac, Carignan, Chambly, Charlemagne, Cote St. Luc, Delson, Deux Montagnes, Dollard des Ormeaux, Dorion, Dorval, Greenfield Park, Hampstead, Ile Perrot, Kirkland, La Prairie, Lachenaie, Lachine, Lasalle, Laval, Lemoyne, Longueuil, Lorraine, Mascouche, Notre Dame, Outremont, Pierrefonds, Pincourt, Pointe aux Trembles, Pointe Calumet, Pointe Claire, Repentigny, Richelieu, Rosemere, Roxboro, Senneville, St. Basile le Grand, St. Bruno, St. Constant, St. Eustache, St. Hubert, St. Jean de Dieu, St. Lambert, St. Laurent, St. Leonard, St. Louis de Terrebonne, St. Paul l'Ermite, St. Pierre, St. Raphael, Ste. Anne de Bellevue, Ste. Catherine, St. Genevieve, Ste. Marthe, Ste. Therese, Terrasse Vaudreuil, Terrebonne, Vaudreuil, Verdun, Westmount, Beloeil, Chateauguay, Hudson, Lery, McMasterville, Mercier, Mont St. Hilaire, Oka, Otterburn Park, St. Amable, Ste. Julie, Varennes, Ile Cadieux.
- Quebec - includes Ancienne Lorette, Beauport, Charlesbourg, Charny, L'Ange Gardien, Lac St. Charles, Lauzon, Levis, Loretteville, Shannon, Sillery, St. David, St. Emile, St. Felix du Cap Rouge, St. Gabriel de Valcartier, St. Jean Chrysostome, St. Jean de Boischatel, St. Redempteur,

St. Romuald, Ste. Foy, Ste. Helene de Breakeyville, Val Belair, Vanier, Chateau Richer, Beaulieu, Bernieres, Lac Delage, St. Etienne, St. Joseph de la Pointe de Levy, St. Lambert de Lauzon, St. Louis de Pintendre, St. Nicolas, St. Pierre, Ste. Brigitte de Laval, Stoneham & Tewkesbury.

Chicoutimi-Jonquiere - includes St. Honore, Kenogami, Larouche, N-D-de-Laterriere, Shipshaw, St. Jean Vianney, Tremblay.

Hull - includes Aylmer, Gatineau, La Peche, Val des Monts.

Sherbrooke - includes Ascot, Fleurimont, Lennoxville, Rock Forest, Deauville.

Ontario:

Hamilton - includes Ancaster, Burlington, Dundas, Flamboro, Grimsby, Stoney Creek, Glanbrook.

Kitchener - includes Cambridge, Waterloo, Dumfries, Woolwich.

London - includes Dorchester North, Nissouri West, Westminster, Belmont, Delaware, Southwold.

Oshawa - includes Whitby.

Ottawa - includes Cumberland, Gloucester, Nepean, Rockcliffe Park, Vanier, Goulbourn, March, Rideau, Rockland, Clarence, Osgoode.

St. Catharines-Niagara - includes Pelham, Port Colborne, Thorold, Welland, Wainfleet.

Sudbury - includes Nickel Centre, Rayside, Balfour, Valley East, Walden.

Toronto - includes Ajax, Aurora, Brampton, Etobicoke, King, Markham, Mississauga, Newmarket, Oakville, Pickering, Richmond Hill, Scarborough, Vaughan, York, East York, North York, Caledon, East Gwillimbury, Whitchurch, Stouffville.

Windsor - includes Belle River, Maidstone, Sandwich West, St. Clair Beach, Tecumseh, Essex, Colchester North, Rochester.

Thunder Bay - includes Neebing, O'Connor, Oliver, Paipoonge, Shuniah.

H.4 The Non-Metropolitan Mobile Population

Preliminary Adjustments

It proved impractical to tabulate the sample results on a basis strictly comparable with the population shown in Table A.2. This was due mainly to the coding in the original licence data of a number of large organizations to more than one SIC class each. As an example, 492 of the BC Ministry of Forests' mobiles were assigned to SIC 931, Provincial Administration, and 1737 to SIC 039, Forestry Services. These were consolidated in SIC 039.

Most of the adjustments were between these two groups, but there were also some between the Government and Transport industry sectors; between Services and Communications; and between Government and Communications. In addition, the numbers of mobiles reported to be in use by some respondents differed from the licence data. In general, however, the licence data closely approximated the numbers of mobiles in use for the majority of respondents and provided an adequate basis for grossing-up the sample data. Details of the adjustments made and factors which result in Table A.9 numbers being higher than those in Table A.2 are detailed overpage.

Grossing-up Factors

The weighting factors used to gross-up the survey results were based on the relationship between this revised population table and the corresponding sample table. Where a zero appeared in a cell of the sample table - as was bound to happen in some of the 144 cells with small populations - an estimate was inserted based on industry averages.

This is the procedure which produced Table A.9.

ESTIMATED MOBILES IN SYSTEMS
WITH NON-METROPOLITAN
REQUIREMENT, 1981

<u>Industry Sector</u>	<u>Nfld</u>	<u>NB</u>	<u>PEI/NS</u>	<u>Que</u>	<u>Ont</u>	<u>Man</u>	<u>Sask</u>	<u>Alta</u>	<u>BC</u>	<u>Yukon</u>	<u>NWT</u>	<u>Total Canada</u>
Agriculture and Fishing	33	219	390	1,057	1,936	2,332	2,405	2,610	691	9	15	11,697
Forestry	12	559	579	2,370 ⁽¹⁾	1,817	84	259	1,332	16,597	92	32	23,733
Minerals	115	134	66	1,391	2,096	263	1,111 ⁽³⁾	15,190 ⁽⁴⁾	3,402	486	768	25,022
Manufacturing	143	1,025	528	5,545	1,203	63	327	4,719	3,810	16	9	17,388
Construction	580	73	1,260	4,795	9,411	1,155	1,096	8,884	5,788	204	88	33,334
Trucking	76	79	147	783	3,943	896	511	5,184	2,724	116	42	14,501
Transport	933	3,804 ⁽⁵⁾	2,468	9,705	18,757	4,702 ⁽⁶⁾	3,148 ⁽⁷⁾	7,849	11,496 ⁽⁸⁾	237	250	63,349
Communications	239	386	806	2,655	4,890 ⁽²⁾	321	1,321	3,893 ⁽⁹⁾	2,394	62	18	16,985
Utilities	596	967	765	6,656	4,468	810	1,465	2,239	4,366	39	42	22,413
Trade and Finance	125	791	652	4,260	1,381	269	884	4,263	4,001	111	43	16,780
Services	249	281	659	4,016	6,788	102	747	9,543	2,910	184	163	25,642
Government	966	2,509	2,842 ⁽¹⁰⁾	10,097	26,059	4,114 ⁽¹¹⁾	4,792 ⁽¹²⁾	8,442	7,148	749	780	68,496
Ships	963	507	1,430	2,018	6,445	86	0	14	12,532	4	112	24,111
Aircraft	181	255	193	2,093	4,512	1,149	1,470	3,203	3,109	251	282	16,698
	<u>5,211</u>	<u>11,589</u>	<u>12,785</u>	<u>57,441</u>	<u>93,706</u>	<u>16,346</u>	<u>19,536</u>	<u>77,365</u>	<u>80,968</u>	<u>2,560</u>	<u>2,644</u>	<u>380,151</u>

Source: Table A.9

MAJOR FACTORS RESULTING IN
DIFFERENCES BETWEEN TABLE A.9 AND TABLE A.2

(1) Mobiles in use*	2,370	1 system exported 27 more units in use than licenced. This grosses up to 82		
Mobiles licenced**	<u>2,287</u>			
Difference	<u>83</u>			
(2) Mobiles in use	4,890	4794 units reported in use by 2 systems. This accounts for all but 96 of difference.		
Mobiles licenced	<u>4,566</u>			
Difference	<u>324</u>			
(3) Mobiles in use	1,111	Petrocan reported 8 more units in use than licenced.		
Mobiles licenced	<u>1,103</u>			
Difference	<u>87</u>			
(4) Mobiles in use	15,190	Petrocan reported 113 more units in use than licenced.		
Mobiles licenced	<u>15,103</u>			
Difference	<u>87</u>			
	(5)	(6)	(7)	(8)
Mobiles in use	3,804	4,702	3,148	11,496
Mobiles licenced	<u>2,408</u>	<u>3,416</u>	<u>2,460</u>	<u>10,828</u>
Difference	<u>1,396</u>	<u>1,286</u>	<u>688</u>	<u>668</u>
CN Railway reported excess of in-use over licences of:	1,584	1,286	669	1,151
(9) Mobiles in use	3,893	441 units reclassified from govt. sector.		
Mobiles licenced	<u>3,445</u>			
Difference	<u>448</u>			
(10) Mobiles in use	2,842	552 units reclassified from forestry. 517 units reclassified from transport.		
Mobiles licenced	<u>2,690</u>			
Difference	<u>152</u>			
(11) Mobiles in use	4,114	RCMP reported 550 more mobiles in-use than licenced.		
Mobiles licenced	<u>3,824</u>			
Difference	<u>290</u>			
(12) Mobiles in use	4,792	RCMP reported 29 more mobiles in-use than licenced.		
Mobiles licenced	<u>4,783</u>			
Difference	<u>9</u>			

* from Table A.9

** from Table A.2

APPENDIX J

MOBILE COMMUNICATIONS USERS
INTERVIEWED IN STUDY

- (D) indicates a company interested in taking part in the demonstration phase of MSat
- (P) indicates a personal interview. All others were by telephone

NOTE: The number of companies interviewed is slightly less than the number of systems indicated in Table A.8 since a few users had multiple systems. The number of mobile communications units (151,965) owned by the organizations in this list of interviews also differs from the 138,000 in Table A.8 due to some duplication, e.g. two interviews each for Petrocan and CN, and some interviews where the data could not be utilized in the airtime calculations e.g. Quebec Department of Communications

INDUSTRY 1 - AGRICULTURE & FISHING

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
<u>Nova Scotia</u>			
National Sea Products, Halifax	041	24	Earl Demone, V.P. Fleet (P)
<u>New Brunswick</u>			
Dept. of Fisheries & Oceans, Caraquet	045	30	Mr. Lanteigne, Liaison Officer
<u>Quebec</u>			
Jean-Paul Durand, Neuchatel	019	20	Jean Paul Durand, Proprietor
<u>Ontario</u>			
Peter J. Brown, Strathroy	017	2	Margaret Brown
Wilson French, Bolton	013	12	Wilson French
GO-Green Sod Supply, Troy	019	3	Mrs. R. Gouier
Norman Lewis, St. Thomas	017	5	Norman Lewis
R. MacKenzie Farms, Alliston	017	4	Jean MacKenzie
Gary Siefker, Essex	017	3	Josie Siefker
Frank Watts, Sod & Seed, Newmarket	021	12	Bill Cherry, Branch Manager
<u>Manitoba</u>			
Larry Gates, Trehene	013	4	Larry Gates, Farmer
Raymond Pritchard, Roland	013	6	Raymond Pritchard, Farmer
<u>Saskatchewan</u>			
Wayne Clews, Pangman	013	7	Wayne Clews, Farm owner
Custom Agricultural Services, Saskatoon	021	6	Harvey Woodard, General Manager
Edwin Matthews, Mantero	017	2	Mrs. Matthews, V.P.
Harold A. Oddan, Maidstone	017	6	Harry Oddan, farm owner
<u>Alberta</u>			
Cremona Veterinary Interests	021	3	Mrs. Reid, part owner
John Horvath	017	5	Mrs. Horvath
Pincher Creek Ranches Ltd, Pincher Creek	017	7	Jean-Pierre Peltier, General Manager
Thiessen Farms Ltd., Strathmore	017	15	Ed Thiessen, Owner (P)
<u>British Columbia</u>			
(D) BC Packers Ltd., Vancouver	041	300	Ralph Hansen, Supervisor of Communications (P)
Prince Rupert Fishermans' Co-op, Prince Rupert	045	10	Mr. Lang, Member Relations

INDUSTRY 2 - FORESTRY

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
<u>New Brunswick</u>			
(D) Dept. of Natural Resources, Fredericton	039	375	Al Fulcher, Director of Technical Services
<u>Quebec</u>			
Domtar Woodland Ltd, Dolbeau	031	27	M. Floriant Duchesne Robert Dryburgh, Communications Department
Ministere de L'Energie et des Ressources, Quebec	039	750	Jacques Buissiere, Communications Supervisor (P)
<u>Manitoba</u>			
Jan Munro Transport, The Pas	031	5	Ernest Leming, Despatcher
<u>British Columbia</u>			
(D) B.C. Forest Products, Vancouver	031	2,500	Peter Demoor, Communications Supervisor (P)
B.C. Ministry of Forestry, Victoria	039	3,600	Alex Stewart, Manager of Electronics (P)
Canadian Cellulose, Interior Woods Operations, Nakusep	031	150	Fred Durocher, Forest Protection Supervisor
Canadian Cellulose, Twin River Woodlands, Terrace	031	140	Mr. Bishop, Woods Controller
Canadian Forest Products, Vancouver	031	40	Dick Herring, General Manager (P)
Pat Carson Bulldozing, Cobble Hill	031	120	Jim Drysdale, Purchasing Agent
Chiam Construction, Hope	031	12	Cathy Hill, Bookkeeper
Coulson Prescott Logging, Port Alberni	031	18	Marlene Phillips, Accountant
Crestbrook Forest Products, Cranbrook	031	95	Jack McKinnon, Chief Forester
Crown Zellerbach, Vancouver	031	298	Clarence Gustavson, Mill Co-ordinator (P)
Dixon Trucking Ltd, Fernie	031	10	Wally Dixon, Owner
Henry Dyck, Vanderhoof	031	1	Mrs. Dyck
Garner Bros. (Cariboo) Ltd, Quesnel	031	32	Lorne Walker, Controller
(D) W. Krause Logging, MacKenzie	031	150	Margaret Mann, Accountant
Lavington Planer Mill, Lavington	031	17	Jeff Wilson, Purchaser
Harold Daniel Schmidt, 100 Mile House	031	1	Harold Schmidt
James D. Simpson, Westwold	031	2	Mrs. Simpson
Terry Logging Ltd, Dixon	031	5	Margaret Steven, Bookkeeper
(D) Vancouver Island Helicopters Ltd, Sidney	031	3	Don Honeyman, Chief Pilot & Operations Manager
Western Forest Products, Vancouver	031	350	Bruce Lang, Mechanical Supervisor

INDUSTRY 3 - MINERALS

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
<u>Newfoundland</u>			
Crosbie Offshore Services, St. John's	099	10	Bruce Carter, Assistant Manager, Personnel and Labour Relations
(D) Petro Canada, St. John's	096	30	Brian Garbett, Communications Supervisor (P)
<u>Nova Scotia</u>			
Cape Breton Development Corp., Sydney	061	15	Joe MacKenna, Transportation Supervisor
(D) Mobil Oil, Halifax	096	5	Art Faulkner, Senior Technologist (P)
Perry L. Miller & Sons, New Minas	087	4	Wes Millet, Owner
<u>New Brunswick</u>			
Brunswick Mining & Smelting, Bathurst	099	37	David Chick, Scales Operator
<u>Quebec</u>			
Thetford Mine, Lac d'Amiante	071	45	Andre Duclos, Shaft Superintendent
Les Mines de Cuivre Gaspé, Murdochville	059	100	Mr. G. Letourneau, Foreman Hermel Godin, Technician
Societe Asbestos, Thetford Mines	071	258	Normand Martineau, Technician
<u>Ontario</u>			
Inco Ltd., Copper Cliff	099	300	Gerry Gallagher, Senior Engineer
Union Gas, Chatham	064	1,000	Jim Lovitt, Communications Director
Union Minerals Exploration & Mining Corp., Pickle Lake	099	4	Wanda Davis, Dispatcher
<u>Saskatchewan</u>			
Manitoba & Saskatchewan Coal Co., Bienfait	061	78	Trev Hall, Purchasing
<u>Alberta</u>			
All-Rite Drilling, Red Deer	096	14	Neil Burke, Field Supervisor
Anadarko Petroleum, Calgary	064	3	Wally Romchak, Division Manager
Braidnor Construction, Edmonton	096	19	Mr. Grollo, Secretary Treasurer
Bralorne Resources, Calgary	064	9	Dale McAuley, Gas & Oil Product Manager
Brooks Field Services, Calgary	099	30	Mickey Barca, Field Operations Manager
Brooks Oilfield Contractors, Brooks	099	25	Brian Murray
Cenalta Oilwell Service, Red Deer	099	20	Ken Johnson, Manager of Operations
Chevron Geo. Services, Calgary	099	10	Ed Hackle, Supervisor, Field Operations
Dome Petroleum, Calgary	064	250	Don M. Larsen, Manager Communications (P)
Dowell of Canada, Grand Prairie	064	50	George Maheadon, Manager
(D) Enertest, Calgary	099	8	Grace Surkan, Office Manager
(D) Esso Resources, Calgary	064	250	Tom Mulholland, Supervisor of Communications and Systems

