Peat, Marwick and Partners

# DEPARTMENT OF COMMUNICATIONS

# LARGE BUSINESS SATELLITE DEMAND STUDY



May, 1983

Peat, Marwick and Partners

Management Consultants

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May 13, 1983

Mr. T.W.J. Rochefort
Director
Industry Structure and Services
National Telecommuication Branch
Department of Communications
300 Slater Street
Ottawa, Ontario
K1A 0C8

Dear Mr. Rochefort:

I am pleased to submit this final report of the Large Business Satellite Demand Study which we carried out for the Department of Communications as an extension of our Satellite/Terrestrial Intermodal Competition Study. We appreciate having had the opportunity to carry out this study, and we feel that it has enhanced the value of the overall study to a considerable degree.

We appreciate the excellent cooperation which we received from the firms participating in the study. We would also like to acknowledge the assistance which we have received from Ms. Nora Hockin and Mr. G. McCullough in carrying out this study. I hope that the results of this work will be of assistance to their study as well.

Yours very truly,

PEAT, MARWICK and PARTNERS

Peat, Marwick and Partners

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Peat, Marwick and Partners

# LARGE BUSINESS SATELLITE DEMAND STUDY

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# I - INTRODUCTION AND APPROACH

## BACKGROUND TO THE STUDY

During the initial phases of our study of the effects of Satellite/Terrestrial Intermodal Competition, it became apparent that one of the major market segments which would have an impact on the market split between satellite and terrestrial facilities would be the private line and private network market. This segment of the market was not covered in detail by Canadian Astronautics Limited during their demand study. However, our discussions with a number of users and potential users of satellite services during the early phases of the Intermodal Competition Study indicated a significant potential demand for satellite service among large businesses.

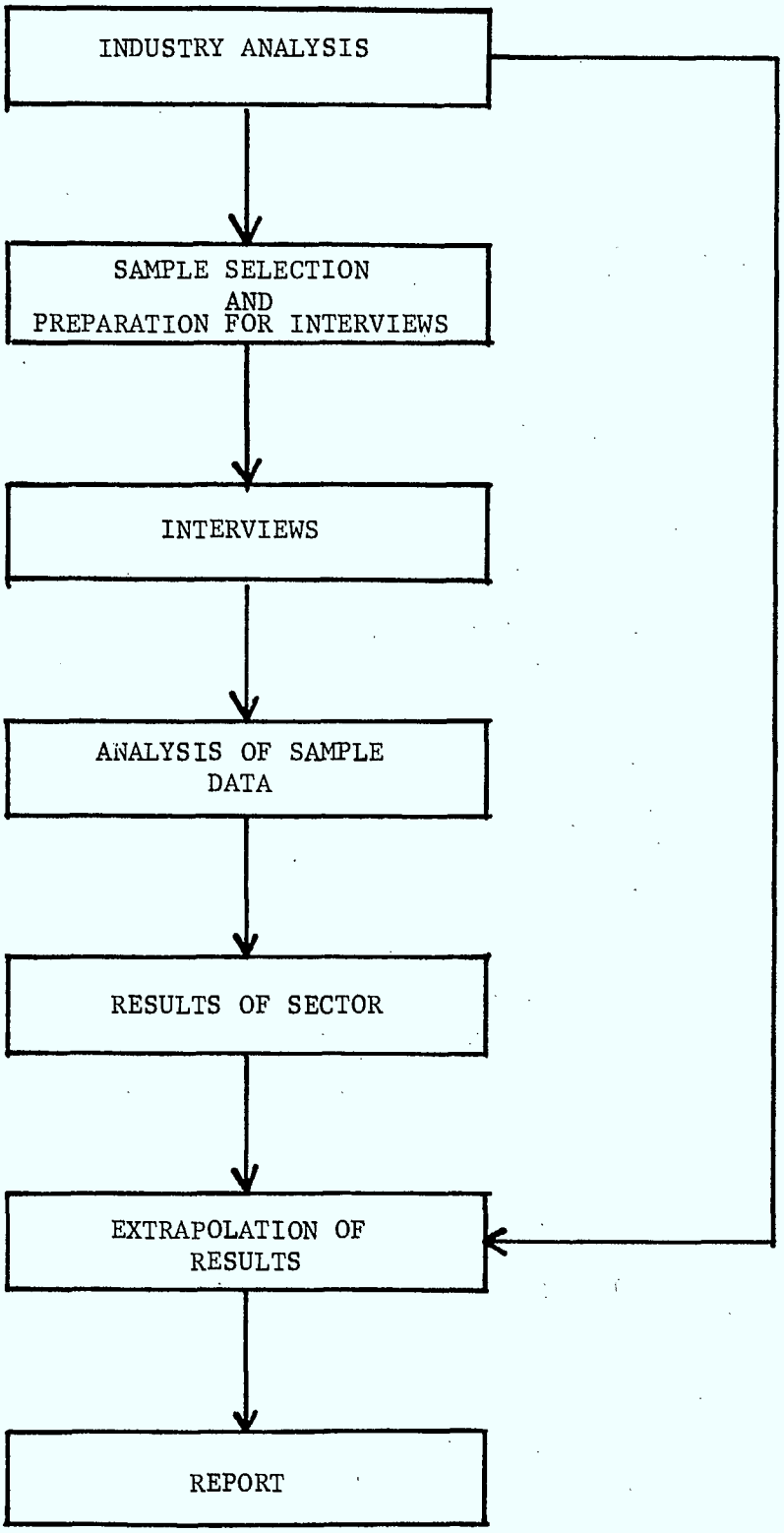
In order to include these considerations in the Intermodal Competition Study, it was necessary for us to obtain more detailed demand data on the potential use of satellites by large businesses for private line and private network applications. Accordingly, we formulated, in discussions with the Department of Communications, an approach to obtaining the basic information, analyzing the data, and preparing the report within the overall stringent deadlines imposed by the Intermodal Competition Study. The total elapsed time for this Large Business Satellite Demand Study was four weeks.

## GENERAL APPROACH

Our general approach to carrying out this study within the limited time frame was to select a small number of firms representing the major industrial sectors in Canada, to carry out a detailed survey of the existing telecommunications expenditures and communications patterns, to compare the costs of providing the satellite - eligible portion of their requirements by satellite and by terrestrial, and finally to extrapolate these results to the largest 250 industrial and government organizations in Canada. Exhibit 1, overleaf, depicts the major steps in this approach.

EXHIBIT 1

OVERALL APPROACH



In carrying out this survey, we considered only current private line usage (both voice and data), and of those private lines, we considered only major routes and key remote locations as eligible for satellite. We did not study message toll or WATS usage because these are generally not known on a point to point basis. We assumed that the companies interviewed would have carried out the necessary studies to optimize their existing use of telecommunications services, so that private lines are used whenever they are more cost-effective than message toll or WATS.

In certain cases, it became apparent that a concerted effort had not been made by certain firms to optimize their use of telecommunications. In some cases, voice and data requirements were being treated separately with no attempt to integrate the facilities. The approach we adopted in this study was to compare the satellite equivalent of each organization's existing terrestrial network, and not to try to improve the network efficiency of their existing facilities prior to looking at the cost of the satellite equivalent.

We also obtained input from those interviewed on a number of qualitative factors, including policy considerations, technical requirements, attitudinal factors, costs and operational/management considerations.

## SELECTION OF SAMPLE

In selecting the firms to be interviewed, we divided the 250 largest organizations in Canada into the following sectors:

- Banks/finance/insurance.
- Oil/gas.
- Transportation.
- Utilities/pipelines.
- Retail.
- Mining.

- Manufacturing/hi-tech/chemicals.
- Hotels/food/hospitality.
- Service bureaux.
- Government.

We then chose large and small firms from each of these sectors with a view to permitting extrapolation of the results over the entire sector. However, other considerations were also used in the choice of sample. For example, we attempted to avoid interviewing firms which had been contacted recently by the Department in carrying out similar studies where other similar firms could be substituted. We also attempted to avoid overlapping with a study carried out some time ago by Canadian Astronautics Limited.

The list of organizations and representatives surveyed is included in Appendix A of this report. We would note that one organization asked not to be listed as a participant in this study and accordingly is not included in the listing in Appendix A.

