

TELECOMMISSION

Study 7(i)

Postal Services and Telecommunications

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POSTAL SERVICES AND TELECOMMUNICATIONS

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This Report is to be considered as a background working paper and no effort has been made to edit it for uniformity of terminology with other studies.

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POSTAL SERVICES AND TELECOMMUNICATIONS1.0 Introduction

The Post Office is in the business of information transfer but, in its traditional role of physically transporting originals of messages, it is experiencing increasing competition from developments in telecommunications. Traditional manual methods are beginning to show signs of inadequacy in face of the volume of mail, the increasing cost of labour, and the changing technological climate in which Post Office customers operate. Telecommunications systems are still not sufficiently developed to offer to the individual an economic, comprehensive means of transacting his household, personal and consumer business, although systems for the purpose have been identified and discussed. In particular there is no cheap and universally available device for transmitting, receiving and printing messages. Consequently, the possession of nation-wide facilities and delivery to every household could permit the Post Office to secure a role in the "wired nation" era as it develops. Techniques already exist for the transformation of any message to electronic signals, their transmission over a communications link and for their conversion at a distant point. It is thus technically feasible to substitute a switched electronic system such as handles telephone and telegraph traffic, for the sorting and transportation of messages comprising conventional letter mail. Such systems in fact exist, and are growing, both in Canada and the United States (e.g. Telex, TWX, facsimile).

Significant developments are occurring in the U.S. which suggest that Canada should not long delay initiative in exploiting the possibilities of this technology. One is the intensive study of General Dynamics, under contract to the U.S. Post Office Department, on electronic mail handling. Indications are that trial systems may soon be initiated in the U.S.A. Another development is the active interest in U.S. domestic communications satellite systems which is expected to result in at least a half dozen proposals to the Federal Communications Commission. It can scarcely be doubted that some of these will include mail message distribution capability, perhaps along the lines of the General Electric submission to the U.S. Federal Communications Commission in February 1969.

The probability thus exists that a U.S. electronic mail system could materialize within a few years, including

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the message distribution network and mass-produced terminal equipment. Should Canada defer taking initiative, the opportunity to influence the type and extent of penetration from the U.S. into Canada could progressively diminish, and the opportunity for participation by Canadian industry in equipment development and manufacture might be reduced by the availability of off-the-shelf U.S. hardware.

An electronic mail system implies the use of a switched telecommunications network by the Post Office. System and equipment problems to be solved are mainly at the interface between the telecommunications network and potential users, that is between the network and the Post Office, and between the Post Office and the customers.

The capability of the Post Office to access, and deliver mail to every household and street address in Canada at a cost rendered low by the scale of operation is a strength which could assist the early initiation of an electronic mail system.

2.0

Essential Features of an Electronic Mail System

The essential difference between the conventional letter mail system and the equivalent electronic mail process is that nothing is physically transported in the telecommunications case until in certain cases at the receiving end, manual delivery is unavoidable.

A telecommunications system comprises three distinct processes: input, transmission and output. The use of telecommunications techniques for a Post Office electronic mail system, involves two additional processes: collection and delivery.

Collection is the process of bringing order to the variety of mail having potential for electronic transmission, variety which includes nature of the message, time of receipt, urgency, format, recording medium, and method by which it is generated.

In general, for other than computer generated mail, some input transformation will be required to convert the message from its original form into electronic signals for transmission. For example, for letters originated on paper the two most likely options for transformation appear to be either conversion of alpha-numeric text, character by character, into digital signals, or raster-type scanning with a degree of resolution sufficient to

reconstruct a fair reproduction of the original pattern (whether alpha-numeric, diagrammatic or cursive script).

Following input transformation, transmission of the electronic signals can take place by well proven, reliable telecommunication techniques.

Output from the telecommunication system is crucial both to the economics and customer acceptance of electronic mail. There exist a variety of options each of which is likely to have appeal to various classes of message recipient. Identification of these options and of the number, size and location of potential customers are factors which must be resolved. These marketing aspects are likely to be time consuming and expensive for future study.

Following the telecommunication system output process, the Post Office could offer a unique type of delivery service for those messages which are required in hard copy and which are received from the telecommunication system at a point separate from the ultimate destination.

It is technically feasible to implement a system which embodies the following characteristics:

- despatch of messages by originators as and when required with storage within the system until transmitted.
- local message concentration and sorting, at least for separation of local and long-distance traffic.
- use of an existing switched message network at off peak load times.
- local delivery by terminating the telecommunications service and printing out, either in postal stations for delivery as normal mail to households, or in postal facilities adjacent to business concentrations for delivery to large volume receivers.

3.0

User Aspects

The features of an electronic mail system requiring most attention, are the interfaces with the users. These include the acceptability of the technique to the users, as well as marketing, technical equipment and system design considerations.

One system of classifying users, based on size, identifies three classes, namely Government, business, and households. It is convenient to consider households as being large in number, widely dispersed, and each originating or receiving small quantities of mail. Businesses are regarded as being moderate in number, relatively concentrated in location, and each originating or receiving medium to large quantities of mail. Major Government offices are regarded as few, in specific locations, and originating or receiving large quantities of mail.