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
Flint Engineering & Construction, Calgary	096	93	Bill Burworth, Office Manager
(D) Garnett Drilling, Edmonton	096	19	Stan Bengtson, President (P)
Gooding & Matt Construction, Nisku	099	25	John Golko, Equipment and Purchasing Manager
Haliburton Services, Calgary	099	260	Ron Kujiviak Mr. Hinkle, Technical Supervisor
Hyalog Oilfield Services, Edmonton	099	6	Mike Brackenreed, General Manager
Hudson Bay Oil and Gas, Calgary	064	400	Mr. Jackson, Communications Director
Int'l Drilling Fluids, Calgary	099	25	Lorne MacKenzie, Operations Manager
Kaiser Oil, Calgary	064	55	Bob Lock, Operations Manager
(D) Mobil Oil, Calgary	064	50	Leon Cantalon, Manager, Communications
Mearn's Oilfield Services, Fox Creek	099	4	Jennifer Mearn
(D) Nowasco Well Service, Calgary	099	300	Gary Nanninga, Communications Supervisor
Pan Canadian Petroleum, Calgary	064	221	Norm Villeneuve, Communications Technician
Petro Line Construction, Nisku	096	41	Glen Hannum, Operations Supervisor
Saxon International, Edmonton	099	2	Larry Nicoletti, Administrative Manager
Suncor, Fort McMurray	064	400	Mair Sveinson, Administrator of Transportation and Communications (P)
(D) Syncrude Canada, Fort McMurray	064	220	Winn Burns, Communications Supervisor (P)
United Directional Drilling, Edmonton	096	15	Ernie Willoby, Shop Foreman
Varco Equipment, Calgary	096	15	Francine, Office Administrator
<u>British Columbia</u>			
(D) BC Coal, Sparwood	061	400	Larry Knut, Assistant Superintendent
Cominco Kimberley Operations, Kimberley	099	30	Keith Mayer, Manager
Noranda Mines, Granisle	099	25	Charles Foreman, Site Supervisor (P)
Rio Tinto Canadian Exploration, Vancouver	099	24	Sperlin Edwards, Administration Manager
Tuckerr Industries, Ft. St. John	096	40	Gordon Scott, Supervisor
Utah Mines, Vancouver	099	35	Joe Radshun, Manager

INDUSTRY 4 - MANUFACTURING

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
<u>Nova Scotia</u>			
(D) Nova Scotia Forest Industries, Point Hawkesbury	259	89	Rus Waycott, Woodland Engineer
Sydney Steel Corp., Sydney	291	71	Bob Moore, General Foreman
<u>New Brunswick</u>			
Boise Cascade, Newcastle	271	67	Gordon Nowlan, Shipping Supervisor
Fraser Inc., Edmunston	271	230	Gerald Le Brun
Strescon, St. John	355	3	Francis Gaughan, Purchasing Agent
<u>Quebec</u>			
Badarco International, Montreal	302	8	Bernard Charrier, Superintendent
(D) Beton Prepare Belcos 1979, St. Raphael	355	80	Andre Martineau, President
Beton Provincial, Matane	355	145	Roger Broaduest, Comptroller (P)
Beton St. Hubert, St. Hubert	354	27	M. Lelievre, Controller
Ciment Independent, Montreal	355	120	Jacques Pouliot
La Cie Price, Chicoutimi	271	167	Jacques Le Jebire, Electronics Technician
L.H. Ericson, Montreal	335	1	Mrs. Blanchard, Agent
Franco Gallese Inc., Ste. Foy	354	2	M. Boutin, Accountant
Gulf Oil, Montreal	365	37	Jacques Degrave
Laberge & Laberge, St. Felicien	251	35	Carol Lapierre, Technician
Inter-Cite Construction, Chicoutimi	355	12	Rodrigue Lemieux
James MacLaren Co., Mt. Laurier	271	34	Laurent St.-Denis, Administrative Superintendent
Marine Industries, Sorel	327	21	Gaby Demers, Electrician
Papeterie Reed, Quebec	271	15	Bruce Hicks
Reynolds Metals, Baie Comeau	296	50	Gilles Masse
Les Services de Cuisines Commerciales, Quebec	266	5	Mlle. Simard, Administrative Assistant
Societe de Cartographie du Quebec	289	4	Aime Carbonneau, Geometer-Surveyor
Les Tapis Peerless, Acton Vale	186	1	Jean Groulx, Traffic Manager
<u>Ontario</u>			
Algoma Steel Corp., Sault Ste. Marie	291	275	Jim Donahue, Purchasing/Communications Officer
Armbro Ready Mix, Brampton	355	37	Herb Farr, Purchasing Officer (P)
Canada Building Materials, Ottawa	355	45	Mr. Perrier, Operations Manager
Copp Builder's Supply Co., London	259	8	Terry Scherins
Dofasco, Hamilton	291	567	Dianne Pursley, Office Services Manager
Dow Chemical, Sarnia	378	136	John Martin, Communications Officer

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
Dufferin Materials, Toronto	354	70	Mr. Corradetty, Communications Manager
Folding & Bindery Systems, Toronto	287	2	Dave Holmes
Ford Motor Co., Windsor	323	44	Bob McCloskey, Dispatcher
General Motors, Oshawa	323	320	Mike Ford, Maintenance Supervisor
Gulf Oil, Home Comfort Centre, Ottawa	365	23	Mr. Brazeau
Impact Case Sales, Markham	399	1	Joan Good, Office Manager
International Harvester, Hamilton	311	24	Bernie Mueller, Information System Manager
Libby, McNeill & Libby, Chatham	103	17	Bob L'Ecuyer, Assistant Communications Director Sid Scholters
(D) Premier Concrete Products, Toronto	355	153	Ed Wallace, Dispatcher
Queen City Plating, Toronto	304	5	Office Clerk
Rothmans of Pall Mall, Toronto	153	22	Murray Miner, Director of Loss Control
Stelco, Toronto	291	552	Ken Christmas, Communications Supervisor
Toronto Star Newspaper, Toronto	289	194	Mrs. Philips, Assistant Superintendent
<u>Manitoba</u>			
Agrovoice Productions, Minto	379	8	Mr. Flewitt, Office Manager
Welders Supplies, Winnipeg	336	6	George Stevens, Purchasing Agent
Supercrete, Winnipeg	355	82	Ken Tymchuk
<u>Alberta</u>			
Alberta Concrete Products, Edmonton	355	140	Terry Norcot, Equipment Expediter
(D) Amoco Canada Petroleum, Calgary	378	60	Stan Numeziki, Telecommunication Analyst
Coneco Equipment, Calgary	315	60	Jane Stewart, Salesman
(D) Procter & Gamble, Grande Prairie	271	170	Reg Allock, Communications Specialist
Redwood Ready Mix, Barrhead	355	26	Frank Smokler, Office Manager
Revelstoke Co., Calgary	355	62	Mr. Aldridge, Office Services Manager
Tru Mix, Lethbridge	355	11	John Hart, Dispatcher
<u>British Columbia</u>			
Aluminum Co. of Canada	295	10	Bruce Webster, Dispatcher
Brink Forest Products, Prince George	251	4	Receptionist
Mill & Timber Products, Surrey	251	12	B. Carson, Telephone Operator
OK Builders Supplies, Kelowna	355	45	John Bone, General Manager
Prince George Pulp & Paper, Prince George	271	80	Ties Rubingh, Production Manager

INDUSTRY 5 - CONSTRUCTION

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
<u>Newfoundland</u>			
Remegor Construction, Wabush	404	7	Mr. Pruden, Vice-President
Wabush Lake Railway, Wabush	409	8	Mr. Bazilsky, Railway Supervisor
<u>Nova Scotia</u>			
Maritime Builders, Sydney	409	5	Gary Chew, Purchasing Agent & Controller
Municipal Ready Mix, Sydney	409	9	Randy Seward, Scaleman
Tidewater Construction, Lower Sackville	409	35	Mr. Smiley, Dispatcher
Will Care Paving & Contracting, Truro	406	4	Karen Lake, Office Manager
<u>New Brunswick</u>			
City of Fredericton, Recreation Dept.	421	15	Robert Mabie, Recreation Director
La Construction Baie Chaleur, Shippegan	404	7	Francis Monserrat
Pullman Power Products, Pt. Lepreau	404	70	Al Northrup, Administration Manager
Quality Concrete, Moncton	421	12	Ron Sherwood, Office Manager
<u>Quebec</u>			
Beaudet & Marquis, Vanier	404	24	Jean Yves Boucher, Technician (P) Mr. Arteau, Superintendent (P)
Lucien Boivin, Chicoutimi	406	12	Lucien Boivin
Brunet & Brunet, St. Joseph - du-Lac	406	8	Therese Lamontagne, Accountant
La Cie Miron, Montreal	409	216	M. Boulianne
Normand Cliche Inc., St. Jean Chrysostome de Levis	404	3	Normand Cliche, President
Construction Dufro, St. Felicien	404	6	Paul H. Dufro, Secretary
Construction Raguenu	409	3	Claire Desbiens, Secretary
(D) Constructions du St. Laurent, Beauport	409	100	M Berube, Director of Administrative Services
Charles Duranceau, Montreal	409	40	Mr. Marcotte, Director of Operations
Les Entreprises Clement Boisvert, Montreal	421	7	M. Boivin, Buyer
Les Entreprises Lt., Beauport	421	5	Yvon Lagace, President
Herbert Lumber, Montreal	409	7	Marc Hebert, Purchasing Agent
Hewitt Equipment, Pointe-Claire	409	16	Mr. Straker, Coordinator of Communications
Isolation Internationale de Magog	421	4	Jean-Guy Lavoie, Inspector
Janin Construction, Candiac	406	15	M.R. Riviuccio, Technician
Gilles Ouellette, Knowlton	421	3	Gilles Ouellette, Owner
St. Romuald Construction, St. Romuald	409	21	Mr. Gosselin, Buyer Mr. Ouellette, Project Manager
Spemont Asphalt, Trois Rivieres	421	6	Jean Turcotte, President
V. Simard & Fils, Alma	404	5	Jean Yves Simard, Owner

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
Taragon Construction, Auteuil	421	49	Michel Caron, Purchasing Manager
Troittoirs & Chaines Pilote, Vanier	409	30	M. Bluteau (P)
<u>Ontario</u>			
R.O. Bean & Son Construction, Stevensville	409	2	Mrs. Bean
L. G. Coco Construction, Windsor	404	2	Bill Coco, President
DRD Excavators, Guelph	421	7	Ron Hall
Dobson Mechanical Contractors, Ottawa	421	1	Donna Dobson
Dufferin Aggregates, Milton	409	12	Art Gray
E. & E. Seegmiller, Kitchener	409	68	Ken Seltzer, Purchasing Agent
Don Ellis Ltd., London	404	7	Jim Needham, Dispatcher
Goreski Roofing & Lathing, Oshawa	421	3	Joan Baubney, Dispatcher
Main Fencing, Cambridge	421	4	Jim Main, Owner
Miracle Construction, Woodstock	409	4	Don Bloomfield, Owner
H.R. Stark, Oshawa	421	29	Casie Dewit
Vanson Construction, Greely	406	6	Terry Vandenhanberg, Mechanic
<u>Manitoba</u>			
A.R. Bittner Welding Associates Winnipeg	421	6	Alex Bittner, Owner
Buchko Enterprises, Arborg	421	12	Don Buchko, President
<u>Saskatchewan</u>			
Rockwool Insulation Services, Saskatoon	421	4	-
<u>Alberta</u>			
Alldritt Development Corp., Edmonton	409	19	Harry Bulldog, Warehouse Manager
Almac Contracting, Edmonton	404	4	Dwain Burnett, Office Manager
Cana Construction, Calgary	406	49	Joe Dery, Warehouse Foreman
Castle Concrete, Nisku	421	17	Adrean Regar
Edmonton Insulation, St. Albert	421	3	Bob Fawcett, Partner
Enterprise Foundation Borings, Edmonton	409	5	Rita Schotte, Secretary
(D) Everall Construction, Edmonton	406	80	Felix Keeufer, Manager
Gilmar Crane Service, Lethbridge	421	8	Bob Gilmar, Owner
Hillbillies Plastering, Edmonton	404	12	Dick Raeix, Manager
MBS Construction, Calgary	421	7	Comptroller
(D) Northern Construction, Calgary	404	7	Al Ahl, Project Manager
PCL Construction, Edmonton	404	105	Ken Dunlop, Senior Buyer
Raffin Electric, Calgary	421	8	Ernie Brooks, Office Manager
Riteway Plumbing & Heating, Edmonton	421	9	Jack Lynn, Owner

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
Rockywood Preservers, Rocky Mt. House	404	9	Mr. L. Tatt, President
(D) Speiss Construction, Calgary	404	25	Andy Speiss, Partner
Standard General Construction, St. Albert	404	80	J. McGarry, Chief Dispatcher
Steel Brothers Concrete, Edmonton	409	53	Jim Palmer, Production Manager
Treco Drywall, Calgary	421	26	Terry, Office Manager
Vryenhoek Holdings, Calgary -	404	1	Mr. Vryenhoek
Western Caissons, Edmonton	404	4	Office Manager
<u>British Columbia</u>			
Aero Asphalt Paving, Dawson Creek	406	20	Don Charpentier, General Superintendent
Anderson Plumbing & Heating, Vancouver	421	8	Carol Anderson
Barek Construction, Dawson Creek	404	10	Rosella Barek, Co-owner
Cana Construction, Richmond	406	3	Neil MacDonald, Equipment Supervisor
Catre Industries, Vancouver	409	46	Ken Lloyd, Equipment Manager (P)
Cloverdale Demolition Salvage, Surrey	421	2	Frank McCanley, Owner
<u>Yukon</u>			
Foothills Pipe Line Ltd.	409	25	Ted Clark, Supervisor Telecontrol Engineering (P)

INDUSTRY 6 - TRUCKING

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
<u>New Brunswick</u>			
Leblanc Oil, Richibucto	507	4	Paul Leblanc, Manager
<u>Quebec</u>			
Association des Camionneurs Artisans, Beauport	507	44	Mme. Desgagne, Secretary
Guy David, St. Etienne des Gres	507	8	Guy David, Owner
J.E. Fortin Transport, St. Bernard de Lacolle	507	33	Jean-Claude Fortin, Secretary-Treasurer
Magenta Courrier Services Montreal	507	51	Ken Brown, Office Clerk
Les Messageries du Lac, Lac St. Jean	507	2	Jean-Pierre Desmenles, President
G. Proulx Inc., Chateauguay	507	10	Mme. Proulx, Secretary-Treasurer
<u>Ontario</u>			
All Trans Express, Milton	507	56	Brian McDonald, Operations Manager
Canada Cartage System, Toronto	507	36	R. McKillop, Maint. Supervisor
Donegan's Haulage, Listowel	507	21	Harry Donegan, Owner
Hutton Transport, Lakeside	507	140	Marvin Arthur, Shop Foreman
(D) Kingsway Transport, Toronto	507	386	Don Preston, Regional Supervisor
Lafferty Smith Express, Belleville	507	100	Roy Phillips, Dispatch Co-ordinator
(D) Listowel Transport Lines, Listowel	507	100	Ted Bennet, President
Amiel Medvic, Wainfleet	507	4	Amiel Medvic, President
Norris Transport, Hamilton	507	27	Carman Cook, Operations Manager
Overland Western, Woodstock	507	17	Red Lauchlin, Dispatcher
Panda Express, Oakville	507	3	Julie Fell
R+N Delivery Service, Mississauga	507	23	Barry Patton, Operations Manager
Taggart Service, Ottawa	507	101	Lou Belleville Manager
<u>Manitoba</u>			
(D) Interlake Enterprise, Lockport	507	22	Eugene Andryo, President
<u>Saskatchewan</u>			
Wesley Emmons, Moose Jaw	507	1	Wesley Emmons, Owner
<u>Alberta</u>			
B.V. Trucking, Leduc	507	3	Mr. Vesby, Manager
Beaver Transport, Grande Prairie	507	10	Gene Gotchier, Manager