# II - ISSUES AND ASSUMPTIONS

In this chapter of the report, we describe the major issues which we faced in carrying out this brief demand study and specify the assumptions which we made in dealing with certain of these issues.

Although there is some overlap between the areas, we describe these issues under the following headings:

- Policy issues.
- Technical issues.
- Attitudinal issues.
- Forecasting issues.
- Costing issues.
- Operational issues.

## POLICY ISSUES

The major policy issue which we faced in carrying out this survey was the earth station licensing policy. Earth station licensing policy can affect the demand for satellite services by large businesses in two ways. There is a quantitative impact on the cost of satellite services when end-users are not permitted to operate their own earth stations, but must instead lease those services from a carrier. The second aspect is the qualitative consideration associated with having an earth station wholly under the user's control, with the user responsible for maintenance.

In initial discussions with the Department, we proposed to analyze the data obtained from the survey under three separate sets of assumptions with regard to earth station licensing. These sets of assumptions were to be as follows:

1. The status quo, with no restrictions on downlinks, with Telesat and the regulated common carriers allowed to operate uplinks at 14/12 GHz, and with Telesat being the sole operator of uplinks at 6/4 GHz.

2. A change in the policy to make licensing of 6/4 GHz uplinks consistent with 14/12 GHz uplinks, so that both carriers and Telesat can operate uplinks at either frequency.

3. A liberalized earth station ownership policy with end users as well as carriers and Telesat permitted to operate uplink and downlink earth stations at both frequencies.

As the analysis proceeded, it became apparent that the second alternative would have very little impact on the demand for satellite services because the pattern of communications favoured mainly the use of 14/12 GHz satellite service. Accordingly, the second alternative above was eliminated and the analysis was carried out using one scenario with the existing earth station licensing policy, and a second scenario with a fully liberalized earth station licensing policy (alternative 3 above).

## TECHNICAL ISSUES

There are a number of technical issues which bear consideration in this study. These include the following:

- Satellite footprint.
- Potential interference problems at 6/4 GHz.
- Security.
- Reliability.
- Delay.
- Earth station characteristics.

## EXHIBIT 2

## TDMA FEATURES

- PARTIAL TRANSPONDER SERVICE
- WIDEBAND CAPABILITIES
- INTEGRATION OF VOICE AND DATA
- TDMA TECHNIQUES (FIXED OR DYNAMIC ASSIGNMENT)
- ANALOGUE AND/OR DIGITAL
- ALLOWS FOR GROWTH UP TO 15Mbps
- USER CONTROL CENTRE
- INTEGRATION WITH TERRESTRIAL FOR BACKUP AND ALTERNATE ROUTING
- NATIONAL COVERAGE

## THIN ROUTE FEATURES

- SINGLE CHANNEL PER CARRIER
- INTEGRATED VOICE AND DATA
- DAMA
- POINT-TO-POINT OR STAR NETWORK APPLICATIONS

For many of these technical considerations, we relied upon respondents in the survey and also the information gathered in the Intermodal Competition Study itself to indicate which technical considerations would have an impact on demand. One consideration is the requirement for backhaul in the 6/4 GHz frequency band. There are no hard and fast rules to be applied in determining whether or not backhaul will be required. It depends on interference problems in each individual case, and the way in which shielding, if required, is used to avoid backhaul. Our approach in dealing with the requirement for backhaul was to include a surcharge on the 6/4 GHz earth station costs, although the results of the analysis indicate limited sensitivity to the additional cost imposed by the backhaul requirement.

In comparing the cost of the existing private line services on terrestrial facilities with equivalent services on satellite, we used two existing technologies on satellite for comparison. These technologies are:

- Time division multiple access (TDMA).
- Single channel per carrier (thin-route).

The features of these two technologies are described in Exhibit 2, opposite. As the earth station costs in particular for these two technologies are different, we prepared cost curves based on both technologies for use in comparing with the existing costs on terrestrial. While it appeared from the analysis that a higher capacity thin route or a less elaborate TDMA technology could be appropriate for many of the users, we did not have any cost or technical information on such equipment.

ATTITUDINAL ISSUES

We would like to emphasize that the purpose of this study was to estimate the potential demand for satellite services among large businesses in Canada. Accordingly, we assumed that end-users will choose the lowest cost alternative which meets their telecommunications requirements. However, we are aware that

the telecommunications management function within certain firms does not have a high priority. Voice and data requirements are often managed by separate departments of the firm so that there is effectively no integration of their telecommunications requirements. In these circumstances, several steps would be required to reorganize responsibilities within the user organization prior to considering the use of satellites.

Our approach to these attitudinal factors was to assume that, for purposes of estimating the potential demand, the end users are rational. However, in terms of actually reaching that potential demand, the attitude of the end user organization and the marketing approach of the carrier are also important. Accordingly, we included questions in our survey questionnaire relating to the prior consideration of satellite usage and to the marketing efforts of the carriers.

FORECASTING ISSUES

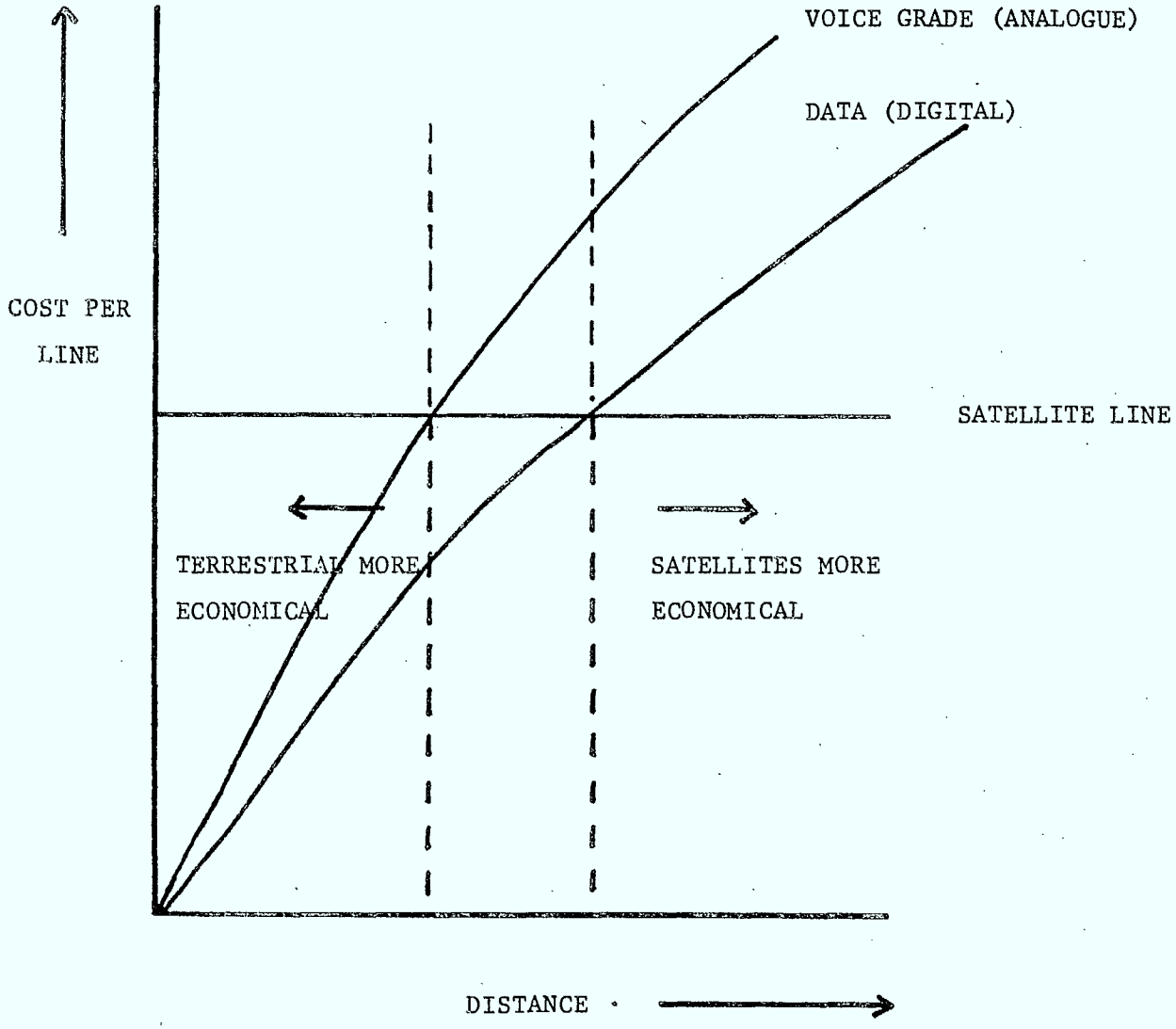
There are two dimensions to the forecast required in order to arrive at the potential demand over time. The first is to use the information on private lines and telecommunication expenditures for the companies surveyed and expand this to cover the 250 largest organizations in Canada. The second step is to look at the growth in traffic expected over time.