The Post Office also makes the distinction between large volume mailers (large sources of mail) and large volume receivers, who may not be one and the same.

Large volume users may handle sufficient traffic to justify the cost of special terminal equipment on the premises for dispatch and receipt of mail. The access to an electronic mail system offered to business may depend on their role as large volume mailers or as large volume receivers, or both. Households, as originators of electronic mail, may individually be insignificant yet in total contribute towards creation of large volume receivers. As recipients of much of the mail generated by large volume mailers households raise a local delivery problem which illustrates the common interest of the telecommunication carrier, and the Post Office with its local delivery capability.

The large volume mailers themselves raise different sets of problems depending upon whether their mail originates in a computer system or as conventional correspondence. These two aspects of "large user" traffic and the interface between the telecommunications network and the Post Office delivery system are discussed in more detail below.

3.1 Computer Originated Mail

This is the area which appears to be of immediate significance to an electronic mail system because:

- (i) message exist in a digital coded form
- (ii) access to the system could be entirely electronic and would present minimum disruption to established conventional means of handling mail.

Computer based business systems are proliferating and the trend is certainly towards involving business and its customers in a comprehensive electronic scheme of transacting their affairs through concepts already being

discussed under such titles as "wired city" and "cashless society".

Most of this traffic as presently printed out from the computer is handled by the originator and by the Post Office as ordinary mail. For transmission in an electronic mail system these messages could for example be recorded on tape and passed to the nearest access point on the telecommunications network either by physical transportation or, on line through appropriate interface equipment at the computer site. When computer systems of this kind can be designed with electronic mail transmission as a requirement, appropriate sorting of messages and direct transmission to line could be integral functions of the system itself, thereby reducing the manpower requirement.

3.2 Large Originators of Conventional Mail

There is a large volume of typed business correspondence in the first class letter mail which is not transmitted by telecommunications (e.g. by Telex, even where the originating firm uses this service) for a variety of reasons which include the aesthetic - quality of paper, decorated letterhead, etc. However the principal reasons are undoubtedly the cost of the toll circuits, and the limited number of subscribers to the system due to the cost of the terminal equipment.

The electronic mail concept offers potential answers to both of these principal objections. By holding and sorting the messages in a store, for overnight transmission on the switched message network rather than on the direct-dialing system, it should be possible to offer a cheaper variant of the Telex type service. The restriction on the number of the available recipients could be removed by the message printing and delivery facility discussed below.

A more comprehensive survey of the problems involved in converting business correspondence to telecommunications is available in a contractor report to the Department of Communications.

3.3 Delivery Interface

Most of the traffic discussed above would be addressed to private individuals and small-scale users for whom manual delivery is still the only feasible solution. Therefore the initial telecommunications message system might be expected to include termination at the nearest postal station for print-out and delivery as normal mail. The printing out process itself presents no new problems, but there are associated system questions to be studied, such as the assurance of the desired degree of message privacy, address codes, and design of an acceptable standard form for the printed message. Customer demand for decorated letterhead, inclusion of advertising inserts, etc. with the electronic mail should also be considered, though it may be possible to defer it, and to make it a follow on requirement to the initial message system.

4.0 Initial Electronic Mail System

From the many conceivable systems, which will vary with demand and technological innovation over time, it is necessary to identify the starting point, and a progressive sequence of actions which could enable the Post Office to secure its involvement in electronic mail, and expand its service to customers.

To this end, the volume and distribution of mail potentially suitable for transmission by electronic means should be defined together with the most expeditious way of implementing an initial system.

4.1 Preliminary Analysis of Potential Electronic Mail Traffic

Some preliminary data on the quantity and distribution pattern of the types of mail susceptible to electronic transmission is available from postal operating statistics.

The total current postal business comprises about 5 billion pieces annually. In the 12 months up to 31 July 1969, excluding parcels, publications and un-addressed circulars, approximately 3.7 billion pieces of first and third class, short and long letter mail were processed. However these 3.7 billion pieces include householder handwritten and other letters originating from "small user" sources. It is assumed that the volume of first class metered letter mail entering the postal system represents a probable maximum potential for electronic mail.

Of the 3.7 billion originating letters, about 2.5 billion are first class, and of this, the estimated annual volume of first class, short and long, metered mail accounts for 1.6 billion pieces. It is desirable to estimate the volume and distribution pattern of that portion of this mail which is computer generated. No definitive means of estimating this are available; an informed guess puts it at about 30 per cent, yielding an annual volume of 480 million pieces.

Based on statistics of all letter mail, about 40 per cent is for local delivery and about 60 per cent for delivery in another city. Therefore, if the sample and estimates are valid, the expected annual volume of first class computer generated mail suitable for electronic transmission is 192 million pieces locally and 288 million pieces for inter-city distribution. This is the most attractive initial target for electronic mail.