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
CN Transportation Services, Calgary	507	6	Don Ray, Communication Dept.
(D) Cliff and Clares Transport, Taber	507	9	Jim, Owner
Halt Cartage, Calgary	507	15	Susan Paulsen, Dispatcher
(D) Laman Transport, Edmonton	507	16	Mrs. Laport, Manager
J. Light Oilfield Hauling, Winterburn	507	12	Leo Hazard, Owner
Speedy Storage and Cartage, Calgary	507	47	Lyle Dupuis, Dispatcher
<u>British Columbia</u>			
Bobell Trucking, Richmond	507	13	Barry Miller, Owner
J.M. McKay Trucking, Port Alberni	507	12	Debbie Dalziel, Accountant
Northern Messenger, Burnaby	507	64	Ted Edmunson, Manager
Ralph Nylander, Fort Nelson	507	1	Mrs. Nylander
Ramrod Construction, Fort St. John	507	2	Barry Fast, Partner (P)
(D) Swanberg Bros. Trucking, Fort St. John	507	15	Peter Foxcroft, Manager (P)
Swift Dispatch Services, Vancouver	507	65	Zarko Perko, General Manager

INDUSTRY 7 - TRANSPORT

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
<u>Newfoundland</u>			
Airline Taxi, Goose Bay, Lab.	512	30	Dispatcher
Ernest Antle, St. John's	512	23	Ernest Antle, Taxi Operator
Newfoundland - Labrador Air Transport	501	15	Pierre Meager, President
<u>Nova Scotia</u>			
Air Canada, Dartmouth	502	24	Peter McCarthy, Airport Manager
Atlantic Pilotage Authority, Halifax	505	12	Captain Ball, Director of Operations
Casino Taxi, Halifax	512	200	Phillip Herritt, Assistant Manager
Halifax - Dartmouth Bridge Commission, Dartmouth	516	10	Mr. Kay, Manager
Nova Scotia Dept. of Highways, Shubenacadie	516	10	Merlin Thompson, Depot Superintendent (P)
<u>Quebec</u>			
Aero Photo, Quebec	502	8	Denis Deron, Mechanical Engineer (P)
Air Canada, Telecommunication, Dorval	501	105	Lee Donahue, Telecomm. Supervisor
Yves Arsensault, Roxborough	512	1	Yves Arsensault, Taxi Driver
Association Cooperative des Taxis du Quebec, Ville Vanier	512	101	Andre Bilodeau, Manager
Bourret Transport, Drummondville	506	10	M. Bourret, President
CN Rail, Montreal	503	18000	J. Hebert, Engineer Radio Systems (P)
(D) CP Rail Communication, Montreal	503	8000	Tom Munford, Director of Communications (P)
Lorenzo Carpinelli, St. Leonard	512	2	Lorenzo Carpinelli
J.M. Chabot Inc., Montreal	517	4	M. St. Ours, Purchasing Agent
Continental Air Freight, Montreal Airport	501	4	Sandra Clark, Transportation Dept. Agent
Gerard Ferland, Ville d'Anjou	512	4	Gerard Ferland, Taxi Driver
Gaz Metropolitain, Montreal	524	168	Jacque Bellemore, Foreman
Laval Cold Storage, Laval	527	2	M. Prudhomme, President
A. Leduc et Freres, St. Timothee	508	16	Mme. Leger, Proprietor
La Maurice Transport, Montreal	509	3	Paul Piche, Dispatcher
Office des Autoroutes du Quebec Montreal	516	100	Hector Biron, Communications Specialist (P)
Outillage Lourd, Hauterive	504	1	Mme. Michaud
Roussille Transport, Montreal	519	14	Marc Roussille, Secretary Treasurer

INDUSTRY 7 - TRANSPORT

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
<u>Newfoundland</u>			
Airline Taxi, Goose Bay, Lab.	512	30	Dispatcher
Ernest Antle, St. John's	512	23	Ernest Antle, Taxi Operator
Newfoundland - Labrador Air Transport	501	15	Pierre Meager, President
<u>Nova Scotia</u>			
Air Canada, Dartmouth	502	24	Peter McCarthy, Airport Manager
Atlantic Pilotage Authority, Halifax	505	12	Captain Ball, Director of Operations
Casino Taxi, Halifax	512	200	Phillip Herritt, Assistant Manager
Halifax - Dartmouth Bridge Commission, Dartmouth	516	10	Mr. Kay, Manager
Nova Scotia Dept. of Highways, Shubenacadie	516	10	Merlin Thompson, Depot Superintendent (P)
<u>Quebec</u>			
Aero Photo, Quebec	502	8	Denis Deron, Mechanical Engineer (P)
Air Canada, Telecommunication, Dorval	501	105	Lee Donahue, Telecomm. Supervisor
Yves Arsenaault, Roxborough	512	1	Yves Arsenaault, Taxi Driver
Association Cooperative des Taxis du Quebec, Ville Vanier	512	101	Andre Bilodeau, Manager
Bourret Transport, Drummondville	506	10	M. Bourret, President
CN Rail, Montreal	503	18000	J. Hebert, Engineer Radio Systems (P)
(D) CP Rail Communication, Montreal	503	8000	Tom Munford, Director of Communications (P)
Lorenzo Carpinelli, St. Leonard	512	2	Lorenzo Carpinelli
J.M. Chabot Inc., Montreal	517	4	M. St. Ours, Purchasing Agent
Continental Air Freight, Montreal Airport	501	4	Sandra Clark, Transportation Dept. Agent
Gerard Ferland, Ville d'Anjou	512	4	Gerard Ferland, Taxi Driver
Gaz Metropolitain, Montreal	524	168	Jacque Bellemore, Foreman
Laval Cold Storage, Laval	527	2	M. Prudhomme, President
A. Leduc et Freres, St. Timothee	508	16	Mme. Leger, Proprietor
La Maurice Transport, Montreal	509	3	Paul Piche, Dispatcher
Office des Autoroutes du Quebec Montreal	516	100	Hector Biron, Communications Specialist (P)
Outillage Lourd, Hauterive	504	1	Mme. Michaud
Roussille Transport, Montreal	519	14	Marc Roussille, Secretary Treasurer

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
Andre Valois, Cap de la Madeleine	512	1	Andre Valois, Taxi Driver
Villeray Transport, St. Vincent de Paul	517	31	M. Bouthot, Secretary Treasurer
<u>Ontario</u>			
Aboutown Cabs, London	512	67	Dispatcher
Airway Transit, Kitchener	519	32	Robert Tiessier, Owner
Algoma Central Railway, Sault Ste. Marie	503	67	K. Coventry, Chief Engineer (P)
Associated Toronto Taxis, Toronto	512	365	Mr. Hadbauny, General Manager
Gilbert Brideau, Connaught	512	1	Gilbert Brideau, President
Burlington Taxi, Burlington	512	17	Gerry Wallace, Owner
Byers Motors, Toronto	517	15	
CNR Telecommunications, Toronto	503	2000	Mr. R. Stevenson, Regional Communications Officer (P)
Davies Motors, Point Edward	508	48	Frank Vergunst, Operator Manager
Diamond Taxicab Assoc., Toronto	512	358	Mr. Bell, President
East End Taxi (1980), Scarborough	512	100	Bob Cowper, Office Manager
Julian Taxi Cab, Ottawa	512	21	Mr. Surges, Owner
Vern Kirby & Son, Glen Williams	519	10	Vern Kirby, Owner
Leuschen Bros., Sudbury	512	48	Gerry Leuschen, Manager
Metro Cab, Toronto	512	350	Jack Levy, General Manager
McDonnell Limousine Service, Toronto	519	100	Jim Sennec, Operations Manager
Min. of Transport & Comm., Downsview	516	2000	Harry George, Director of Communications (P)
Ottawa Roman Catholic School Board, Ottawa	519	52	Mr. Cousineau, Transport Officer
Queen Taxi, Sturgeon Falls	512	3	Mrs. Gagnon
Sharp Bus Lines, St. George	519	60	Don Sharp, Owner
Toronto, Hamilton & Buffalo Railway	503	34	Art Johnson, Supervisor of Electric Comm.
TransCanada Pipelines, Toronto	515	440	Ray Hobson, Communications Director (P)
Travelways School Transit, Markham	519	160	Mr. Ritsdale
Lorne Wilson Transportation, Snelgrove	519	52	Lorne Wilson, President
Windsor Airline Limousine, Windsor	512	138	Stan Heeney, Supervisor
<u>Manitoba</u>			
Garden Valley School, Winkler	519	20	John Wiebe, Administrator

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
<u>Saskatchewan</u>			
Crown Cab, North Battleford	512	15	Alice Krelow, Owner
Harry Hansen, Strasbourg	519	4	Harry Hansen
(D) Sask. Dept. of Highways, Regina	516	863	Bill Tuer, Equipment Director (P) Reg Jesseys, Equipment Officer (P)
<u>Alberta</u>			
(D) Alberta Dept. of Transportation, Edmonton	516	1000	Alex Thom, Radio Administrator (P)
City Cab, Edmonton	512	195	Dennis O'Donnell, Dispatcher
(D) City of Edmonton Transit Dept.	509	790	Don Kinney, Supervisor Service Control
Home Oil Co., Calgary	515	75	Ray Paschkey
Northern Alberta Railways, Edmonton	503	9	Wally McNally, Head of Communications
(D) Nova, An Alberta Corp., Edmonton	515	550	Warner Unterberger, Communications Technician
Southland Transportation, Calgary	519	33	Mr. Neva, Dispatcher
Yellow Cab, Calgary	512	427	Jackie Majors, Operator
<u>British Columbia</u>			
A & B Cabs, Powell River	512	10	Diane Kifoil, Dispatcher
A/C Taxi, Nanaimo	512	32	Mr. Smith, Owner
B.C. Min. of Highways, Victoria	516	1336	Garth Sherring, Communications Engineer (P)
(D) B.C. Railway, North Vancouver	503	1500	Dan Serby, Manager, Communications
(D) C.P. Airlines, Vancouver	502	100	Jan Marlon, Engineering Technician
Golden Crown Cabs, North Vancouver	512	101	Shelley Bell, Telephone Operator
MacLanes, Vancouver	512	79	Dispatcher
Master Wash Products, Richmond	519	9	Dispatcher
Northern Mountain Helicopters, Prince George	501	24	Wolfgang Zabel, Technician
Prince George Limousine, Prince George	508	9	Dave Neilson, Dispatcher
Teco Taxi, Fort St. John	512	6	Ron Olson, Owner (P)
Vernon Helicopters	501	2	Dick Biggs, Manager
Westwood Rentals, Vancouver	501	10	Carol Mah, Radio Operator

INDUSTRY 8 - COMMUNICATIONS

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
<u>New Brunswick</u>			
Cable Services Ltd.	543	9	Mrs. Allen, Dispatcher
<u>Quebec</u>			
CFLV Radio, Valleyfield	543	2	Yvon Allard, Mechanic (P)
Cable TV, Montreal	545	20	Mr. Sullivan, V.P. of Engineering
Canada Post Office, Investigation Branch, Hull	548	42	M. Poirier, Dispatcher
Centre de Telephone Mobile, Montreal	544	5	M. Tremblay, President
National Cablevision, Victoriaville	545	6	Gaetan Morin, Technician
<u>Ontario</u>			
BVH Communications, Ottawa	543	20	Dean Larkin, Manager
Bell Canada, Toronto	544	4774	Bob Beatty, Marketing Services
MacLean Hunter Cable TV, Toronto	543	7	Sherry Quinn, Dispatcher
<u>Alberta</u>			
(D) AGT, Edmonton	544	3556	Clarence Seitz, Mobile Communications (P)
Canadian General Electric, Calgary	543	5	Tom Craig, Dispatcher
<u>British Columbia</u>			
Cable West TV, Vancouver	543	2	Mr. Coskinin, Installation

INDUSTRY 9 - UTILITIES

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
<u>Newfoundland</u>			
Nfld. Light & Power, St. John's	572	282	Ray Schofield, Supervising Engineer (P)
Churchill Falls Labrador Corp., Churchill Falls	572	118	Mr. Ott, Communications Officer
<u>Nova Scotia</u>			
Nova Scotia Power, Halifax	572	900	John Nicholson, Radio Engineer and Technologist (P) Herb McMullon, Head Telecontrol Section (P) Nick Easton, Telecontrol Engineer (P) Paul Green, Telecontrol Engineer (P)
<u>New Brunswick</u>			
N.B. Electric Power, Fredericton	572	450	Greg Hickey, Telecommunications Engineer (P) Lloyd Steeres, Communications Technician (P)
<u>Quebec</u>			
Enlevement Sanitaire des Rebutis, Ville d'Anjou	579	200	Claude St. Louis, Equipment Director
Hydro Quebec, Montreal	572	8000	Mr. Fortin, Chief of the Division (P) Mr. Villeneuve (P)
Service Sanitaire de La Rive Sud, Longueuil	579	17	Mme. Sedaway, Secretary
<u>Ontario</u>			
Browning-Ferris Industries, Windsor	579	25	Mike Pare, Director of Operations
Consumers Gas, Scarborough	574	725	Bill Paul, Manager of Building Operations
Great Lakes Power Corp. Sault Ste. Marie	572	60	Jerry Siegfried, Communications Engineer (P)
Ontario Hydro, Toronto	572	3400	Don Mittle, Communications Supervisor
Leslie Pallagi, Burford	579	5	Leslie Pallagi
<u>Manitoba</u>			
(D) Manitoba Hydro, Winnipeg	572	1000	Len Bray, Senior Design Engineer (P)
<u>Saskatchewan</u>			
(D) Sask. Power Corp. Regina	572	1422	Dirk Hoogereen, Supply & Service Engineer (P)
<u>Alberta</u>			
Alberta Power, Edmonton	572	131	Larry Phinney, Mobile Co-ordinator (P)
Calgary Power, Calgary	572	700	Wes Johnston, Manager Telecontrol (P)
Plains-Western Gas & Electric	574	46	Jules Gouvreau, Manager
<u>North West Territories</u>			
Northern Canada Power Commission, Yellowknife	572	8	Ron Hilton, Supervisor of Operations (P) Hank Vanthull, Ass't Supervisor (P)
<u>British Columbia</u>			
BC Hydro, Vancouver	572	388	Nigel Smith-Gander, Radio Systems Supervisor (P)

INDUSTRY 10 - TRADE AND FINANCE

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
<u>Newfoundland</u>			
R.E. Mercer Ltd., St. John's	608	26	Jack Williams
Ultramar, St. John's	608	25	Peter M. Grimes, Manager, Domestic Sales (P)
<u>New Brunswick</u>			
N.B. International Paper, Dalhousie	629	140	Mr. Firlotte, Purchasing Manager
<u>Quebec</u>			
Raymond Belisle et Fils, St. Eustache	608	2	Raymond Belisle, Proprieter
Jos. H. Blanchet et Fils, St. Pamphile	626	6	Denis Blanchet, V.P.
J. D. Chevrolet Oldsmobile, Quebec	656	1	M. Gilbert, Service Director
Ducharme and Carbonne, Montreal	608	8	M. Ducharme, President
B.P. Petroles, Outremont	608	40	Andree Mojette, Dispatcher Andre Hamel, Director, Customer Service
Les Petroles Irving, Louiseville	608	4	Claude Lupien, Teller
P.L. Pieces d'Auto, Chicoutimi	652	3	Jean Gagnon
Produits Petroliers Champlain, St. Laurent	608	175	Robert Blanchard, Repartiteur Senior
Rene Thisdele Inc., Val Morin	608	4	M. Racette, Owner
Ultramar Canada, Montreal	608	90	Louis Bolte, Domestic Sales Manager (P)
<u>Ontario</u>			
Bouchard-Robertson, Sarnia	678	6	Mr. Bouchard, Manager
CIBC, Communications Department, Toronto	701	22	John Upper, Assistant Manager
Elgin Motors, Toronto	656	7	Rick McCormack, Parts Manager
Independent Fuels and Lumber, Ottawa	608	17	Tom Simpson, Service Supervisor
<u>Manitoba</u>			
Brookeside Enterprises, Steinbach	622	10	Ed Lowen, Manager
Edwards Sales and Service, Deloraine	622	5	Howard Edwards, Owner
Engineering and Plumbing Supplies, Westburne Winnipeg	624	6	Don Epp, Office Manager
Simplot Chemical, Brandon	629	9	Prapap Varsheny, Project Engineer
<u>Alberta</u>			
Auto Rescue Towing, Edmonton	654	23	Garry Cullum, Dispatcher
Ken Busby Grader Service, Rocky Mt. House	623	7	Ken Busby, Owner
Clearwater Building Supplies, Fort McMurray	626	3	Faye Diacon, Office Manager (P) Glenn Foreman (P)
Consolidated Gypsum Supply, Division of Alldritt, Edmonton	626	5	Mike Borlee, Shipper
Ken Basher, Sherwood Park	627	14	Don Kotak, Manager
MacDonald's Consolidated, Calgary	614	10	Allan Dechenne, Driver Supervisor