In scaling up the results from the 24 organizations surveyed, we used the only available basis for that scale up. That is, based on either revenues (in most cases), or assets (in the case of the chartered banks). This approach is probably most valid in sectors such as the computer service bureaux or the chartered banks where the operations of the individual firms within each industry are very similar. This approach admittedly has limited validity in highly variable industrial sectors such as the manufacturing sector. Accordingly, the confidence levels which we are able to attach to the various estimates of potential demand vary considerably across the industrial sectors. However, it would seem equally inappropriate not to attempt to scale up the results from the 24 firms surveyed to get some idea of the potential demand which exists.

EXHIBIT 3

ECONOMICS OF USING SATELLITES

(FROM A USER OR CARRIER POINT OF VIEW)



In terms of the growth in demand, each respondent was asked to estimate the expected growth in existing services, and expansion into new service areas. These estimates were used to develop the potential 1988 demand.

## COSTING ISSUES

Exhibit 3, opposite, is a simplified chart illustrating the distance insensitivity of satellite costs compared to the distance sensitivity of terrestrial telecommunication costs. The terrestrial costs are based on the carrier tariffed rates for point-to-point private lines. The satellite costs are based on a combination of the space segment costs and the earth station costs. Based on tariffed rates for 6/4 GHz and 14/12 GHz and a requirement of 64 Kb/s per voice channel, we estimate that a space segment cost of $3,000 per line per year would be compensatory, allowing for the required spacing. The earth station cost can be either the annual lease cost in the case of a leased earth station or the annual operating cost to the end user in the case where end user operation of the earth station is permitted and the end user choses to own its own earth station.

Exhibit 4, overleaf, compares the TDMA and thin route technologies and the cost associated with those two technologies, both in the case of a carrier-owned earth station and user-owned earth station. All costs have been analyzed on the same basis - 12% cost of money and ten year life with no salvage.

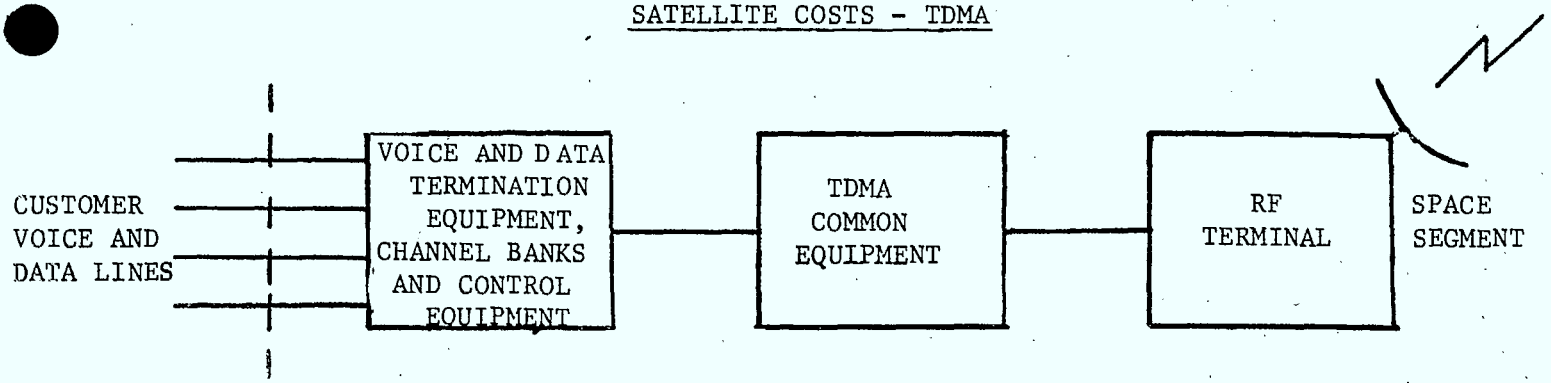
## OPERATIONAL ISSUES

As indicated during the discussion of attitudinal issues above, there are a number of operational issues which can have an effect on the actual demand for satellite services as opposed to the potential demand. In other words, there are a number of factors affecting the likelihood of satellite service actually being implemented.

During our survey, we asked questions with respect to the organization, including details on the departments and individuals responsible for the procurement and maintenance of communications services. We asked for their views on the current environment for using satellites from a feasibility point of view,

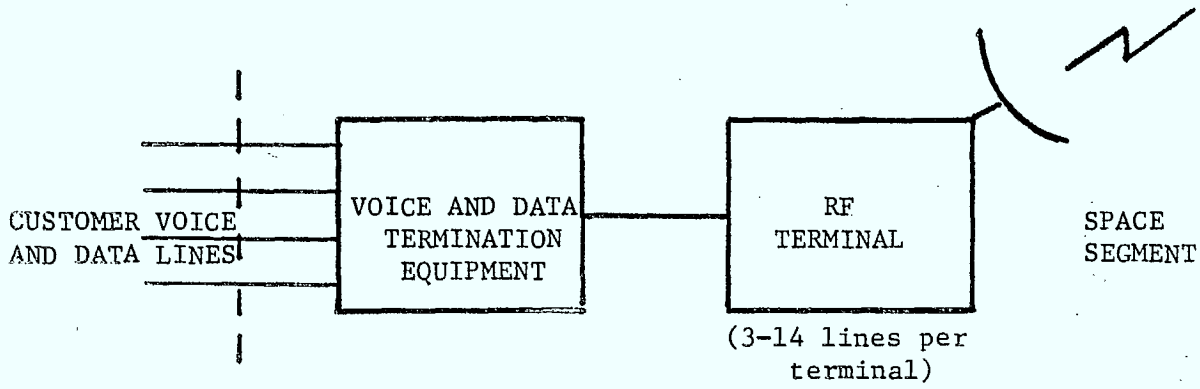
EXHIBIT 4

SATELLITE COSTS - TDMA




| | ANNUAL COSTS[1] | |
|---|---|---|
| 6/4 GHz | CARRIER LICENSING ALTERNATIVE | OPEN LICENSING ALTERNATIVE |
| TERMINATION AND CONTROL EQUIPMENT | $ 14K | $ 9K |
| TDMA COMMON EQUIPMENT | 44K | 35K |
| RF TERMINAL | 160K | 99K |
| BACKHAUL[2] | 2K | 2K |
| TRAINING AND MAINTENANCE | 30K | 20K |
| TOTAL ANNUAL COST | $250K | $165K |
| 14/12 GHz | | |
| TERMINATION AND CONTROL EQUIPMENT | $ 14K | $ 9K |
| TDMA COMMON EQUIPMENT | 44K | 35K |
| FR TERMINAL | 122K | 76.5K |
| TRAINING AND MAINTENANCE | 27K | 18K |
| TOTAL ANNUAL COST | $207K | $138.5K |

## SATELLITE COSTS - THIN ROUTE




| | ANNUAL COSTS[1] | |
|---|---|---|
| 6/4 GHz | CARRIER LICENSING ALTERNATIVE | OPEN LICENSING ALTERNATIVE |
| TERMINATION EQUIPMENT | 4.6K + .3K/LINE | 3.1K + .2K/LINE |
| RF TERMINAL | 13.4K + 2.3K/LINE | 8.9K + 1.5K/LINE |
| TRAINING AND MAINTENANCE | 3K +.4K/LINE | 2K + 0.3K/LINE |
| TOTAL ANNUAL COSTS | 21K + 3K/LINE | 14K + 2K/LINE |

1. ASSUMES 12% COST OF MONEY, AND 10 YEAR LIFE WITH NO SALVAGE

2. ONLY REQUIRED WHERE THERE IS INTERFERENCE WITH TERRESTRIAL MICROWAVE

taking into account policy, technical, operational and cost considerations. We asked about perceived benefits of using satellite communications, and we asked whether there was any reason why the firm would or would not want to own or operate its own transmit/receive earth station.