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
Ron MacDonald Equipment, Edmonton	626	1	-
Marwayne Crop Care Services, Marwayne	629	5	Donne Belsheim, Secretary
<u>British Columbia</u>			
Larry Barmaster, Port Coquitlan	699	1	Larry Barmaster
Block Bros. Realty, Vancouver	737	8	Mike Kumar, Operations Manager
J.P. Cronin and Sons, Fort St. John	608	7	Rick Cronin, Partner (P)
Clifford Edward Dubberley, Vancouver	678	2	Don Wolf, Senior Electronic Technician
Hoover Realty, Kelowna	735	39	Karen Brandle, Administration Manager
Kelowna Auto Towing, Kelowna	654	6	Gordon Stedman, Owner
Neil Realty, Vernon	735	8	Daphne Twilia, Manager
M.P. Tanchak Ltd., Port Coquitlan	652	1	Maurice Tanchak, Owner
Jon W. Tarton, Vancouver	735	1	Jon Tarton, Salesman
Grant O. Wheeler, Oliver	608	1	Grant Wheeler, Owner
Woodwards Stores, Vancouver	642	3	Mr. Turnbull, Manager
<u>Yukon Territories</u>			
Finning Tractor and Equipment, Whitehorse	623	8	Ingo Holler, Dispatcher (P)

INDUSTRY 11 - SERVICES

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
<u>Prince Edward Island</u>			
Atlantic Police Academy, Charlottetown	809	4	Inspector Jim Clarke, Training Officer
<u>Quebec</u>			
Barette Chapais, Chapais	869	75	M. Martineau, Gerant du Garage
Remy Belanger, Evaire	864	2	Penny Belanger, President
Canadian Electrolytic Zinc, Valleyfield	864	10	Gaston Arsenaault, Chief Technician
Rene Giguere, Montreal	899	60	Rene Giguere, Partner
Hotel Dieu de Gaspé, Gaspé Harbour	821	8	M. Cormier, Director of Administrative Services
Institut Armand Frappier, Laval	270	2	Mme. Debloie, Principal Assistant
Montreal Baseball Club	849	14	Gilles Rochefort, Director of Operations
Bill Miller Inc., Montreal	869	5	Mr. Miller, President
Pierre's Food, Montreal	899	8	Pierre Carrieu, Administrator
Quick Messenger, Montreal	869	42	Mr. Cornell, Dispatcher
Reeves Security Agency, Montreal	855	1	Daniel Reeves, Manager
Roger Rioux Inc., Trois Pistoles	877	6	Roger Rioux, Owner (P)
Syndicat Professionnel de la Police Municipale du Quebec	891	22	Jacques Darnas, President
<u>Ontario</u>			
Baycrest Centre for Geriatric Care, Toronto	821	4	Doug Grant, Maintenance Planner
Canada Square Management, Toronto	899	17	Bill Heffernan, Building Manager
Dofasco - Adams Mine, Kirkland Lake	864	40	Fredrick West, Manager
Dominion Electric Protection, London	855	4	Mr. Sharp, Supervisor
Dominion Electric Protection, Toronto	855	16	Mr. Kempt, Maintenance Manager
Graham Protection Services, Mississauga	899	4	Paul Graham, Manager
Lakehead Board of Education, Thunder Bay	802	112	Mr. Karkkainen, Transportation Manager
Ministry of Health, Ambulance Service, Toronto	827	500	Jerry Barr, Assistant Director (P)
Phillips Security Agency, Scarborough	855	2	Kent Hall
Quick Messenger Service, Toronto	869	200	Gerry Smith, Dispatcher
St. John Ambulance, Toronto	826	6	Mr. Peever, Administration Director
Sarnia Leasing and Repair, Sarnia	895	27	Bruce Bond, Manager
Sheraton Centre Hotel, Toronto	881	25	Pat Carrington, Telecommunications Director
Wells Fargo Armoured Service, Toronto	899	9	Dispatcher
<u>Manitoba</u>			
Central Collection Service, Winnipeg	869	2	Paul Devlin, Dispatcher
Loomis Armoured Car Service, Winnipeg	855	7	Phil Whitlock, Dispatcher
Salvation Army, Winnipeg	831	6	Brigadier Carey, Administrator

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
Western Messenger and Transfer, Winnipeg	869	16	Hy Chochinor, Dispatcher
<u>Alberta</u>			
Alberta Motor Assoc., Calgary	899	20	Mr. Ashbrook, Manager (P)
Amoco Canada Petroleum, Calgary	864	190	Stan Numeziki, Telecommunications Analyst
Canadian Hydraulics, Red Deer	897	12	Jim Henson, Manager
Control Land Surveys, Edmonton	864	7	Elwin Kohler, Operations Manager
Digiseis Exploration, Calgary	864	51	Arnold Harvey, Field Supervisor
Dome Petroleum, Calgary	864	250	Don Larsen, Manager, Communications
Esso Resources, Calgary	864	100	Nick Lundhild, Communications Co-ordinator (P) Mr. Delisle, Telecommunications Advisor (P)
Geophysical Services, Calgary	864	80	Walter Cook, Field Service Manager
Loomis Armoured Car Service, Calgary	855	10	Larry McDonald, Route Supervisor
Minnewanka Tours, Banff	849	6	Mr. Mackie
Motorola Electronics Sales, Edmonton	869	7	Mr. Cumming, Regional Manager
(D) Murphy Oil, Calgary	864	20	Doug Biles, District Operations Manager
Petro Canada Exploration, Calgary	864	970	Ed Williams, Communications Supervisor
Richardson Rug and Upholstery, Calgary	874	3	Terry Mills, Office Manager
Rite Equipment (Western), Edmonton	899	6	Allen Lemiski, Service Manager
Rocky Mt. Messenger, Calgary	869	12	Kam Evans, Owner
Sefel Geophysical, Calgary	864	106	Albert Sprague, Field Service Supervisor
Shell Resources, Calgary	864	687	Wayne Taylor
Texaco Canada Resources, Calgary	864	76	Linda Vaness, Computer Technician
Trial Appliances, Calgary	895	1	John Broderick
Triple A Welding, Drumheller	896	1	Cathy Armstrong
<u>British Columbia</u>			
Absolute Pest Control Service, Surrey	898	5	Lyle Page, President
School District #28, Quesnel	809	30	John Bull, Maintenance Supervisor
School District #55, Burns Lake	802	5	Ernie Carlson, Supervisor
Terra Engineering Laboratories, Vancouver	864	7	Stan Russel, Principal
UBC Purchasing Agent, Vancouver	806	65	Al Hutchinson, Director of Traffic and Security

INDUSTRY 12 - GOVERNMENT

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
<u>Newfoundland</u>			
Nfld. Department of Fisheries, St. John's	909	16	Captain Robert Crouse, Marine Operations Office John Candu, Radio Operator (P)
City of St. John's, Parks & Rec.	951	91	Herbert Noseworthy, Superintendent
Nfld. Department of Transportation, St. John's	909	14	Mr. McCarthy, Highways Manager
Nfld. and Labrador, Department of Wildlife, St. John's	931	34	D.G. Pike, Director (P), Bill Davies, Regional Superintendent, Clarenville
Town of Clarenville, Fire Department	952	7	Bruce Strong, Fire Chief
<u>Nova Scotia</u>			
N.S. Department of Lands and Forests, Shubenacadie	931	1,400	Harold I. Durling, Superintendent, Communicati Equipment (P) Eamonn J. Oldham, Consultant (P)
Town of Bridgewater, Fire Department	952	14	
<u>Prince Edward Island</u>			
City of Charlottetown, Fire and Works	952	22	Mr. Smith, Engineer
<u>New Brunswick</u>			
City of St. John, Works Department	953	93	Mr. McKinnon, Communications of Engineering
City of St. John, Water and Sewage	951	28	Peter Raymond
N.B. Department of Supply and Services, Fredericton	931	14	Steve MacDonald, Manager of Services
N.B. Department of Transportation, Fredericton	931	520	George Burt, Equipment Engineering (P)
N.B. Department of Transportation, Fredericton	931	700	Jim Lister, Control Radio Operator
<u>Quebec</u>			
Cite de Cote St. Luc, Public Works	951	23	Mr. Poirier, Public Works Director
Cite de Hull, Service des Travaux Publics	952	106	Robert Gagnon, Telecommunications Specialist
Cite de Montreal - Nord, Service de la Voierie	951	35	Mrs. Jenkins, Principal Assistant
Cite de Trois-Rivieres, Police Department	953	51	M. Gingras, Administrative Assistant
CUM Police, Montreal	953	1,620	Fernand Gagnon, Telecommunications Engineer (P) Andre Blanchard, Assistant (P)
Department of Communications, Quebec	931	5,400+	Mr. Grenier, Director of Technical Services (P) Mr. Marse, Assistant Director of Technical Services (P)
Montreal Travaux Publics	951	540	Guy Millette, Engineer
Regie des Installations Olympiques, Montreal	931	189	Pierre Chabot, Chef de Division
Surete de Quebec, Montreal	932	1,000	Pierre Roy, Andre Bergeron, Telecommunications
Ville de Gatineau	953	46	Mme. Lortie, Commercial Clerk
Ville de Mascouche	951	9	M. Patterson, Police and Fire Services Director
Ville de Mirabel, Travaux Publics	953	20	M. Prudhomme, Public Works Director Sergeant Delisle, Deputy Policy Director

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
Ville de Napierville	952	32	M. Rene Babeu, Fire Chief
Ville d'Outremont	952	18	M. Gagnon, Assistant Director of the Fire Department
Ville de Quebec, Incendies	952	83	Jean-Marie Auger Michel Renaud, Electronic Technician
Ville de Quebec, Travaux Publics	951	42	Michel Mercier Roger Hamel, Controller
Ville de Richelieu	953	20	M. Jean Laureat
Ville de Saint-Eustache	953	40	M. Bissonette, Fire Service Director
Ville de St. Hyacinthe, Public Protection	953	18	Lt. Dostie
Ville de St. Laurent, Travaux Publics	951	14	Raymond Seguin, Electricity Foreman
Ville de la Tuque	951	6	M. Roger Moire, Police Lieutenant
<u>Ontario</u>			
Borough of Etobicoke	951	161	Bruce Brunton, Commissioner of Public Works
Canada Post Office, Security and Investigations, Ottawa	909	16	Mr. Contanch, Building Manager
City of Brantford, Works Department	951	31	Mr. J.F. Longley, Maintenance Supervisor
City of Guelph, Police Department	953	50	Mr. Mayes, Deputy Chief of Administration
City of Hamilton, Fire Department	952	63	Charles Wilson, Captain
City of Hamilton, Police Department	953	234	Staff Sargeant Rack, Communications Department
City of London, Engineering Department	951	122	Art Lake, Superintendent of Mechanical Services
City of Mississauga Transit System	251	180	Don Cousins, Manager of Special Projects
City of Orillia	951	25	Mike Cox, Administrative Assistant and Transit Manager
City of Port Colborne, Works Department	951	12	Ken Cressey, City Superintendent
City of Sudbury, Hydro Electric Commission	951	52	Tom Faddis, Technical Officer
City of Toronto Fire Department	952	145	Captain Murray
City of Windsor Police Department	953	206	Inspector Mounbourquette, Director of Communications
County of Lanark, Roads Department	951	18	Bob Strachan, County Engineer
County of Wellington, Roads Department	951	45	Jack Freer, Assistant County Engineer
Department of Indian and Northern Affairs, Ottawa	909	?	Howard B. Taylor (P)
Fisheries and Oceans, Ottawa	909	264+	John McDougall, Departmental Telecommunications Coordinator (P) John Hackman, Assistant Chief, Information Systems Development (P) Howard R. Edel, Remote Service Coordinator (P)
Hydro Electric Commission, Kitchener	951	47	Ray West, Operations Manager
Metro Toronto, Department of Ambulance Services	951	319	George Oksiutik, Controller
Municipality of North York, Fire Department	952	99	Stan Curry, Communications Officer
Municipality of Oshawa, Public Works	951	83	George Goldburn, Maintenance Supervisor
Niagara Regional Police, St. Catharines	953	270	Sergeant Lightfoot, Communications Officer
OPP, Toronto	932	3,800	L. Collison, Communications Director (P)

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
Ontario Ministry of Correctional Services, Whitby	932	55	Sgt. Denning, Shift Supervisor
Ontario Ministry of Government Services, Toronto	931	13,300	Glen Chung Yan, Communications Manager (P)
(D) Ontario Ministry of Natural Resources, Sault Ste. Marie	931	4,291	Jim Scotland, Communications Supervisor (P)
Peel Regional Police Force, Brampton	953	369	David Berry, Communications Director (P)
Polar Continental Shelf Project, Department of Energy, Mines and Resources, Ottawa (D)	909	72	George Hobson, Former Representative on MSat Advisory Group (P)
RCMP, Ottawa	909	13,127	Gerry Lutley, Chief Telecommunications Engineer
Regional Municipality of Durham, Oshawa	953	205	Staff Sgt. Jarvis, Communications
Toronto Transit Commission, Toronto	951	100	Greg Metrakos, Transportation Department
Toronto Area Transit Authority, Downsview	951	185	Terry Miller, Communications Officer (P) Gerry Slykius, Operator (P)
Town of Burlington, Fire Department	952	47	
Town of Dryden, Municipal Services	951	37	Walter Grieves
Town of Napanee, Public Utilities Commission	951	4	Mr. Norris, Manager
Township of Carodoc	951	7	Blair Campbell, Road Grader Superintendent
Township of London, Roads Department	951	10	Mr. Dean, Road Superintendent
Township of Dover	951	7	Terry Reid, General Works Supervisor
Township of Sandwich W., Fire Department	952	11	Bob Tessier, Fire Chief
Transport Canada, Ottawa	909	?	Jack Woodbury, Telecommunications and Electronics Policy and Coordination (P) Ed Durcotte, Superintendent, Radio Operations, Coast Guard (P) Bert Tepper, T & E Branch (P) Mr. Thomas, MoT Air (P)
<u>Manitoba</u>			
City of Winnipeg, Transit System	951	95	Don Morrison, Special Project Officer
City of Winnipeg, Emergency Services	952	700	George Sagyi, Manager, Communications Branch
(D) Manitoba Air Radio Division, Winnipeg	931	933	Irv Streimer, Supervisor (P) Wilf Picknicki, Senior Technician (P)
<u>Saskatchewan</u>			
City of Saskatchewan Centennial Auditorium	951	8	General Manager
(D) North Saskatchewan Resources Division, Prince Albert	931	1,400	Staw Keith, Director
Town of Gravelbourg	953	3	Ernie Karlson, Town Administrator
Town of Spiritwood	951	4	Merv Vey, Town Administrator
Town of Nipawin	951	11	Rick Barber, Town Engineer
<u>Alberta</u>			
(D) Alberta Energy and Natural Resources, Edmonton	931	680	Helen Ledingham, Communications Officer
Alberta Energy and Natural Resources, Edmonton	931	525	Bill Griggs, Telecommunications Officer (P)

<u>COMPANY</u>	<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>
Alberta Recreation, Parks and Wildlife, Edmonton	931	94	Mr. Burcy, Technologist
City of Calgary, Engineering Department	951	140	Danny Barn, Electronic Communications Director
(D) City of Calgary, Police Department	953	200	Constable Davison
City of Calgary, Public Works	951	122	Mr. De Simon
City of Calgary, Transportation	951	213	Ray Gayford, Communications
City of Edmonton, By-Law Enforcement	951	45	Don Lavoy, Director of Security
City of Edmonton, Electric Power	951	205	Lloyd McCloud, Site Manager
City of Edmonton, Sanitation	951	150	Susan Smith, Administrative Services Co-ordinator
County of Leduc	953	81	Reg Whitiss, Shop Foreman
(D) County of Parkland #31, Stoney Plain	951	64	Staff Sgt. Steel, Communications Department
County of Wheatland #16, Strathmore	951	24	Ed Schultz, Dispatcher (P)
Energy Resource Conservation Board	931	50	Bill Wylie, Drilling Secretary Supervisor
<u>Northwest Territories</u>			
NWT Natural Resources and Cultural Affairs, Yellowknife	931	45	Ellis Land, Co-ordinator of Field Services (P)
(D) NWT Public Works, Yellowknife	931	65	Jim Bentley, Highway Chief (P) Fred Lamb, Superintendent
<u>British Columbia</u>			
(D) B.C. Ferry Corp., Victoria	931	26	Captain Decunha, Operations Manager (P)
<u>COMPANY</u>			
<u>SIC</u>	<u>MOBILES</u>	<u>CONTACT</u>	
B.C. Fish and Wildlife, Victoria	931	26	Bill Crystal, Conservation Officer (P)
City of Drumheller, Fire Department	951	4	Bill Bachymski, Deputy Fire Chief
City of Nelson, Electrical Department	951	6	John Hacquoil, Assistant Supervisor
City of North Vancouver	951	22	Constable Beaudouin, Head of Communications
City of Vancouver, Engineering Department	951	356	Frank Bowois, Engineer
City of Vancouver, Police Department	953	416	Sgt. Peter Frazer, Community Relations
District of Cowichan, Public Works, Duncan	951	25	Bob McKinnon, Timekeeper
District of Surrey, Engineering Department	951	132	Stan Bob, Director of Recreation
Municipality of Richmond, Engineering Department	951	87	Bernie Doughton, Engineer
Provincial Emergency Department, Victoria	931	300	Mike Considine, Communications Co-ordinator (P)
Regional District of Fraser - Fort George, Prince George	952	1	Gary Dinsmore, Parks Co-ordinator
Transport Canada Coast Guard, Vancouver	909	60	Fred Mullen, Regional Manager, Tel. and Elect. Branch (P)
Village of Burns Lake	951	3	Gordon Burdan, Treasurer
<u>Yukon Territory (Whitehorse)</u>			
(D) Yukon Terr., Department of Wildlife	909	25	Mark Hoffman, Chief Conservation Officer (P)
Yukon Terr., Department of Parks	909	10	Darwin Wreggitt, Park Officer (P)
Yukon Terr., Department of Highways	991	119	Kurt Koken, Assistant Deputy Head (P)

AIRCRAFT

<u>COMPANY</u>	<u>MOBILES</u>	<u>CONTACT</u>
<u>Quebec</u>		
Express Air Division of the Dubarry Group, Quebec	29	Mr. Gascogne, V.P.
Jocelyn Martin, Riviere du Loup	1	
Ministere des Transports, Quebec	34	Jean Yves Trudel, Chef Section Avionique (P)
Won-Del Aviation, St. Hubert	23	Jean Lussier, Pilot Instructor (P)
<u>Ontario</u>		
Stuart Lee, Port Credit	1	Stuart Lee
<u>Alberta</u>		
Calgary Flying Club, Calgary	14	Ray Scott, Traffic Manager
Shirley Air Services, Edmonton	74	Ian Young, Operations Manager
<u>British Columbia</u>		
Forest Industries Flying, Port Alberni	5	Reg Young, Pilot
Frontier Helicopters, Abbotsford	8	John Bird, Radio Operator
<u>Northwest Territories</u>		
(D) Northwest Territorial Airways, Yellowknife	7	John Robertson, Head of Operations (P)
Ptarmigan Airways, Yellowknife	11	C.F. Bekar, President (P)
<u>SHIPS</u>		
<u>Newfoundland</u>		
Fortune Fisheries, Fortune	8	Gerald Tibbo, Chief Engineer and Ship Operator
<u>New Brunswick</u>		
Connors Bros., Black's Harbour	35	Art Card, Marine Radio Operator
<u>Quebec</u>		
Ministere des Transports, Quebec	44	Charles Dugual, Engineer
<u>Vancouver</u>		
Department of Fisheries and Oceans, Vancouver	150	Charlie Warburton, Communications System Supervisor
Dirk Kirkwood, Delta	2	-
J.B. McMillan Fisheries, Vancouver	3	Ed Scoag, Mobile Operator
(D) Seaspam International, Vancouver	?	Mal MacDonald, Supervisor of Electronics (P)

APPENDIX K

FACTORS INFLUENCING THE MIX OF TYPES OF COMMUNICATIONS UNIT LIKELY TO BE UTILISED IN THE FUTURE

Mobile Telephone:

- o Expected to secure an increasing share of the wide-area market due to higher growth rates for this service, particularly in the services and trade and finance sectors where current mobile communications range is low.
- o Ability to provide 'roaming' capability at low cost is expected to assist in maintaining higher-than-average growth in this sector of the market. Areas covered by MTS service are continually expanding to improve coverage and roaming capability.
- o Additional growth expected through introduction of portable telephones. The mobile telephone projections in Appendix Table A.20 include allowance for a more versatile portable/in-vehicle combination unit.

Personal Portables:

- o Increased usage of hand-held voice personal portables was expected by the survey respondents.
- o Introduction of specialized hand-held data transmission portable would open up a new range of applications e.g. use by Fisheries and Oceans for reporting fish-catch data from isolated areas.

Field Portables & Transportables:

- o An increased proportion of these units with multi-function capability such as voice, data and facsimile is expected as more sophisticated facilities become available. These will be used by a limited number of sophisticated users such as seismic exploration crews, oil well logging companies and similar.
- o Field portable mobile telephones are expected to become more widely available (i.e. briefcase size units) and this is expected to account for a sizeable proportion of future growth in this type of unit.

The above factors were taken into account in developing projections for changes in the mix of mobile communications units required (See Appendix Table A.20)

Note: The type of unit most desired by the majority of non-metropolitan users interviewed, and not currently available, was a combination in-vehicle/portable unit, ie. one with a vehicle-mounted chassis which can be 'un-plugged' and used as a personal portable when away from the vehicle.

APPENDIX L

MSat PAGING POTENTIAL

	<u>1981</u>	<u>1986</u>	<u>1991</u>	<u>1996</u>	<u>2001</u>
<u>1. Number of Units</u>					
Projected average % growth in preceding 5 years	-	20	15	10	5
'000 units in use	150	373	751	1209	1543
<u>2. Airtime per average unit</u>					
Seconds per page	___ 10 for tone-and-voice, 1 for tone-only ___				
Pages/day/unit	_____ 2 _____				
% of units with voice	60	50	40	30	20
* Minutes/unit/month	6.5	5.6	4.7	3.8	2.8
* 1981 calculation: Minutes/page x Pages x Days	$\frac{(60 \times 10) + (40 \times 1)}{100} \times \frac{1}{60} \times 2 \times \frac{365}{12} = 6.5$				
<u>3. Total Monthly Airtime</u>					
'000 minutes (units x airtime/unit)	973	2080	3503	4535	4380
<u>4. MSat Potential</u>					
% of units with wide-area/roaming applications	20	25	30	35	40
Gross monthly potential ('000 minutes) (Total airtime x %)	195	520	1051	1587	1752
Potential share for MSat ('000 minutes) (estimated at 50% of gross from 1991)	-	-	525	794	876

Source: Composite of results of WG interviews with paging service suppliers, etc.

APPENDIX M

DEVELOPMENT OF COST FORMULAE TO PROVIDE ESTIMATES OF MOBILE RADIO SYSTEM OPERATING COSTS

M.1 Fixed Installations

M.1.1 Number of Sites

Assuming a site (i.e., meaning a base or repeater station) can give good coverage for 25 miles, with a 5-mile overlap between site coverage areas, a site is needed every 40 miles in a linear system. The number of sites needed (n) is therefore found as:

$$n = 1 + \frac{L-50}{40} = \frac{L-10}{40},$$

rounded up to the next whole number, where L is the length of the system in miles.

For a block system, the area is imagined broken into 50-mile-wide ribbons, so that for L in the above formula we substitute πR^2 , where R is the radius of the system.

50

M.1.2 Capital Costs

i) Sites

The cost will differ depending on whether the site is in a remote (i.e. unserviced) or a rural area. The cost elements per site are estimated as:

	<u>Rural</u>	<u>Remote</u>
200-foot tower	\$15,000	\$20,000
Equipment shelter	3,000	4,000
Civil works (e.g. roads, site preparation)	2,500	10,000
Power installation	500	5,000
	<u>21,000</u>	<u>39,000</u>
Total Sites Cost:	21,000n	39,000n

ii) Radio Links

Each site is linked by radio to the next. In rural areas, common carrier links are assumed, so no capital costs. In remote areas, the transmitter, receivers, antennae, cables and installation will cost about \$20,000 per link, and the number of links will be n-1.

Total Radio Links Cost: $20,000(n-1)$

iii) Fixed Radio Equipment

Each site will have an automatic base/repeater, plus signalling, duplexer, antenna, cable and battery, in total costing about \$11,000 installed.

Total Fixed Radio Equipment Cost: $11,000n$

iv) Control Point Equipment

This costs an estimated basic \$10,000 installed for furniture, housings, power supplies and electronics, plus \$2,000 per site for individual control and signalling equipment.

Total Control Point Equipment Cost: $10,000 + 2,000n$

v) Engineering Costs

These amount typically to about 5% of the total capital costs above, i.e. $\frac{\text{Sum of Capital Costs}}{20}$

Total Engineering Cost:

$$\text{Rural} = \frac{21,000n + 11,000n + 10,000 + 2,000n}{20}$$

$$= 1,700n + 500$$

$$\text{Remote} = \frac{39,000n + 20,000(n-1) + 11,000n + 10,000 + 2,000n}{20}$$

$$= 3,600n - 500$$

M.1.3 Operating/Maintenance Costs

Monthly \$ costs are estimated at:

	<u>Rural</u>	<u>Remote</u>
Maintenance - per site	10	25
- per link	0*	120
- fixed radio per site	40	60
- control point	90	90
Leased circuits, per link	600¢	0*
Power, per site	20	50

* See M.1.2 ii) ø40 miles at \$15/mile.

These numbers consolidate to:

$$\begin{aligned} \text{Rural : } & 10n + 40n + 90 + 600(n-1) + 20n = 670n - 510 \\ \text{Remote: } & 25n + 120(n-1) + 60n + 90 + 50n = 255n - 30 \end{aligned}$$

M.2 Mobiles

A typical mobile costs \$2,200 and is estimated to cost \$10 per month to maintain. Capital costs are therefore 2,200m and maintenance 10m/month, where m is the number of mobiles.

M.3 Capital Amortization

Money/opportunity costs are typically set at 15% per annum at present for internal financing (i.e. when equipment is owned) and 20% at commercial rates (i.e. when the supplier's R.O.I. is allowed for).

The formula for monthly capital equipment costs, using straight-line depreciation, is: $M = \frac{Cx(R/100+1)}{12 Y}$

where M is the monthly charge
C is the capital cost
R is the interest rate %
Y is the amortization period in years

Typical amortization periods for the various items would be:

Sites	- 15 years
Links, fixed radio, control point, engineering	- 10
Mobiles	- 7

M.4 Monthly Costs

The above estimates can now be combined to yield estimates of monthly costs for a variety of systems. As an example, the calculation for a private rural system is:

Monthly Capital Amortization for Fixed Installations

$$= \frac{21,000n \times 1.15^{15}}{12 \times 15} \text{ for sites}$$

$$+ \frac{(0 + 11,000n + 10,000 + 2,000n + 1,700n + 500) \times 1.15^{10}}{12 \times 10} \text{ for links, fixed radio, control point, and engineering.}$$

$$= 1,445n + 354$$

Operating and maintenance costs will add $670n - 510$ to this (see M.1.3 above), for a total of $2,115n - 156$

If the user also owns the mobile units, these will be assigned a monthly cost of: $\frac{2200m \times 1.15^7}{12 \times 7}$ for

capital charges, plus $10m$ for maintenance, totalling $79.67m$.

M.5 Application of Costing System

We considered that, in practice, classifying each system as rural or remote in the sense described, or a mixture of the two, would not have been a feasible proposition. We therefore investigated the possibility of using an average between the two estimates, and found that the maximum individual errors from using this combination approach over a wide spectrum of cases would be of the order of 20% - see the tables on the following pages. Considering that the figures were only to be used on an aggregated basis, this was judged acceptable.

The following tables present the monthly cost estimates for a variety of system sizes (range and number of mobiles) and types (block or linear) as developed from the cost formulae:

STANDARD MONTHLY COST ESTIMATES FOR PRS SYSTEMS -
BLOCK CONFIGURATION

		RANGE OF SYSTEM (MILES)					
MOBILES	AREA	25	50	100	250	500	1000
5	- RURAL	2357	8702	31966	207503	829283	3322750
	- MIXED	2812	10862	40380	263104	1052029	4215781
	- REMOTE	3266	13022	48793	318703	1274771	5108796
10	- RURAL	2756	9100	32364	207901	829681	3323149
	- MIXED	3210	11260	40778	263502	1052427	4216180
	- REMOTE	3665	13420	49192	319102	1275169	5109195
25	- RURAL	3951	10295	33559	209096	830877	3324344
	- MIXED	4405	12455	41973	264697	1053622	4217375
	- REMOTE	4860	14615	50387	320297	1276364	5110390
50	- RURAL	5942	12287	35551	211088	832868	3326335
	- MIXED	6397	14447	43965	266689	1055614	4219366
	- REMOTE	6851	16607	52378	322289	1278356	5112382
100	- RURAL	9926	16271	39534	215071	836852	3330319
	- MIXED	10380	18431	47948	270672	1059598	4223350
	- REMOTE	10835	20591	56362	326272	1282340	5116365
250	- RURAL	21876	28221	51485	227022	848802	3342269
	- MIXED	22331	30381	59899	282623	1071548	4235300
	- REMOTE	22785	32541	68312	338223	1294290	5128316
500	- RURAL	41794	48139	71402	246939	868720	3362187
	- MIXED	42248	50299	79816	302540	1091466	4255218
	- REMOTE	42703	52459	88230	358140	1314208	5148233
1000	- RURAL	81629	87974	111237	286774	908555	3402022
	- MIXED	82083	90134	119651	342375	1131301	4295053
	- REMOTE	82538	92294	128065	397975	1354043	5188068
2500	- RURAL	201134	207479	230742	406279	1028060	3521527
	- MIXED	201588	209639	239156	461880	1250806	4414558
	- REMOTE	202043	211799	247570	517480	1473548	5307573
5000	- RURAL	400309	406654	429917	605454	1227235	3720702
	- MIXED	400763	408814	438331	661055	1449981	4613733
	- REMOTE	401218	410974	446745	716655	1672723	5506748
10000	- RURAL	798659	805004	828267	1003804	1625585	4119052
	- MIXED	799113	807164	836681	1059405	1848331	5012083
	- REMOTE	799568	809324	845095	1115005	2071073	5905098

STANDARD MONTHLY COST INDICES FOR PRS SYSTEMS -
BLOCK CONFIGURATION

		RANGE OF SYSTEM (MILES)					
MOBILES	AREA	25	50	100	250	500	1000
5	- RURAL	84	80	79	79	79	79
	- MIXED	100	100	100	100	100	100
	- REMOTE	116	120	121	121	121	121
10	- RURAL	86	81	79	79	79	79
	- MIXED	100	100	100	100	100	100
	- REMOTE	114	119	121	121	121	121
25	- RURAL	90	83	80	79	79	79
	- MIXED	100	100	100	100	100	100
	- REMOTE	110	117	120	121	121	121
50	- RURAL	93	85	81	79	79	79
	- MIXED	100	100	100	100	100	100
	- REMOTE	107	115	119	121	121	121
100	- RURAL	96	88	82	79	79	79
	- MIXED	100	100	100	100	100	100
	- REMOTE	104	112	118	121	121	121
250	- RURAL	98	93	86	80	79	79
	- MIXED	100	100	100	100	100	100
	- REMOTE	102	107	114	120	121	121
500	- RURAL	99	96	89	82	80	79
	- MIXED	100	100	100	100	100	100
	- REMOTE	101	104	111	118	120	121
1000	- RURAL	99	98	93	84	80	79
	- MIXED	100	100	100	100	100	100
	- REMOTE	101	102	107	116	120	121
2500	- RURAL	100	99	96	88	82	80
	- MIXED	100	100	100	100	100	100
	- REMOTE	100	101	104	112	118	120
5000	- RURAL	100	99	98	92	85	81
	- MIXED	100	100	100	100	100	100
	- REMOTE	100	101	102	108	115	119
10000	- RURAL	100	100	99	95	88	82
	- MIXED	100	100	100	100	100	100
	- REMOTE	100	100	101	105	112	118

STANDARD MONTHLY COST ESTIMATES FOR PRS SYSTEMS -
LINEAR CONFIGURATION

LENGTH OF SYSTEM (MILES)

MOBILES - AREA	50	100	250	500	1000	3000
5 - RURAL	2357	4472	12932	25621	53115	158860
- MIXED	2812	5495	16229	32329	67214	201385
- REMOTE	3266	6518	19526	39038	81313	243909
10 - RURAL	2756	4870	13330	26019	53513	159258
- MIXED	3210	5894	16627	32728	67612	201783
- REMOTE	3665	6917	19924	39436	81711	244307
25 - RURAL	3951	6066	14525	27215	54708	160453
- MIXED	4405	7089	17822	33923	68807	202978
- REMOTE	4860	8112	21119	40631	82906	245503
50 - RURAL	5942	8057	16517	29206	56700	162445
- MIXED	6397	9080	19814	35915	70799	204970
- REMOTE	6851	10103	23111	42623	84898	247494
100 - RURAL	9926	12041	20500	33190	60683	166428
- MIXED	10380	13064	23798	39898	74783	208954
- REMOTE	10835	14087	27095	46606	88881	251478
250 - RURAL	21876	23991	32451	45140	72634	178379
- MIXED	22331	25014	35748	51849	86733	220904
- REMOTE	22785	26037	39045	58557	100832	263428
500 - RURAL	41794	43909	52368	65058	92551	198296
- MIXED	42248	44932	55666	71766	106651	240822
- REMOTE	42703	45955	58963	78474	120749	283346
1000 - RURAL	81629	83744	92203	104893	132386	238131
- MIXED	82083	84767	95501	111601	146486	280657
- REMOTE	82538	85790	98798	118309	160584	323181
2500 - RURAL	201134	203249	211708	224398	251891	357636
- MIXED	201588	204272	215006	231106	265991	400162
- REMOTE	202043	205295	218303	237814	280089	442686
5000 - RURAL	400309	402424	410883	423573	451066	556811
- MIXED	400763	403447	414181	430281	465166	599337
- REMOTE	401218	404470	417478	436989	479264	641861
10000 - RURAL	798659	800774	809233	821923	849416	955161
- MIXED	799113	801797	812531	828631	863516	997687
- REMOTE	799568	802820	815828	835339	877614	1040211