It was apparent during our survey that several firms had made no real attempt to optimize their use of telecommunications. As mentioned earlier, some firms had not integrated their voice and data telecommunication requirements to permit their total requirements to be used in planning. In other cases, the firms were not collecting the data which would allow the minimization of costs. Finally, in certain cases it was apparent that the existing use of private lines and private networks was less than optimal in terms of keeping telecommunications costs to a minimum.

However, in carrying out this study, we have made no attempt to optimize the existing use of private lines and private networks prior to converting those requirement to satellite. To this extent, it might be said that the study inflates the potential demand by offering to replace non-optimum terrestrial facilities with non-optimum satellite facilities. However, we would counter such a suggestion by pointing out that optimal satellite facilities would result in even greater savings to those users who would benefit from the use of satellite facilities. Accordingly, while the demand might be slightly less once the network is optimized, satellite would also be more competitive in more applications for this reason. Accordingly, we do not view this as having a significant impact on the results of this study.

# III - FINDINGS AND CONCLUSIONS

In this chapter of the report, we present the results of the survey of 24 large businesses and organizations, discuss the results of the scale-up of these results to the 250 largest companies in Canada, and discuss our findings.

## RESULTS OF SURVEY

This section of the report contains both the qualitative and quantitative results of the survey of large business users which we carried out.

### Policy Considerations

Respondents expressed views on two policy considerations. These include earth station ownership and the membership of Telesat in TCTS. Some of the often mentioned comments and quotations are included in point form under the respective headings below.

#### Earth Station Ownership

- Majority of users saw no effect of making 6/4 GHz policy consistent with 14/12 GHz policy.
- Main issue concerning 6/4 GHz earth stations is the requirement for backhaul which also reduces the flexibility of TDMA. While extent of interference problem is dependent on location, it is not a major factor in any case since the majority of users would fall into the 14/12 GHz footprint where there are no interference problems. Exceptions are in the north of Canada beyond the 14/12 GHz footprint. Most of the NorthwesTel's service area falls outside the 14/12 GHz footprint.
- A majority of users interviewed believed that restrictions on earth station licensing impedes the availability of satellite services.

- Several users expressed the desire to design and control their own networks, including the earth stations.

- Several users already have earth stations locations planned on rooftop sites or on towers.

Telesat/TCTS Agreement

- Users generally felt constrained by the Telesat/TCTS agreement. This arrangement is perceived to impede the implementation of satellite services through:

  - the refusal of Telesat to allow users to design and control their own networks

  - delays in obtaining service

  - no marketing of satellite services done by TCTS (majority of potential users have never heard of ISBN)

  - information on services and rates not provided

  - maintenance costs high

  - end-to-end private line and network services treated as special assemblies, not tariffed items.

- Following comments were received from various users:

  - "no incentive on part of carriers to offer satellite services"

  - "similar situation to the railways owning the airlines"

  - "Canada is five years behind the US in this policy area"

  - "the Canadian satellites (14/12 GHz) are designed for broadcasting"

Technical Considerations

In this section, we will reflect the respondents comments on a number of the technical issues relating to satellites.

Delay

- Not seen as a problem for voice.
- Thirty per cent of respondents see delay as a problem in data applications. Examples include:
  - incompatible computer communications protocols on older machines
  - cumulative effects of delay unacceptable in systems such as on-line banking
  - polling applications would have to be changed in some cases.

Reliability

- Not seen as a problem by the majority of users.
- Most would use terrestrial back-up.
- Several users pointed to reliability problems on terrestrial networks.

Security

- Perceived as a potential problem by 20% of respondents.
- Awareness of encryption devices, but concern about the cost of these devices.

Double Hop for National Coverage on 14/12 GHz Band

- Seen as a problem by some users, depending on the cost.
- Possible technical problems due to additional delay.

## Costing Considerations

Costing considerations often mentioned by respondents included the following:

- Satellite costs are perceived to be high because of current policies with respect to earth station licensing and competition; however, all users perceived cost advantages in using satellites.

- Major cost advantages seen in communicating with remote areas. Particularly advantageous for oil companies, mining companies, timber companies and certain government departments.

## Operational and Management Considerations

Respondents often mentioned the following factors which favoured the use of satellite:

- Allows users to control their own networks.

- Ability to deal directly with the satellite service provider.

- Improved satellite services will encourage the development and the optimization of other business applications.

- Higher quality service.

Those factors often mentioned by respondents which would tend to limit the use of satellite include the following:

- The organization requires education on the use of the new technology.

- One quarter of users saw potential problems with integrating the satellite and terrestrial facilities.

- The organization would have to deal with more than one service supplier.

- Administration costs within the organization could increase.

## Expected Benefits

A ranking of the expected benefits to be realized through the use of satellites was as follows:

EXHIBIT 5

RESULTS OF DEMAND STUDY : CURRENT YEAR (SCENARIO 1)

| ORGANIATION | TOTAL TELECOM $ | ELIGIBLE $ | BASIS OF ELIGIBILITY | MARKET SPLIT | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | TERRESTRIAL | SATELLITE | SAVINGS | EARTH STATIONS | LINES |
| OIL/GAS A | 25M | 8M | MAJOR AND REMOTE LOCATIONS | 0 | 3.75M | 4.25M | 12 TDMA(6/4) | 250 |
| OIL/GAS B | 15M | .450M | MAJOR ROUTES | 0 | .375M | .75M | 10 TR | 39 |
| TRANSPORTATION A | 12M | 2.7M | VOICE AND DATA LINES | .5M | 1.85M | .35M | 7 TDMA (14/12) | 135 |
| TRANSPORTATION B | 13.5M | 1.1M | MAJOR ROUTES | .003M | .57M | .527M | 12 TR | 42 |
| RETAILER A | 16M | 2.4M | MAJOR ROUTES | .53M | 1.22M | .65M | 5 TDMA (14/12) | 61 |
| RETAILER B | 7M | .7M | MAJOR EASTERN LOCATIONS | .265M | .38M | .055M | 5 TR | 36 |
| RETAILER C | .278M | 0 | | 0 | 0 | 0 | 0 | 0 |
| GOVERNMENT A | 64M | 27.4M | 60% OF DIRECT SERVICES (MAJOR ROUTES) | 11.6M | 5.3M | 10.5M | 11 TDMA (14/12) | 1000 |
| GOVERNMENT B | 26M | 9.6M | THIN ROUTES (NORTH-SOUTH) | 4.8M | 3.4M | 1.4M | 132 TR | 120 |
| GOVERNMENT C | 6.7M | 1.0M | IMAGE NETWORK | 0 | 1.19M | (.19M) (EXPANDED CAPACITY) | 6 TDMA<br>80 DATA RECEIVE | 100 |
| TIMBER COMPANY A | +10M | .84M | REMOTE LOCATIONS | .84 | 0 | 0 | 0 | 0 |
| TIMBER COMPANY B | 1.5M | .292M | MAJOR ROUTES | .016M | .252M | .024M | 6 TR | 17 |
| MINING COMPANY A | 4M | .196M | MAJOR ROUTES | 0 | .156M | .04M | 3 TR | 14 |
| SERVICE BUREAU A | 20M | 3.4M | MAJOR ROUTES | 0 | 1.4M | 2.0M | 5 TDMA (14/12) | 150 |
| SERVICE BUREAU B | 4M | 4M | MAJOR ROUTES | 0 | 2.0M | 2.0M | 6 TDMA (14/12) | 248 |
| BANK A | +30M | 3M | MAJOR ROUTES EXCLUDING ON-LINE RANKING | 0 | 2.2M | .8M | 8 TDMA (14/12) | 179 |
| BANK B | 22M | .33M | MAJOR ROUTES | 0 | .23M | .01M | 6 TR | 15 |
| INSURANCE COMPANY A | 1.5M | .285M | MAJOR ROUTES | 0 | .285M | 0 | 10 TR | 13 |
| UTILITY A | 3.6M | .266M | TIE LINES | .266M | 0 | 0 | 0 | 0 |
| UTILITY B | 4M | .23M | MAJOR ROUTES | .01M | .084M | .136M | 2 TR | 6 |
| MANUFACTURING A | 2.4M | .29M | MAJOR ROUTES | .29M | 0 | 0 | 0 | 0 |
| MANUFACTURING B | 2M | 0 | TORONTO AREA | 0 | 0 | 0 | 0 | 0 |
| HOTEL CHAIN A | .6M | .03M | MAJOR ROUTES | .03M | 0 | 0 | 0 | 0 |
| HOTEL CHAIN B | .4M | 0 | TORONTO AREA | 0 | 0 | 0 | 0 | 0 |
| SAMPLE TOTALS | $291.5M | $66.5M | | $19.2M | $24.6M | $22.7M | 59 TDMA<br>186 TR<br>80 DATA RECEIVE | 2580 |

1. Potential cost reductions.

2. Flexbility in terms of control over private networks, reconfiguration, ability to reach remote areas and elimination of local loops.