STANDARD MONTHLY COST INDICES FOR PRS SYSTEMS -
LINEAR CONFIGURATION

LENGTH OF SYSTEM (MILES)

MOBILES	AREA	50	100	250	500	1000	3000
5	- RURAL	84	81	80	79	79	79
	- MIXED	100	100	100	100	100	100
	- REMOTE	116	119	120	121	121	121
10	- RURAL	86	83	80	80	79	79
	- MIXED	100	100	100	100	100	100
	- REMOTE	114	117	120	120	121	121
25	- RURAL	90	86	81	80	80	79
	- MIXED	100	100	100	100	100	100
	- REMOTE	110	114	118	120	120	121
50	- RURAL	93	89	83	81	80	79
	- MIXED	100	100	100	100	100	100
	- REMOTE	107	111	117	119	120	121
100	- RURAL	96	92	86	83	81	80
	- MIXED	100	100	100	100	100	100
	- REMOTE	104	108	114	117	119	120
250	- RURAL	98	96	91	87	84	81
	- MIXED	100	100	100	100	100	100
	- REMOTE	102	104	109	113	116	119
500	- RURAL	99	98	94	91	87	82
	- MIXED	100	100	100	100	100	100
	- REMOTE	101	102	106	109	113	118
1000	- RURAL	99	99	97	94	90	85
	- MIXED	100	100	100	100	100	100
	- REMOTE	101	101	103	106	110	115
2500	- RURAL	100	99	98	97	95	89
	- MIXED	100	100	100	100	100	100
	- REMOTE	100	101	102	103	105	111
5000	- RURAL	100	100	99	98	97	93
	- MIXED	100	100	100	100	100	100
	- REMOTE	100	100	101	102	103	107
10000	- RURAL	100	100	100	99	98	96
	- MIXED	100	100	100	100	100	100
	- REMOTE	100	100	100	101	102	104

APPENDIX N

MSat SERVICE CONCEPTS AND
PRELIMINARY ESTIMATES OF SERVICE COSTS

The data contained in this Appendix
are reprinted from service concept
documents provided to Woods Gordon
by DOC for mobile radio, mobile
telephone and mobile data service

MSAT SERVICE CONCEPTS

1. Type of Service

Mobile Radio Service (MRS)
(Mobile, Portable and personal portable)

2. Description of Service

Mobile radio service will be provided between a fixed location (S Band base stations, UHF base stations or locations connected to a gateway by a dedicated communications channel) to mobile stations operating within a beams coverage. Mobile to mobile operation is possible when operating through the gateway but will be double-hopped. Interconnection to other networks is subject to regulations. The mobile stations will be; (a) similar to the current terrestrial but employing a special antenna, (b) the same as for the mobile telephone service radio, (c) specially designed radios for satellite service depending on user needs.

The grade of service (GOS) will depend on whether satellite channels are pooled or dedicated to a specific user. The GOS for pooled channels is P.10. The leasor of dedicated channels will control the GOS of his leased channels. Voice quality is nominally telephone toll quality or field quality depending on user needs. Mobile coverage above 60°N, to the horizon, will be subject to degradation resulting from multipath and blockage of the station to satellite path. It is anticipated that this service will be leased from the gateway operator by a carrier and sub-leased to MRS subscribers. Lease of dedicated channels from the gateway operator is expected.

3. Description of System

Satellite channels will be grouped into a common user pool and a number of channels dedicated to specific user requirements. MRS subscribers in the common user pool will be controlled by the gateway station, but addressing will only be to subscribers to this service. Annex A, Figures 1 and 2 show the link between base and mobile locations. Access via UHF base stations will be double hopped and via a dedicated channel to the gateway will be single hopped. Common user pool subscribers may purchase service guaranteeing access to a specified number of common user channels at a premium cost.

Dedicated channel subscribers can communicate directly to the mobile via an S Band Base Station or via the gateway from a UHF base station or dedicated communications channel. Annex B Figures 1, 2 and 3 indicate these modes of operation. The voice quality and GOS will be determined by the equipment parameters and the channel loading selected by the offerer of this service.

Beam coverage at the sub-satellite longitude (110°W) and 54°N latitude is approximately:

- a. 39 Beam satellite: 230 mile radius
- b. 20 Beam satellite: 390 mile radius

Typical coverage for the two systems is shown in Annexes C and D.

4. Subscriber Costs

Preliminary estimates of service costs for three different satellite sizes are:

- a. Pooled; System GOS

- (1) Space Segment

- (a) Satellite serving 210,000 subscribers: \$105-175 per month or \$0.60 - \$1.00 per minute.

- (b) Satellite serving 150,000 subscribers: \$150-\$250 per month or
\$0.85 - \$1.40 per minute
- (c) Satellite serving 70,000 subscribers: \$250-\$420 per month or
\$1.45 - \$2.35 per minute

(2) Ground Segment

- (a) Capital cost per mobile \$2,000
- (b) Monthly rental per mobile \$65

(3) Access

- (a) Dedicated channel: Varies, depending on location of base and gateway.
- (b) UHF: As per 4.a.(1) plus \$4,000 capital cost of UHF base station.
- (c) S Band: Capital cost \$50,000.

b. Pooled; Guaranteed

(1) Space Segment

- (a) 210,000 subscribers: As per 4.a.(1)(a) plus \$6,000 per month per guaranteed channel
- (b) 150,000 subscribers: As per 4.a.(1)(b) plus \$8,000 per month per guaranteed channel
- (c) 70,000 subscribers: As per 4.a.(1)(c) plus \$15,000 per month per guaranteed channel

(2) Ground Segment

As per 4.a.(2)

(3) Access

As per 4.a.(3)(a and b)

c. Dedicated Channels

(1) Space Segment

(a) 210,000 subscribers: \$11,500 per month per
dedicated channel

(b) 150,000 subscribers: \$16,800 per month per
dedicated channel

(c) 70,000 subscribers: \$29,500 per month per
dedicated channel

(2) Ground segment

As per 4.a.(2)

(3) Access

As per 4.a.(3) (a and c).

ANNEX A

MRS OPERATION IN Common User Pool

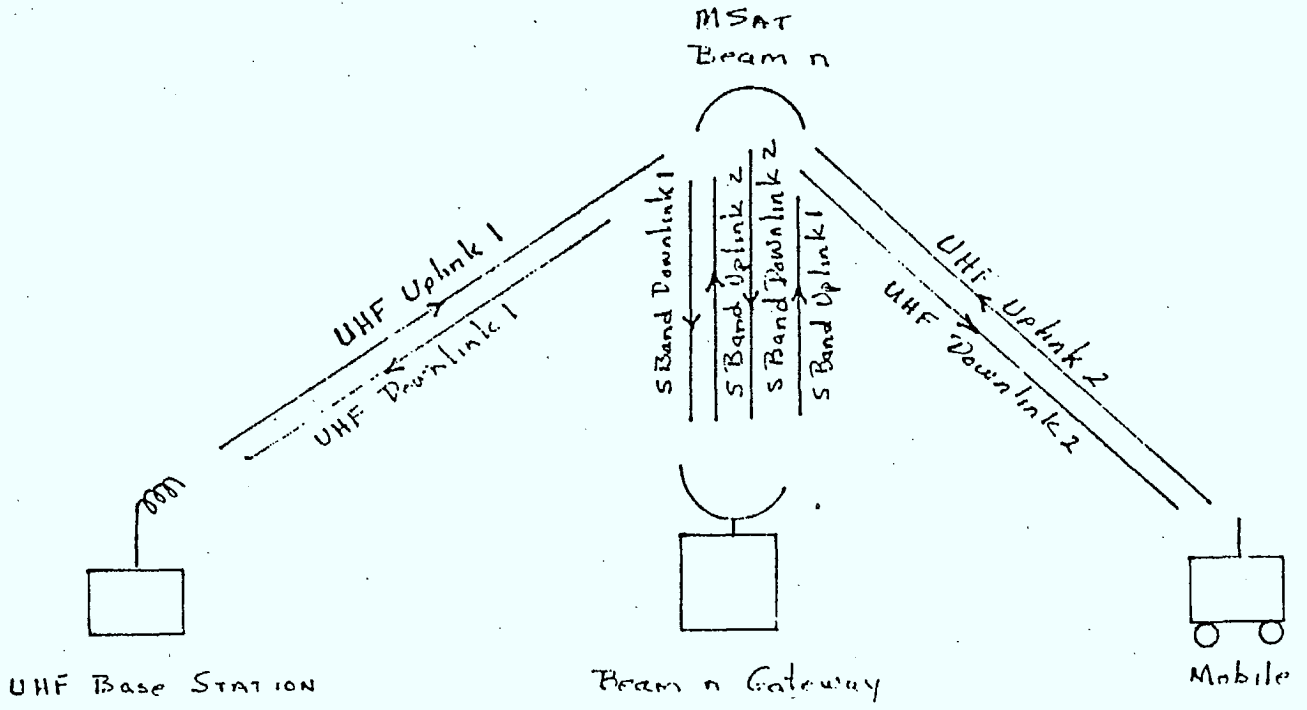


FIGURE 1

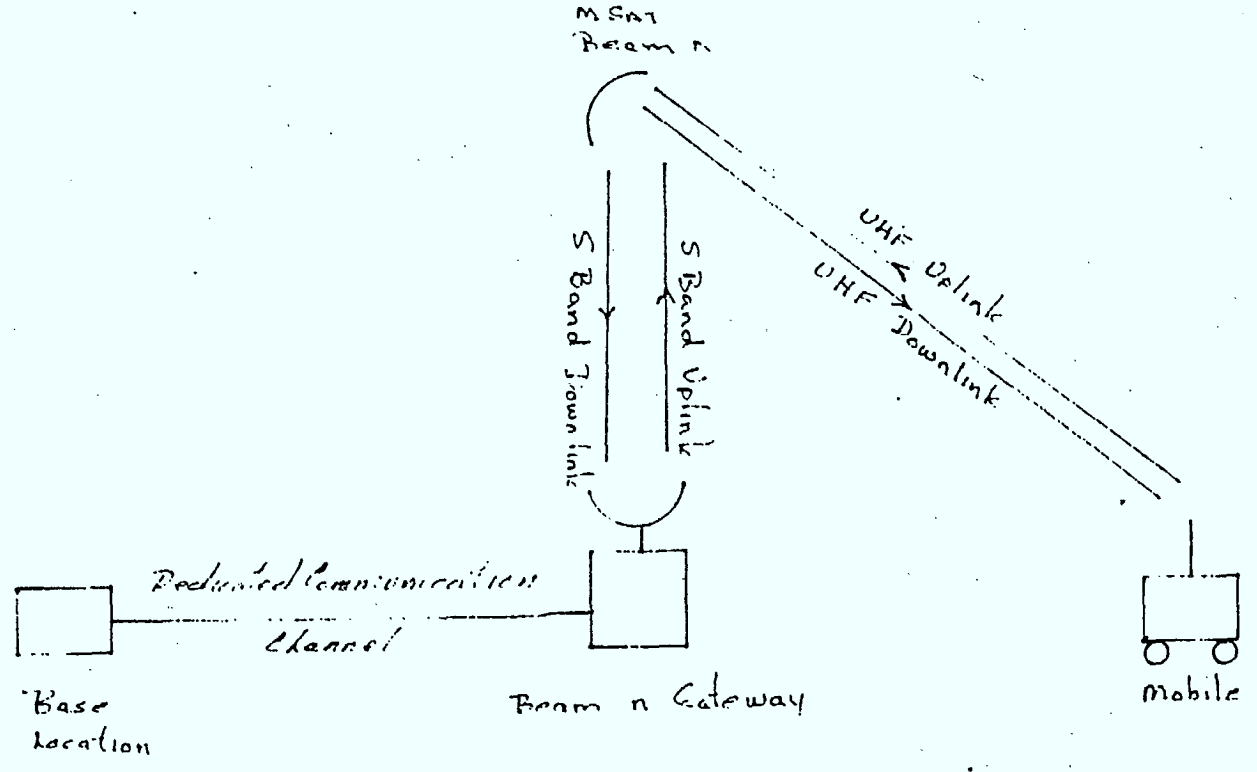


FIGURE 2

MRS OPERATION USING DEDICATED CHANNELS

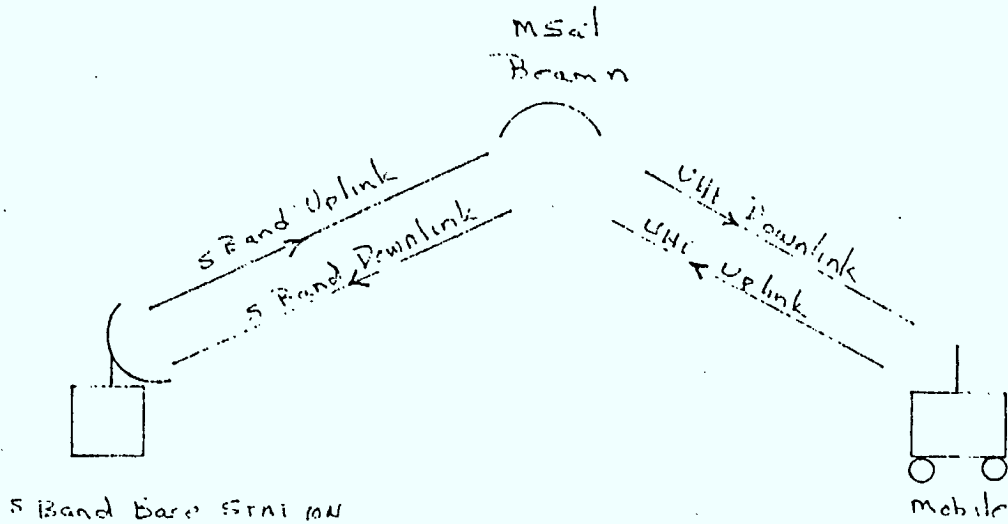


FIGURE 1

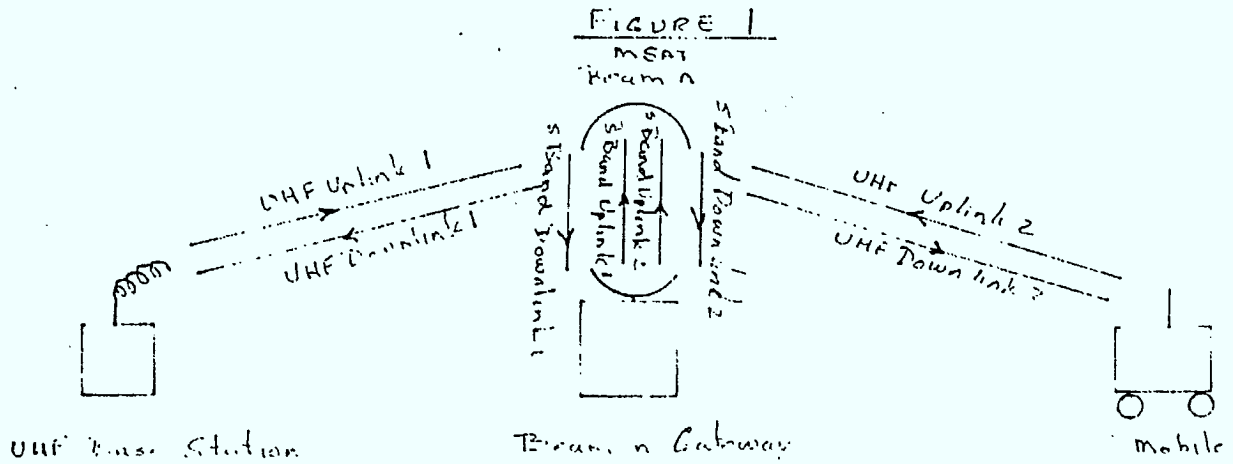


FIGURE 2

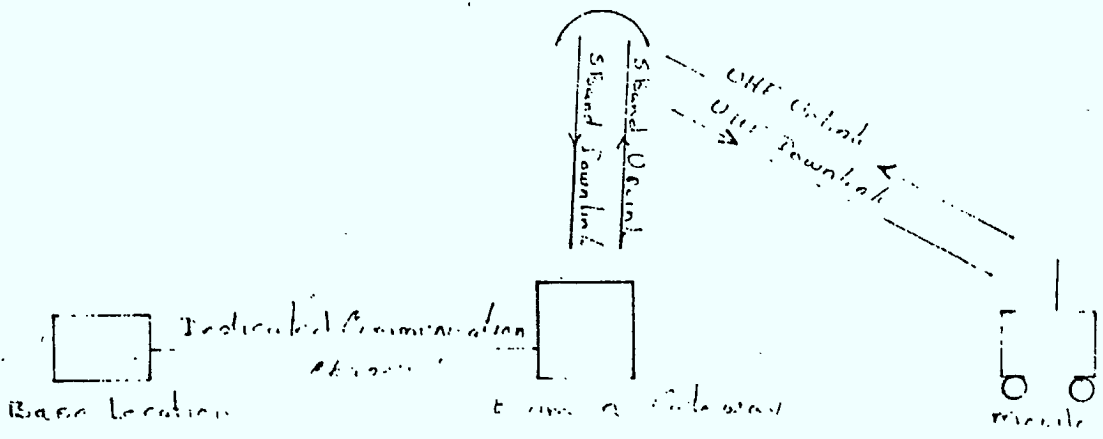
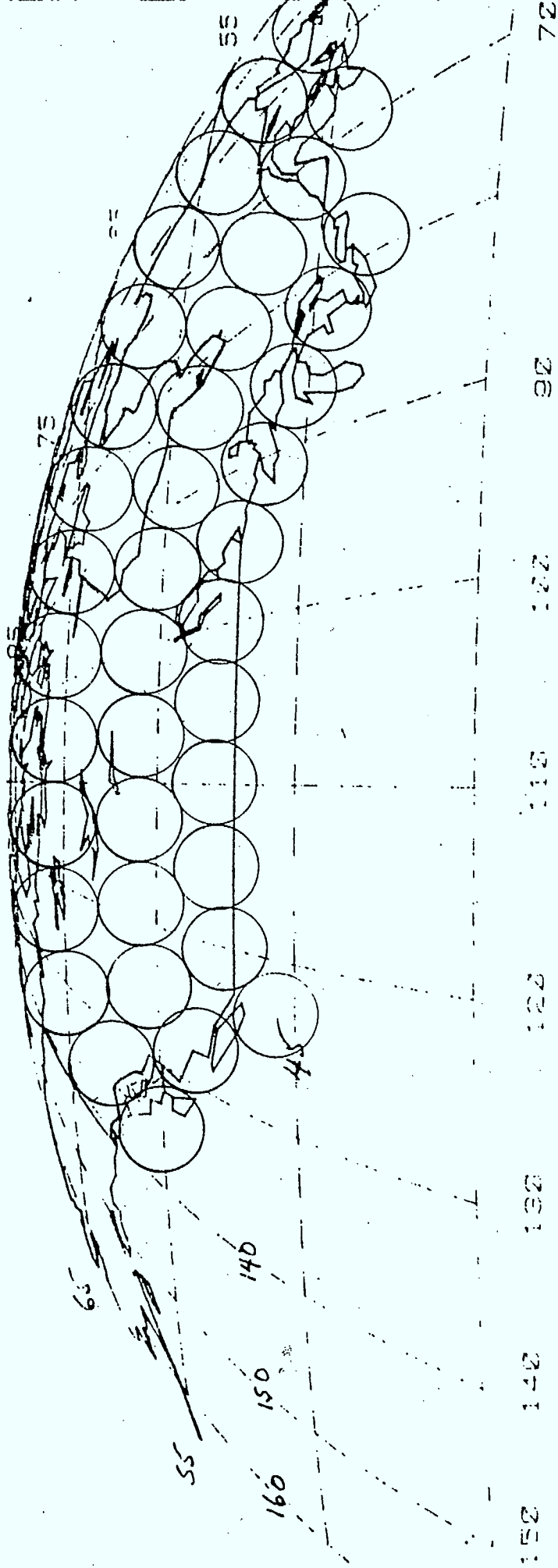


FIGURE 3

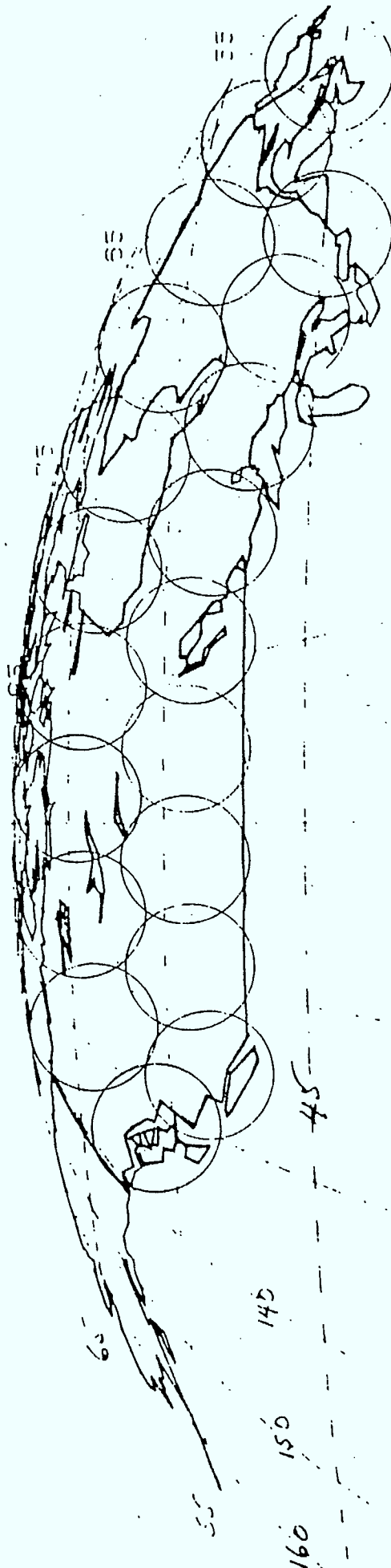
ANNEX C



VIEW 110° W LONG.

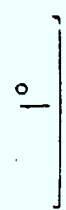


ANNEX D



251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272

VIEW 110W LONG.



MEAT SERVICE CONCEPTS

1. Type of Service

Mobile Telephone Service
(Includes land, air and ship service)

2. Description of Service

The land mobile station will be terrestrial/satellite interoperable using different antennas for the two services. Air and ship service will be provided using a satellite terminal. Signalling would be direct from mobile subscriber to telephone/mobile addressee and vice versa. Voice quality will be equivalent to telephone toll quality. Satellite channels will be pooled and the number of channels will provide a grade of service (GOS) of P.10, corresponding to a blockage of 10 calls in 100. One gateway station will be located in each beam providing automatic interface with the direct dial network (DDN), operator intercept and satellite/terrestrial billing. It is anticipated that Telcos will operate the gateways and market this service.

3. Description of System

Mobile to terrestrial addressed calls would be via a single hop satellite link to the gateway where automatic interface to the DDN will be provided (See Annex A Figure 1). Mobile to mobile calls will be double hopped via the gateway as shown in Annex A Figure 2.

Beam coverage at the sub-satellite longitude and 54°N latitude is approximately:

- a. 39 beam satellite: 230 mile radius
- b. 20 beam satellite: 390 mile radius

Annexes B and C indicate typical coverage patterns for the two systems. Land mobile coverage above 60°N, to the horizon, will be subject to degradation resulting from multipath and blockage of the station to satellite path.

4. Subscriber Costs

Preliminary estimates of service costs for three different satellite sizes are:

a) Space segment (Including MSAT/DDN Interface)

(1) Satellite serving

210,000 subscribers: \$105 - \$175 per month or
\$0.60 - \$1.00 per minute

(2) Satellite serving

150,000 subscribers: \$150 - \$250 per month or
\$0.85 - \$1.40 per minute

(3) Satellite serving

70,000 subscribers: \$260 - \$420 per month or
\$1.45 - \$2.35 per minute

Per minute costs are based on six minutes usage per day per subscriber. Actual costing could be based on a percentage of the monthly rate and a per minute charge.

b) Ground Segment

(1) Capital cost per land mobile \$7,000

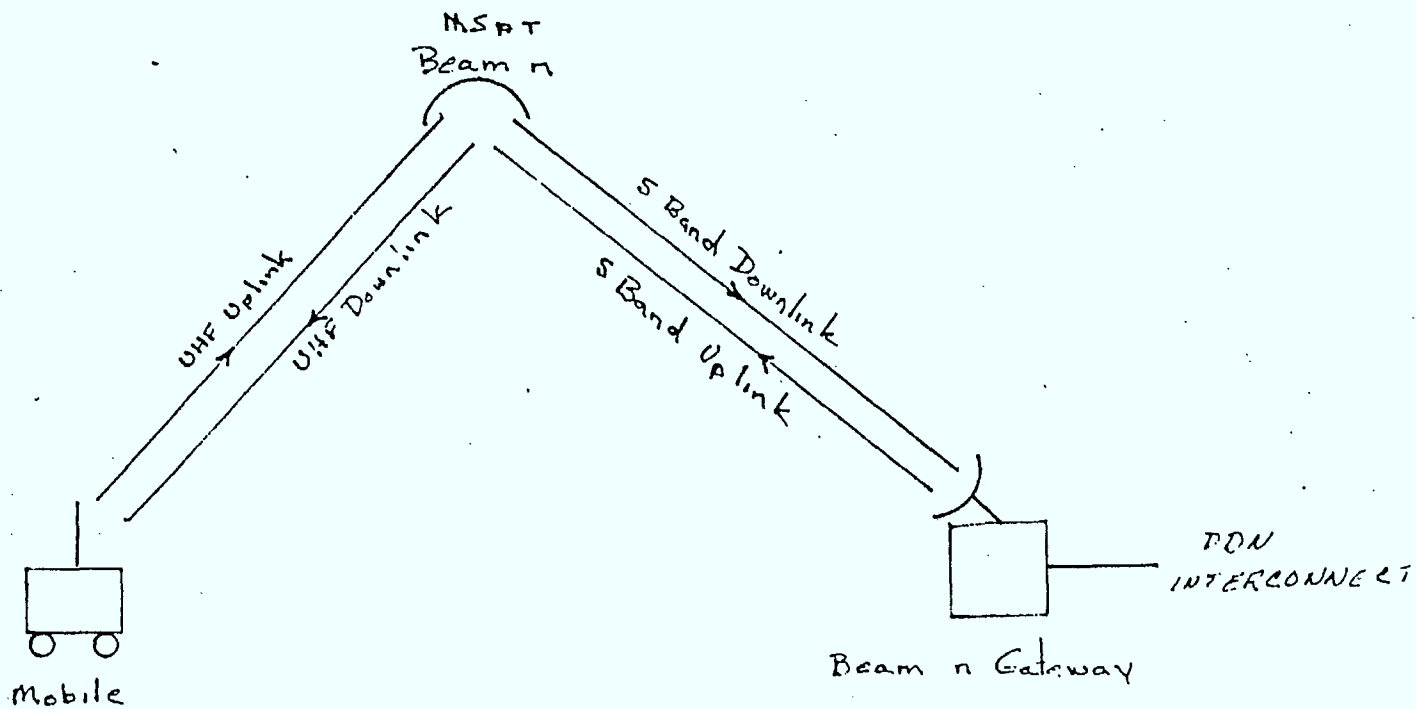
(2) Monthly rental per land mobile \$65

(3) Air and ship terminal costs to be determined

c) Terrestrial

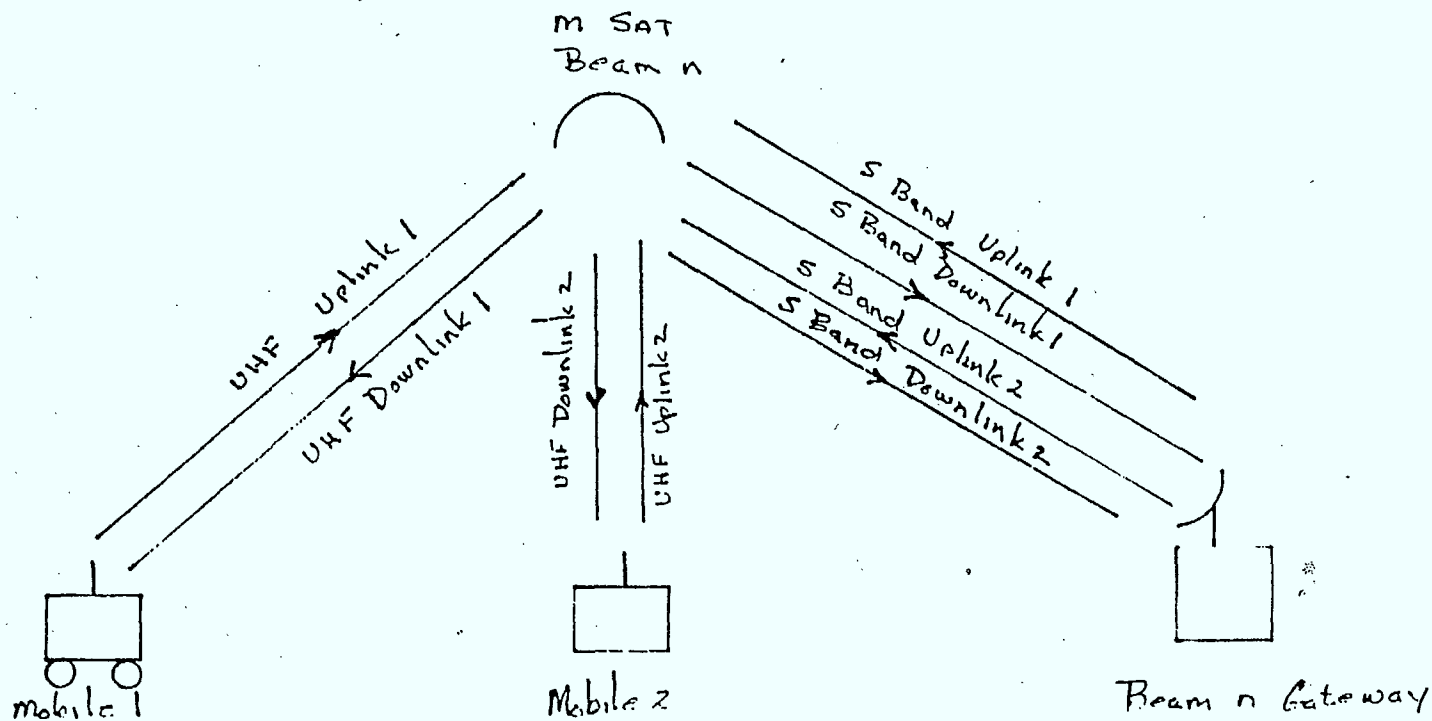
(1) Normal toll charges from gateway to addressee

Mobile TELEPHONE SERVICE



Mobile to DDN

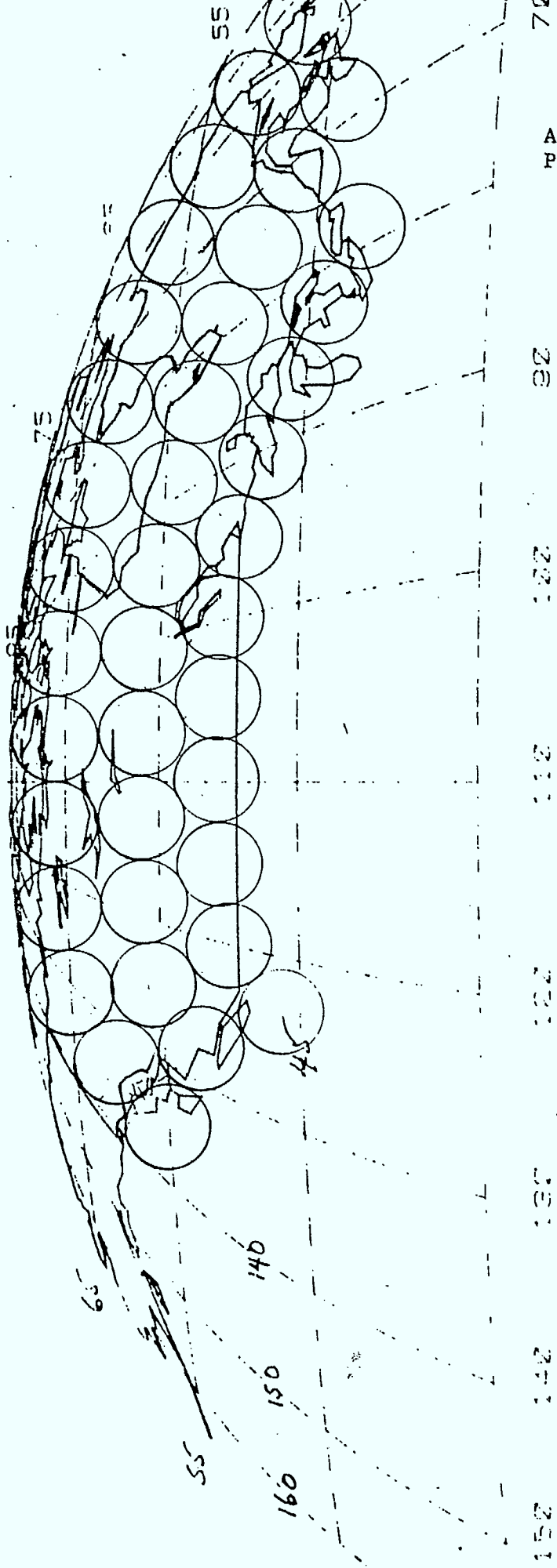
FIGURE 1



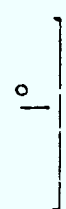
MOBILE TO MOBILE

FIGURE 2

ANNEX B



VIEW 110W LONG.