3. Reliability.

4. Potential cost reductions in other areas through distributed data processing, reduced travel, reduced use of courier services, and use of electronic mail.

- More flexible Canada-U.S. telecommunications.

- Stimulation of new services such as video conferencing, imaging, and high speed data applications.

## ANALYSIS OF RESULTS

Using the approach outlined earlier, we compared the cost of providing each organization's existing private line services by terrestrial facilities and by satellite. Either TDMA or thin route technology was used, depending on which was more economical in the circumstances of each organization.

Exhibit 5, opposite, shows the results for the current year based on the existing earth station policy (scenario 1). Total telecommunications expenses and the portion of those expenses considered eligible for satellite, the basis on which that portion of the telecommunication expenses were chosen, and the market split of those eligible services between terrestrial and satellite are shown for each organization. In seven of the 24 cases, no savings would result from the use of satellite. For the other 17 firms, savings estimated at $22.7 million would be realized if complete conversion of eligible services to satellite were to take place.

Because data was not available from the majority of respondents for their WATS and DDD services on a point to point basis, none of those expenses were considered to be eligible for conversion to satellite for purposes of this study. However, it is apparent that if satellite technology were implemented on a private network basis, many of those existing WATS and DDD services would be converted to those private networks as well.

Exhibit 6, overleaf, shows the results of the demand study for the current year based on a liberalization of the earth station licensing policy (scenario 2). In this case, 19 of the 24 organizations would realize savings by using satellite facilities. The total estimated savings for the current year, if all eligible circuits were converted to satellite, would be $28.5 million. Again, no attempt has been made to estimate the impact of conversion of WATS and DDD services.

Growth in Demand

During the interviews, we discussed with each respondent the expected growth in telecommunications traffic for both voice and data. These growth rates covered both increases in traffic and new demand as a result of new services.

Expected growth rates for both voice and data traffic centered upon the 9 to 12 percent annual growth rate range, with expected growth in data traffic being somewhat higher than that for voice. Two separate respondents forecast data traffic growth rates in the range of 20% per year.

Stimulation of demand due to new services was expected to be in the following areas:

- video conferencing
- facsimile
- distributed data processing
- higher speed data
- integration of voice and data
- increased of capability of networks.

These expected growth rates over the next five years were used to estimate the market split between satellite and terrestrial for 1988.

EXHIBIT 6

RESULTS OF DEMAND STUDY : CURRENT YEAR (SCENARIO 2)

| ORGANIATION | TOTAL TELECOM $ | ELIGIBLE $ | BASIS OF ELIGIBILITY | MARKET SPLIT | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | TERRESTRIAL | SATELLITE | SAVINGS | EARTH STATIONS | LINES |
| OIL/GAS A | 25M | 8M | MAJOR AND REMOTE LOCATIONS | 0 | 2.73M | 5.27M | 12 TDMA (6/4) | 250 |
| OIL/GAS B | 15M | .450M | MAJOR ROUTES | 0 | .277M | .173M | 10 TR | 39 |
| TRANSPORTATION A | 12M | 2.7M | VOICE AND DATA LINES | .5M | 1.375M | .825M | 7 TDMA (14/12) | 135 |
| TRANSPORTATION B | 13.5M | 1.1M | MAJOR ROUTES | .003M | .378M | .719M | 12 TR | 42 |
| RETAILER A | 16M | 2.4M | MAJOR ROUTES | .53M | .875M | .995M | 5 TDMA (14/12) | 61 |
| RETAILER B | 7M | .7M | MAJOR EASTERN LOCATIONS | .265M | .288M | .157M | 5 TR | 36 |
| RETAILER C | .278M | 0 | | 0 | 0 | 0 | 0 | 0 |
| GOVERNMENT A | 64M | 27.4M | 60% OF DIRECT SERVICES (MAJOR ROUTES) | 11.6M | 4.6M | 11.2M | 11 TDMA (14/12) | 1000 |
| GOVERNMENT B | 26M | 9.6M | THIN ROUTES (NORTH-SOUTH) | 4.8M | 2.4M | 2.4M | 132 TR | 120 |
| GOVERNMENT C | 6.7M | 1M | IMAGE NETWORK | 0 | 1.0M | 0 (EXPANDED CAPACITY) | 6 TDMA<br>80 DATA RECEIVE | 100 |
| TIMBER COMPANY A | +10M | 1.2M | REMOTE AND HIGH VOLUME LOCATIONS | 0 | 1.16M | .04M | 5 TDMA (14/12) | 155 |
| TIMBER COMPANY B | 1.5M | .292M | MAJOR ROUTES | .016M | .185M | .091M | 6 TR | 17 |
| MINING COMPANY A | 4M | .196M | MAJOR ROUTES | 0 | .118M | .078M | 3 TR | 14 |
| SERVICE BUREAU A | 20M (est.) | 3.4M | MAJOR ROUTES | 0 | 1.1M | 2.3M | 5 TDMA (14/12) | 150 |
| SERVICE BUREAU B | 4M | 4M | MAJOR ROUTES | 0 | 1.6M | 2.4M | 6 TDMA (14/12) | 248 |
| BANK A | +30M | 3M | MAJOR ROUTES EXCLUDING ON-LINE BANKING | 0 | 1.6M | 1.4M | 8 TDMA (14/12) | 179 |
| BANK B | 22M | .33M | MAJOR ROUTES | 0 | .163M | .167M | 6 TR | 15 |
| INSURANCE COMPANY A | 1.5M | .285M | MAJOR ROUTES | 0 | .203M | .082M | 10 TR | 13 |
| UTILITY A | 3.6M | .266M | TIE LINES | 0 | .234M | .032M | 7 TR | 28 |
| UTILITY B | 4M | .23M | MAJOR ROUTES | .01M | .062M | .158M | 2 TR | 6 |
| MANUFACTURING A | 2.4M | .29M | MAJOR ROUTES | .138M | .121M | .031M | 3 TR | 13 |
| MANUFACTURING B | 2M | 0 | TORONTO AREA | 0 | 0 | 0 | 0 | 0 |
| HOTEL CHAIN A | .6M | .030M | MAJOR ROUTES | .030M | 0 | 0 | 0 | 0 |
| HOTEL CHAIN B | .4M | 0 | TORONTO AREA | 0 | 0 | 0 | 0 | 0 |
| SAMPLE TOTALS | $291.5M | $67.0M | | $17.9M | $20.6M | $28.5M | 65 TDMA<br>196 TR<br>80 DATA RECEIVE | 2621 |

## 1988 Satellite Demand

Using the growth rates provided by the companies interviewed, we estimated both total and eligible telecommunication expenses and prepared a split of eligible telecommunications expenditures between terrestrial and satellite facilities on the same basis as developed for 1983. Exhibit 7 and 8, overleaf, provide the results of this analysis.

## INDUSTRY SCALE-UP

The results of the analysis for the 24 firms surveyed were scaled-up to the 250 largest companies in Canada based on annual revenues or total assets.

As indicated earlier, this approach has a fair degree of validity in industrial sectors which tend to be relatively homogeneous. These sectors include, for example, the banks, service bureaux and hotels. However, for segments of the resource and manufacturing sectors which can have a high degree of variability from one firm to another, we can attach less confidence to the results. However, such an approach does permit the determination of an order of magnitude for the total private line and private network market on satellite.

Exhibits 9 and 10, overleaf, provide an estimate of demand for the two earth station licensing policy scenarios determined in this manner. Based on total annual telecommunications expenditures estimated at $1.7 billion, we estimate that just over $200 million in private line charges would be eligible for carriage on satellite. Based on a cost comparison with terrestrial, we estimate that some 7,250 lines would be carried on satellite, resulting in savings to the end user of approximately $66 million. With a liberalization of the earth station policy, we estimate that 8,475 lines would be carried on satellite resulting in satellite revenues of $71 million and savings to the end user of $94.5 million.

EXHIBIT 7

RESULTS OF DEMAND STUDY - 1988 (SCENARIO 1)

| ORGANIZATION | TOTAL TELECOM $ | ELIGIBLE $ | MARKET SPLIT | | SAVINGS |
|---|---|---|---|---|---|
| | | | TERRESTRIAL | SATELLITE | |
| Oil/Gas A | 45M | 15M | 0 | 7M | 8M |
| Oil/Gas B | 26M | .945M | 0 | .8M | .145M |
| Transportation A | 17M | 4.2M | .8M | 2.9M | .5M |
| Transportation B | 19M | 1.7M | .01M | .89M | .8M |
| Retailer A | 25M | 4.0M | .901M | 2.03M | 1.069M |
| Retailer B | 13M | 1.4M | .53M | .76M | .11M |
| Retailer C | .5M | 0 | 0 | 0 | 0 |
| Government A | 135M | 57.5M | 24.4M | 11.1M | 22M |
| Government B | 47M | 17.3M | 8.6M | 6.1M | 2.6M |
| Government C | 13M | 2.0M | 0 | 2.38M | (.38)M |
| Timber Company A | 15M | 1.3M | 1.3M | 0 | 0 |
| Timber Company B | 2.5M | .338M | .026M | .291M | .021M |
| Mining Company A | 8M | .196M | 0 | .156M | .04M |
| Service Bureau A | 32M | 5.2M | 0 | 2.1M | 3.1M |
| Service Bureau B | 6.5M | 6.4M | 0 | 3.2M | 3.2M |
| Bank A | 45M | 4.8M | 0 | 3.52M | 1.28M |
| Bank B | 28M | .42M | 0 | .29M | .13M |
| Insurance Company A | 2M | .365M | 0 | .365M | 0 |
| Utility A | 4M | .3M | .3M | 0 | 0 |
| Utility B | 5.2M | .290M | .012M | .11M | .168M |
| Manufacturing A | 4.8M | .53M | .53M | 0 | 0 |
| Manufacturing B | 2.6M | 0 | 0 | 0 | 0 |
| Hotel Chain A | 1.0M | .03M | .03M | 0 | 0 |
| Hotel Chain B | .8M | 0 | 0 | 0 | 0 |
| SAMPLE TOTAL | $497.9M | $124.2M | $37.5M | $43.9M | $42.8M |

## EXHIBIT 8

## RESULTS OF DEMAND STUDY - 1988 (SCENARIO 2)

| ORGANIZATION | TOTAL TELECOM $ | ELIGIBLE $ | MARKET SPLIT TERRESTRIAL | MARKET SPLIT SATELLITE | SAVINGS |
|---|---|---|---|---|---|
| Oil/Gas A | 45M | 15M | 0 | 5M | 10M |
| Oil/Gas B | 26M | .945M | 0 | .459M | .486M |
| Transportation A | 17M | 4.2M | .800M | 1.6M | 1.7M |
| Transportation B | 19M | 1.7M | .010M | .600M | 1.1M |
| Retailer A | 25M | 4.0M | .901M | 1M | 2.1M |
| Retailer B | 13M | 1.4M | .530M | .506M | .370M |
| Retailer C | .5M | 0 | 0 | 0 | 0 |
| Government A | 135M | 57.5M | 24.4M | 7.9M | 25.2M |
| Government B | 47M | 17.3M | 8.6M | 2.8M | 5.8M |
| Government C | 13M | 2.0M | 0 | 2M | 1M |
| Timber Company A | +15M | 1.9M | 0 | 1.4M | .5M |
| Timber Company B | 2.5M | .338M | .026M | .210M | .102M |
| Mining Company A | 8M (assumed to double) | .196M | 0 | .118M | .078M |
| Service Bureau A | 32M | 5.2M | 0 | 1.65M | 3.55M |
| Service Bureau B | 6.5M | 6.4M | 0 | 2.5M | 3.9M |
| Bank A | +45M | 4.8M | 0 | 2.0M | 2.8M |
| Bank B | 28M | .420M | 0 | .230M | .190M |
| Insurance Company A | 2M | .365M | 0 | .260M | .105M |
| Utility A | 4M | .300M | 0 | .250M | .050M |
| Utility B | 5.2M | .290M | .012M | .079M | .199M |
| Manufacturing A | 4.8M | .530M | .291M | .202M | .037M |
| Manufacturing B | 2.6M | 0 | 0 | 0 | 0 |
| Hotel Chain A | 1.0M | .030M | .030M | 0 | 0 |
| Hotel Chain B | .8M | 0 | 0 | 0 | 0 |
| SAMPLE TOTAL | $497.9M | $124.8M | $35.6M | $30.8M | $58.4M |

EXHIBIT 9

DOC DEMAND STUDY - INDUSTRY SCALE-UP (SCENARIO 1)

| SECTOR | TELECOM EXP. (1983) | ELIGIBLE CIRCUITS | MARKET SPLIT TERRESTRIAL | MARKET SPLIT SATELLITE | MARKET SPLIT SAVINGS | NO. OF EARTH STATIONS | NO. OF LINES | BASIS OF SCALE-UP |
|---|---|---|---|---|---|---|---|---|
| BANKS/FINANCIAL/ INSURANCE | $191.0M | $ 12.8M | 0 | $10.0M | $ 2.8M | 57 TR<br>28 TDMA | 737 | OVER $3B IN ASSETS |
| OIL/GAS | $157.0M | 33.1M | 0 | 16.0M | 17.1M | 38 TR<br>47 TDMA | 1124 | 15 LARGEST COMPANIES |
| TIMBER | 33.0M | 3.2M | 2.4M | .7M | .1M | 16 TR<br>13 TDMA | 450 | 15 LARGEST COMPANIES |
| TRANSPORTATION | 99.0M | 14.7M | 1.9M | 9.4M | 3.4M | 47 TR<br>27 TDMA | 686 | 9 LARGEST COMPANIES |
| UTILITIES/PIPELINES | 38.0M | 2.5M | 1.38M | .7M | .42M | 10 TR | 38 | SALES ABOVE $125M |
| RETAIL | 108.0M | 14.7M | 3.7M | 7.7M | 3.3M | 24 TR<br>26 TDMA | 467 | OVER $200M IN SALES |
| MINING | 12.3M | .607M | 0 | .48M | .127M | 19 TR | 43 | OVER $125M IN SALES |
| MANUFACTURING/CHEMICAL/ HI-TECH | 650.0M | 29.5M | 29.5M | 0 | 0 | 0 | 0 | OVER $500M IN SALES |
| HOTELS/FOOD | 10.0M | .2M | .2M | 0 | 0 | 0 | 0 | 5 TOP HOTELS/ FOOD |
| SERVICE BUREAUX | 132.0M | 40.6M | 0 | 18.6M | 22.0M | 60 TDMA | 2175 | TOP COMPUTER SERVICE BUREAUX |
| GOVERNMENT | 300.0M | 57.0M | 24.6M | 15.0M | 17.4M | 200 TR<br>16 TDMA<br>80 DATA RECEIVE | 1530 | ESTIMATED TOTAL TELECOM EXPENDITURES |
| TOTALS | $1730.0M | $208.9M | $63.7M | $78.6M | $66.6M | 411 TR<br>212 TDMA<br>80 DATA RECEIVE | 7250 | |