1. Type of Service

4800 bps Data Service

2. Description of Service

Data service at 4800 bps will be provided between mobile, transportable and personal portable terminals, and base stations or gateways. Mobile and personal portable terminals will employ visual displays with 35-120 characters in memory for message reception and composition. The display unit will be sized to meet specific service needs. An audible alarm will be sounded on receipt of a message at the addressed terminal. Acknowledgement of receipt of a message will be sent by the addressed terminal or gateway station. Standard data terminals can be used at transportable terminal locations at data rates up to 4800 bps.

This service is intended for users with a relatively unrestricted line of sight path to the satellite. Coverage North of 60°N latitude may be subject to degradation resulting from multipath and blockage of the terminal to satellite path.

3. Description of System

Data service will be carried on dedicated data channels time shared by subscribers. Mobile and personal portable subscribers will randomly access the data channel and the system will be sized to yield a probability of overlap no greater than 10%. The gateway will automatically route or relay all messages from subscribers to their destination based on its knowledge of network configuration. Figures 1 and 2 of Annex A illustrate mobile and personal portable service.

Transportable terminals due to their longer message duration will request service on the signalling channel through the gateway. The gateway will control access to the channels and time share them among the subscribers. Operation will be similar to that illustrated in Annex A.

Annexes B and C indicate typical coverage for different beam configurations for the two services. Annex D is a summary of the characteristics of this type of service.

4. Subscriber Costs

Preliminary estimates of service costs per message (Note 1) for three different satellite sizes are:

a. Space Segment (Note 2)

- (1) Satellite serving 210,000 subscribers
 - (a) Personal portable/mobile - \$0.05
 - (b) Transportable - \$0.12

- (2) Satellite serving 150,000 subscribers
 - (a) Personal portable/mobile - \$0.07
 - (b) Transportable - \$0.15

- (3) Satellite serving 70,000 subscribers
 - (a) Personal portable/mobile - \$0.13
 - (b) Transportable - \$0.25

Notes:

- 1a. Personal portable/mobile message nominally 1,000 bits (20 words).
- b. Transportable message nominally 12,000 bits (250 words or 1 page).

- 2. Mobile to mobile messages cost twice the above rates.

b. Terminal costs

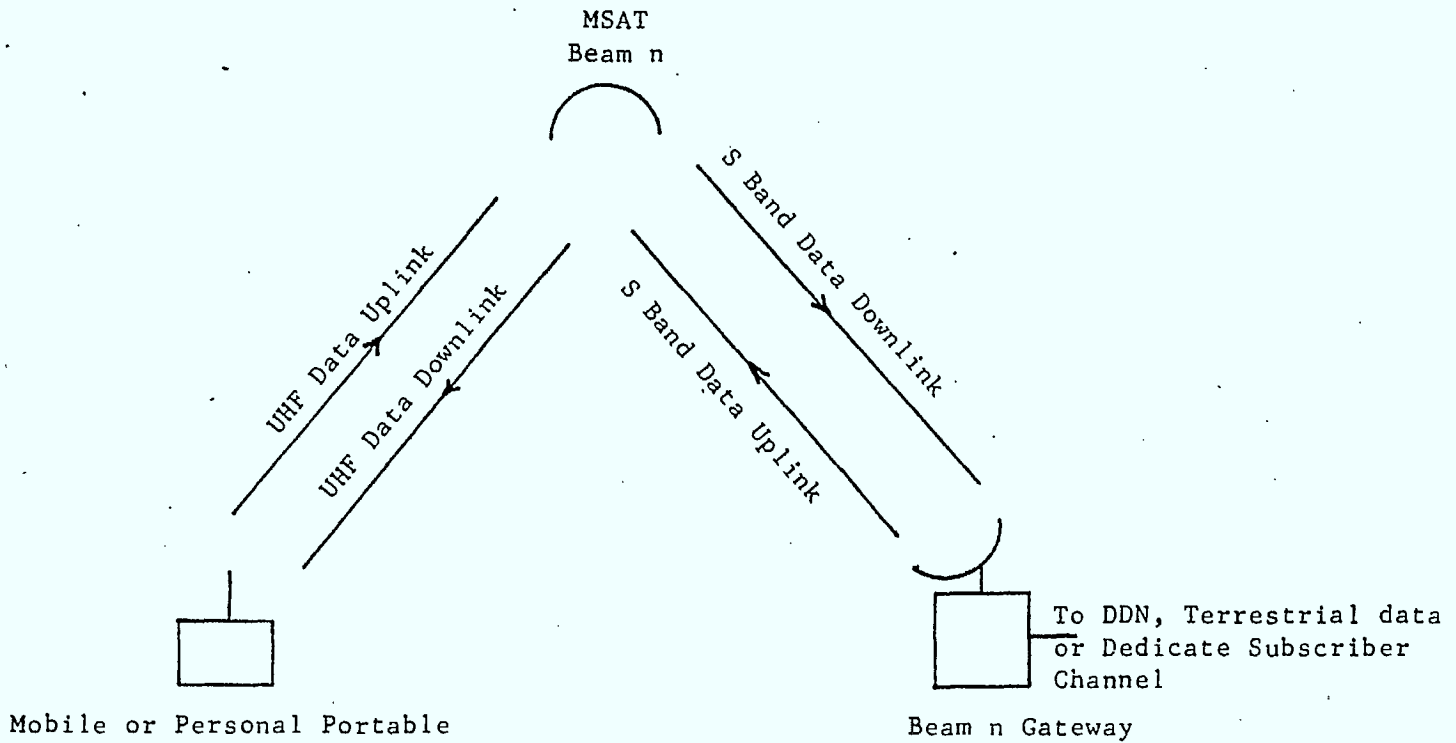
- (1) Mobile \$2,500
- (2) Personal portable \$2,000
- (3) Transportable \$3,500 plus data entry/display unit

c. Terrestrial

- (1) Normal charges for DDN, data network or dedicated channel at 4800 bps.

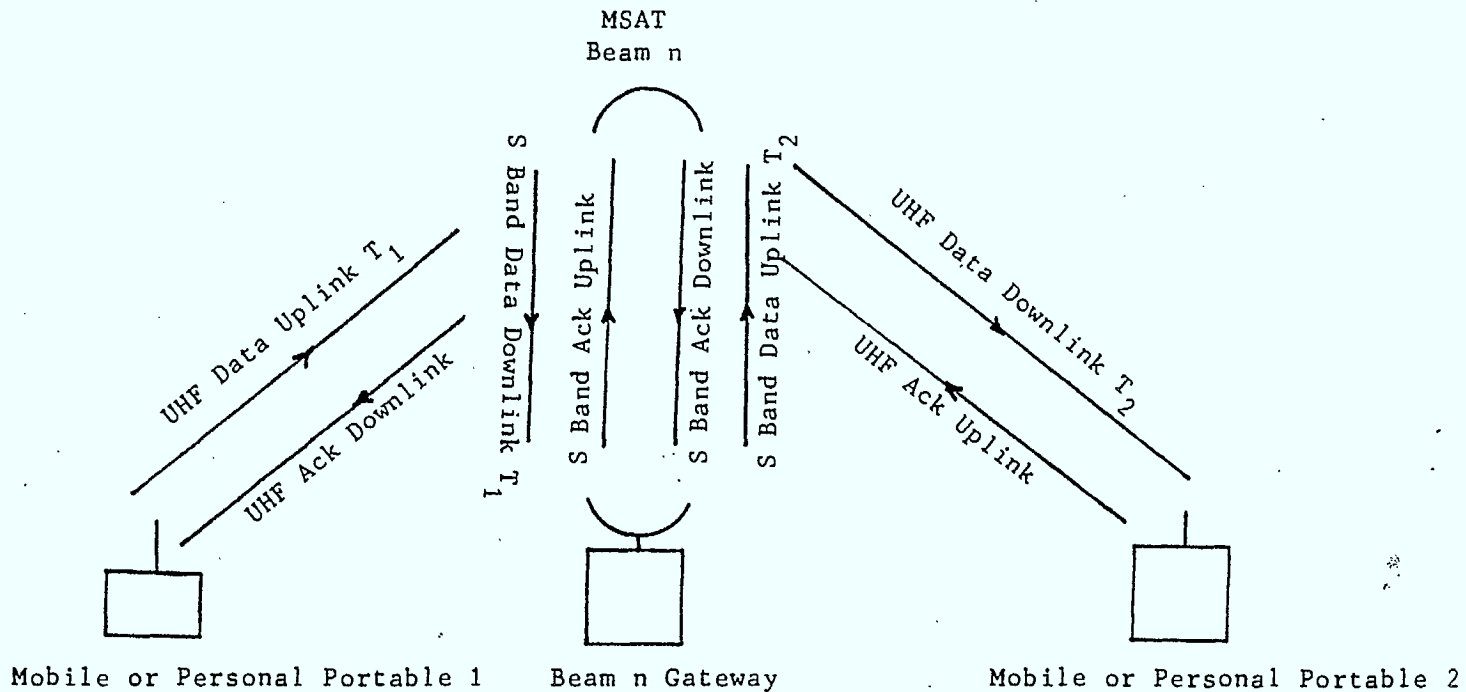
Mobile and Personal Portable

Data Service



Mobile to Gateway Service

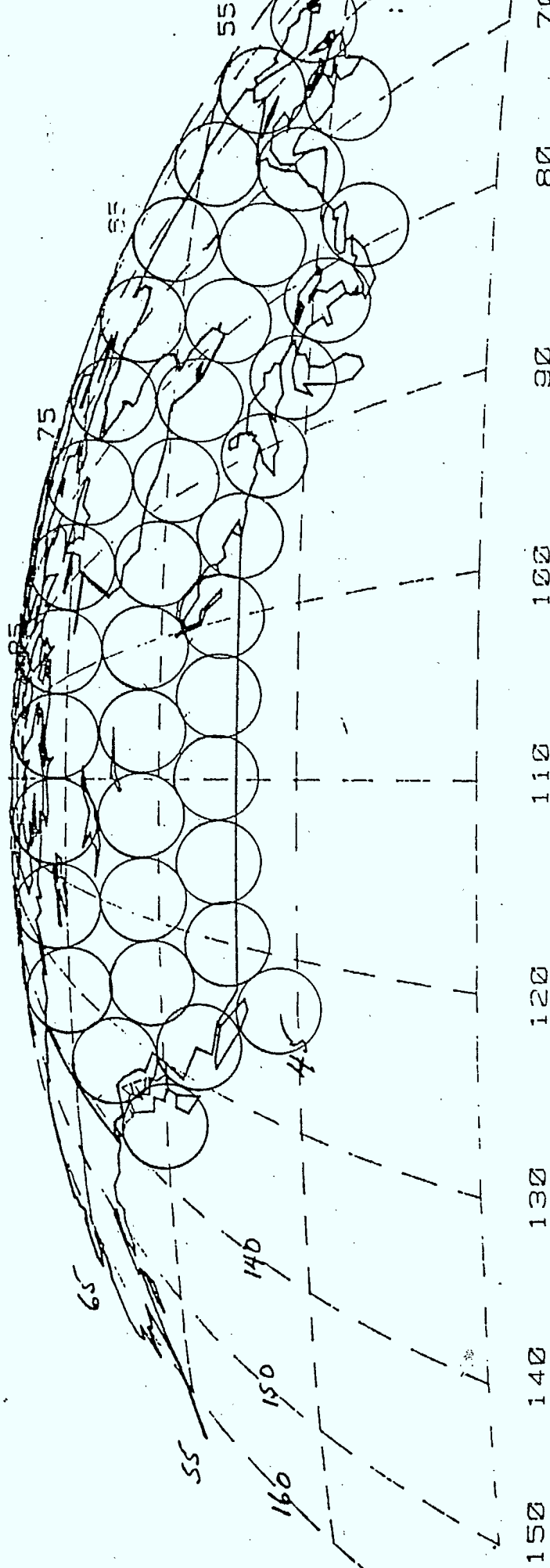
Figure 1



Mobile to Mobile Service

Figure 2

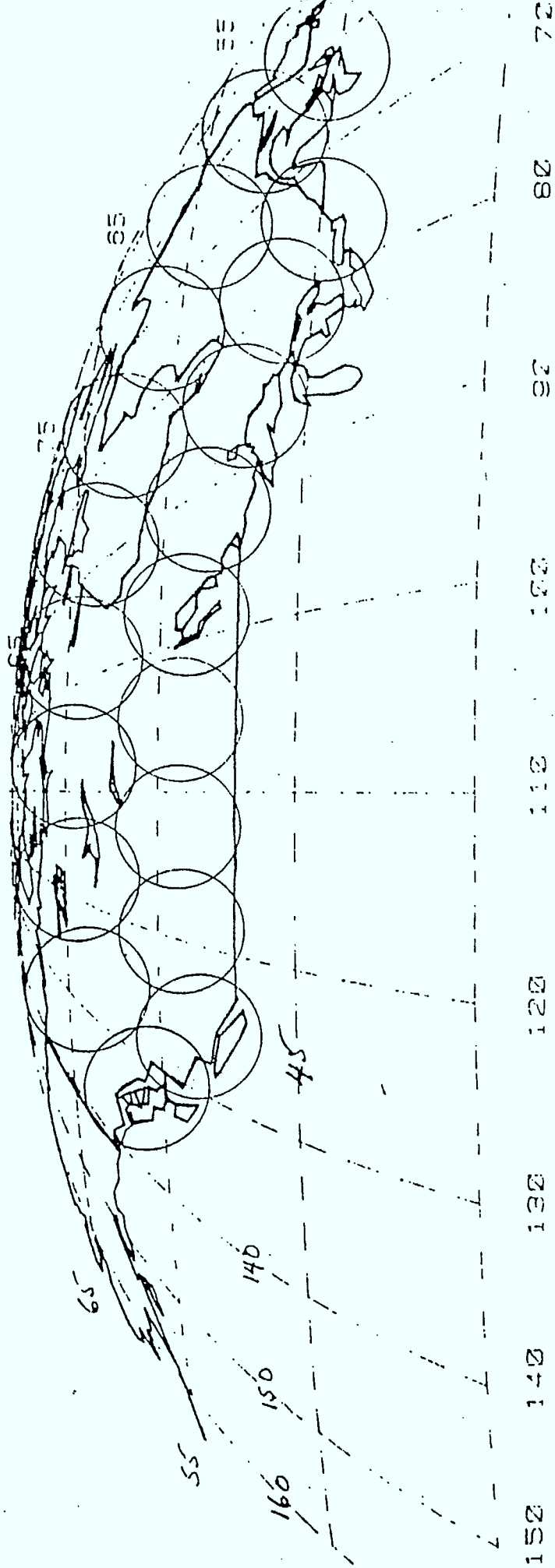
Annex B



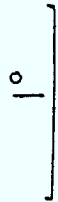
VIEW 110°W LONG.



Annex C



VIEW 110W LONG.



ANNEX D

4800 bps Data Service

SUMMARY OF CHARACTERISTICS

1. General

Information Rate - 4800 bps

Space Segment Error Rate - 10^{-6}

2. Personal portable/Mobile Terminals

Message Length - up to 1000 bits including address (approximately 20 words)

Probability of overlap in 8 hour busy period - 10%

System capacity per channel in 8 hour busy period - 960 calls per hour

3. Transportable Terminals

Message Length - 12,000 bits (approximately 250 words or 1 page)

- Not restricted to above but used to size system

Number of subscribers for 3 channel allocation - 7,300