EXHIBIT 10

DOC DEMAND STUDY - INDUSTRY SCALE-UP (SCENARIO 2)

| SECTOR | TELECOM EXP. (1983) | ELIGIBLE CIRCUITS | MARKET SPLIT | | | NO. OF EARTH STATIONS | NO. OF LINES | BASIS OF SCALE-UP |
|---|---|---|---|---|---|---|---|---|
| | | | TERRESTRIAL | SATELLITE | SAVINGS | | | |
| BANKS/FINANCE/ INSURANCE | $191.0M | $12.8M | 0 | $ 7.0M | $ 5.8M | 57 TR<br>28 TDMA | 737 | OVER $3B IN ASSETS |
| OIL/GAS | 157.0M | 33.1M | 0 | 11.7M | 21.4M | 38 TR<br>47 TDMA | 1124 | 15 LARGEST COMPANIES |
| TIMBER | 33.0M | 4.3M | .047M | 3.875M | .378M | 16 TR<br>13 TDMA | 450 | 15 LARGEST COMPANIES |
| TRANSPORTATION | 99.0M | 14.7M | 1.9M | 6.8M | 6.0M | 47 TR<br>27 TDMA | 686 | 9 LARGEST COMPANIES |
| UTILITIES/PIPELINES | 38.0M | 2.5M | .05M | 1.5M | 1.0M | 46 TR | 172 | SALES ABOVE $125M |
| RETAIL | 108.0M | 14.7M | 3.7M | 5.6M | 5.4M | 24 TR<br>26 TDMA | 467 | OVER $200M IN SALES |
| MINING | 12.3M | .607M | 0 | .366M | .241M | 19 TR | 43 | OVER $125M IN SALES |
| MANUFACTURING/CHEMICAL/ HI-TECH | 650.0M | 29.5M | 14.0M | 7.4M | 8.1M | 185 TR | 791 | OVER $500M IN SALES |
| HOTELS/FOOD | 10.0M | .2M | .2M | 0 | 0 | 0 | 0 | 5 TOP HOTEL/FOOD |
| SERVICE BUREAUX | 132.0M | 40.6M | 0 | 14.8M | 25.8M | 60 TDMA | 2175 | TOP COMPUTER SERVICE BUREAUX IN CANADA |
| GOVERNMENT | 300.0M | 57.0M | 24.6M | 12.0M | 20.4M | 200 TR<br>16 TDMA<br>80 DATA RECEIVE | 1830 | ESTIMATED TOTAL TELECOM EXPENDITURES |
| TOTALS | $1730.0M | $210.0M | $44.5M | $71.0M | $94.5M | 632 TR<br>217 TDMA<br>80 DATA RECEIVE | 8475 | |

## DISCUSSION OF FINDINGS

The results of the survey carried out among the 24 large business users and the analyses of the data collected from those users indicate that there is a large potential demand for satellite services. Based on an analysis of the 24 companies surveyed, representing approximately $300 million in annual telecommunications expenditures, approximately $66 million of this $300 million constitutes point-to-point private line dedicated circuits for voice or data which could be converted to private line on satellite. A cost comparison with tariffed terrestrial rates indicates that some 2,580 lines could be carried more economically on satellite, and that saving to the end user would result.

When scaled-up to the 250 largest business organizations, the percentage of eligible expenditures drops considerably to approximately 12% of total telecommunication expenditures. This is because of the weighting of the manufacturing sector and the relatively low potential utilization of satellite by firms in our sample from the industrial sector. As stated earlier, the manufacturing sector is the most variable sector in our study. There would undoubtedly be some manufacturing firms for which satellite private lines would prone in. However, as none of the firms in our sample were in this position, we have no basis for estimating the potential demand in the manufacturing sector.

It should be emphasized that these results are the potential demand based on the conversion of existing private lines. These figures are conservative to the extent that the conversion of existing WATS and DDD is not included.

The extent to which this potential demand will be realized depends on a number of factors from the perspective of both the service provider and the end user. Effective marketing of satellite services by the service providers will enhance the market share for satellite, albeit at the expense of the terrestrial side. The extent to which telecommunications managers in various firms are motivated to explore all alternatives in order to reduces total telecommunications costs will also affect, to a large degree, the extent to which this market potential for satellite can be realized.

Our interviews with the 24 firms indicated that the use of satellites either as an alternative to existing terrestrial private line or on an integrated basis using TDMA technology had not been discussed with most users. However, the results of our analyses indicate that many of these users could realize savings from the use of satellites.

The results of our survey also indicated that many firms do not coordinate their telecommunications usage internally even to the point, in some cases, of integrating their voice and data requirements. In these and other cases, the information which we would deem necessary to analyze alternative methods of providing service were not being collected by the firms. These factors would seem to indicate that the control of telecommunications costs is not, in many cases, receiving the attention that one would expect given the magnitude of those expenses. In most cases, there seems to be a heavy reliance on the local telephone company to provide all advice with respect to telecommunications.

At the other extreme, we found firms who were actively pursuing alternatives to their present telecommunications system, even to the point of being heavily involved in the design of their own private networks and dealing with several members of the TransCanada Telephone System in order to obtain the services which they wanted. While firms in this position were in the minority of those interviewed, it seems that some other firms will be pursuing such alternatives in the near future.

In order to use the results of this demand study in the overall Intermodal Competition Study, it was necessary to arrive at penetration rates for the private line and private network potential market on satellite. Under a competitive satellite/terrestrial scenario, we assume that the satellite provider would formulate a marketing plan in order to approach the largest firms which would appear to have satellite-eligible circuits. The constraints on the development of the market would then be the time required to develop and conduct a marketing strategy, the internal administration of telecommunications within those firms, and the reluctance to adopt a new technology.

The penetration rates used for each scenario in the Intermodal Competition Study are outlined in the report on that study.

# APPENDIX A

## ORGANIZATIONS/REPRESENTATIVES SURVEYED

# APPENDIX A

## ORGANIZATIONS/REPRESENTATIVES SURVEYED

| ORGANIZATION | REPRESENTATIVE | TITLE OR AREA OF RESPONSIBILITY |
|---|---|---|
| Imperial Oil Ltd. | M. J. Delisle | Telecommunications Advisor |
| Union Gas Ltd. | W. B. Davis | Manager, Telecommunications Systems |
| Air Canada | A. J. Comeau | Manager, Computer and Communications Control |
| CP Air | C. Vokes | Voice Services |
| | D. Harding | Manager, Data Communications |
| | J. Greenwood | Manager, Telephone Systems |
| MacMillan Bloedel Ltd. | M. Hodgkins | Supervisor, Network Management |
| The Bay | Mr. Strait-Gardner | Vice-President - Information Systems |
| Sears | G. Barret<br>J. Rundell | Voice Services |
| | D. Davies | Data Communications |
| Government Telecommunications Agency | R. Arsenault | Head, Technology Research Development |
| | B. A. Edwards | Telecommunications Planning |
| Transport Canada | T. C. Calow | Chief, Telecommunications Network Division |
| | M. Hiller | Project Officer, Leased Communications |
| | B. Tepper | Superintendent, Point-to-Point Telecommunication Communications |
| Atmospheric Environment Services | B. Atfield | Communications Networks |
| Royal Bank | K. S. Sharma | Manager, Network Planning and Facilities |
| | R. H. Bamford | Senior Communications Analyst |

| ORGANIZATION | REPRESENTATIVE | TITLE OR AREA OF RESPONSIBILIT |
|---|---|---|
| Toronto Dominion Bank | S. Bray | Manager, Telecommunications |
| | H. Cramer | Manager, Systems |
| Travelers Canada | W. Hindle | Manager, Office Services |
| Abitibi-Price | M. Regan | Supervisor, Communication Services |
| Delta Hotels | D. Hill | Supervisor, Data Processing |
| | W. Markwart | Director, Reservations |
| General Foods Inc. | W. Kay | Manager, Telecommunications |
| | T. Dawson | Telecom Analyst |
| Datacrown | G. Georgeff | Manager, Network Services |
| Reichhold | J. R. Pearson | Manager, Facilities Planning |
| Best Western | S. Taylor | Manager, Reservations |
| Noranda Mines | R. Ledshem | Manager, Communications |
| TransCanada Pipelines | W. J. Haines | Manager, Operations |
| | K. Pollard | Manager, Engineering |
| Control Data | C. Closs | Manager, Telecommunications |

Note: One organization asked not to be identified as a participant in this study and accordingly is not included in this listing.

# APPENDIX B

## SURVEY QUESTIONNAIRE

# BUSINESS TELECOMMUNICATIONS DEMAND STUDY

## Initial Telephone Call to User

- Introduction:
  - who we are
  - nature of study
  - nature of information we are requesting
  - 1/2 day visit to collect the information.

1. Has your organization considered possible usage of satellites for communications?
   - costing studies
   - how were you made aware of the potential for satellite usage (i.e., by a TCTS representative, Telesat, CNCPT, U.S. scene?).

2. Please provide the following basic company information:
   (a) total $ spent on communications annually
   (b) major locations (identify the major areas)
   (c) organization revenue/costs
   (d) number of employees in the organization.

3. Please prepare an organization chart showing the departments and key individuals responsible for the procurement and maintenance of communications services for:
   - data
   - voice
   - messaging (i.e., facsimile, Envoy, etc.)
   - video.

4. Please provide an overall network diagram of your telecommunications system identifying:
   - locations
   - PBX's, major terminal equipment
   - private line circuits (i.e., number of circuits between each location for voice and data).

5. Specification of meeting place and time.

6. We will be asking for more detailed information at the meeting on:

   - communications costs within and between each major location (location matrix)
   - breakdown of the quantities and dollars by service type:
     - voice (toll, WATS, private)
     - data (public and private)
     - messaging (fax, twx/telex, van)
     - video (conferencing)
   - by supplier:
     - TCTS
     - CNCPT
   - to U.S. and International (if available).

Detailed Questionnaire

1. What is your anticipated growth in each major service category over the next five years?

2. Include new services, locations (remote) and applications that are in the plans.

3. What are your thoughts on the current environment for using satellite from a feasibility point of view?

   - policy considerations
   - technical constraints
   - operational/management considerations
   - costs.

4. What are the perceived benefits of using satellite communications to your organization (relate to the above considerations).

5. Workshop to fill in the communications matrices.

6. What is the estimated percentage of TCTS versus CNCPT services used by your organization?

7. Are there any reasons why you would or would not want to own or operate your own transmit/receive earth stations?

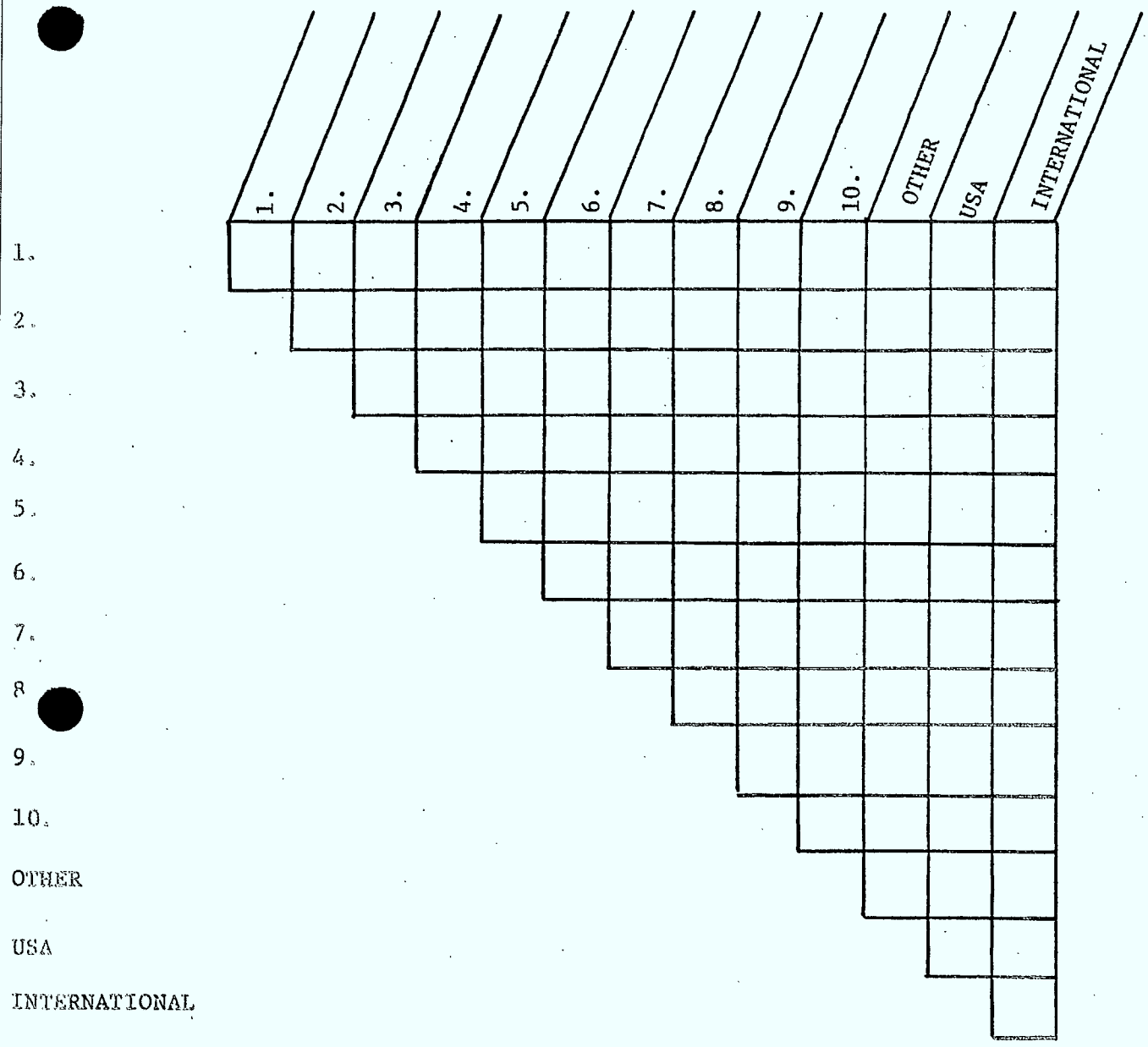
8. Other considerations and comments? e.g., U.S. parent company system, etc.

## A. COSTS WITHIN EACH MAJOR LOCATION (ANNUALLY)

($000's)

| LOCATION | EQUIPMENT | TOLL (SHORT-HAUL) | ACCESS | |
|---|---|---|---|---|
| | | | SWITCHED | DEDICATED |
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |
| 4. | | | | |
| 5. | | | | |
| 6. | | | | |
| 7. | | | | |
| 8. | | | | |
| 9. | | | | |
| 10. | | | | |
| OTHER | | | | |
| TOTAL | | | | |

C. COMMUNICATIONS MATRIX (%$)



B. COSTS BETWEEN LOCATIONS (ANNUALLY) ($000's)

| LOCATION | VOICE | | | | DATA | | | | | | MESSAGE | | | VIDEO | OTHER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TOLL | WATS | PRIVATE LINE | | PRIVATE LINE | | | | SWITCHED | | TWX/TELEX | FACSIMILE | OTHER | | |
| | | | | | 9.6 KBPS | | 9.6 KBPS | | DIAL UP | PACKET | | | | | |
| | | | # | $ | # | $ | # | $ | | | | | | | |
| 1. | | | | | | | | | | | | | | | |
| 2. | | | | | | | | | | | | | | | |
| 3. | | | | | | | | | | | | | | | |
| 4. | | | | | | | | | | | | | | | |
| 5. | | | | | | | | | | | | | | | |
| 6. | | | | | | | | | | | | | | | |
| 7. | | | | | | | | | | | | | | | |
| 8. | | | | | | | | | | | | | | | |
| 9. | | | | | | | | | | | | | | | |
| 10. | | | | | | | | | | | | | | | |
| 11. | | | | | | | | | | | | | | | |
| 12. | | | | | | | | | | | | | | | |
| 13. | | | | | | | | | | | | | | | |
| 14. | | | | | | | | | | | | | | | |
| 15. | | | | | | | | | | | | | | | |
| OTHER | | | | | | | | | | | | | | | |
| TOTAL | | | | | | | | | | | | | | | |