If, in addition, all typed correspondence generated by large users (all first class metered mail) proves amenable to electronic transmission the potential is increased to 640 million pieces locally (40 per cent of 1.6 billion) and 960 million pieces inter-city (60 per cent of 1.6 billion).

It is also known that 60 per cent of the first class metered mail originates within the limited area around and between Toronto and Montreal. Finally, it should be recalled that these potential message volumes are derived from existing mail volumes. Since historically the introduction of a new product or service has in turn created new markets (the motor car, cable television) it is likely that message volumes would in fact become even greater than anticipated from current mail volumes.

The significant point however is that the existing mail volumes are sufficiently large to justify further investigation into means of electronic transmission.

4.2

Alternatives for a Canadian System

For an electronic mail system to accommodate all types of letter mail the collection process would have to accommodate messages which can originate in a variety of forms. They can originate in graphic or handwritten form; they can be produced in a typewriter or equivalent printer; they can be generated by an off-line keyboard coding device (teleprinter, paper tape or incremental magnetic tape recorder), or be generated by computer.

The variety of messages forms to be accommodated suggests the variety of input devices which might be used: high-resolution scanning, optical character reading devices or page readers, direct input from coded tape or computer, or on-line manual keyboard devices. Of these, computer originated mail was identified in Section 3.1 as being of immediate significance.

For some time into the future, the type of electronic mail system foreseeable in Canada could not transmit messages directly from all originators to all recipients because there is no feasible transmission network designed for the purpose and terminal equipment is not economically available for households. It appears probable therefore, that the initial national system might commence with computer originated mail, and utilize a nation-wide telecommunications network terminated by manual delivery.

The telecommunications network would comprise two systems; the local facility to collect traffic originating in the area and to deliver messages to local recipients, and the nation-wide network to link the local facilities.

For the local facility, two alternatives are worth considering:

- a) The telephone system which already reaches almost all Canadians and which is increasingly being used for electronic transmission of messages (e.g. Telex, facsimile).
- b) The CATV network which in time will probably reach at least half of all Canadian households. However, the merits of adapting wide band cable for mail transmission when the switched telephone network already exists need examination.

Alternative nation-wide networks include:

- (i) the telephone network
- (ii) the computer controlled message network, which provides a "store and forward" capability
- (iii) the Telex network
- (iv) future distribution satellite network

The high costs of utilizing a broad band network are likely to be supportable only if traffic is organized so as to use the network at optimum capacity. This favours a "store and forward" capability if it can be provided at a cost less than that of real time transmission.

Cost trade-offs between using a central sort, store and forward capability as opposed to a combination of a central capability supplemented by local sort, store and forward computers would have to be determined in a subsequent study. Message originators desiring immediate real time communication could probably be accommodated on the same network, but would have to bear a significantly increased cost per message.

A national electronic mail service included terminal equipment and connecting networks could not be implemented overnight. It is suggested that such a service should start with a limited number of originating customers and recipients in one or two centres only and evolve under careful control.

Therefore, although in the long term a distribution satellite (alternative (iv) above) might provide the most cost-effective network for the volume of messages anticipated, a better approach might be to evolve an operating system at minimum capital investment cost with a view to switching over to a satellite system when and if careful systems analysis so justifies. (The appendix provides a more detailed note on Satellite Communication Relays). Probably a special multi-access satellite system would be required. The first Telesat configuration might not be adequate since it is designed to meet a colour TV channel band width requirement.

These considerations suggest that for an initial system early attention might be given to the first three alternatives above, of which the existing computer controlled message network with its store and forward capability, and unused capacity could be the most readily available basis for initial trials and implementation.

Since the Canada Post Office is today exclusively in the business of physical transportation of messages and has no close affiliation with telecommunications systems as is the case with PTT operations in many other countries, the alternatives for accessing a Canada-wide network should be examined. Should the Post Office decide to develop an electronic mail service under its own control there appear to be three options:

- (i) To develop and install a Post Office network from scratch (See the note on Satellite Communication Relays in the Appendix).
- (ii) To develop a Post Office network by leasing circuits as required from common carriers.

- (iii) To negotiate an agreement with existing communication carriers from network services as required.

All of these options imply the development within the Post Office of new capabilities in the area of telecommunications systems planning and operations, and of the equipment needed to form the various user interfaces. This approach would be time consuming and costly and might be avoided by a joint electronic mail venture between the Post Office and the common carriers. (There is a precedent, for example, in the U.S. Post Office and the Western Union Telegraph Co. provision of the Mailgram service).

Finally consideration might be given to alternative locations of terminal output equipment. Manual delivery is already being provided by the Post Office and some form of it will be required indefinitely, e.g. the delivery of things as distinct from messages. Hence, it is assumed that the Post Office could accommodate manual delivery required by an electronic mail system. Clearly, delivery will be faster and more direct the nearer the terminals are located to the recipient; the four alternatives below are listed in order of increasing proximity to the user:

- (i) in post offices and/or postal stations
- (ii) adjacent to groups or large users, or in customer concentrations
- (iii) on large user premises
- (iv) in individual offices and households

The discussion below on how an electronic mail service might desirably evolve under Post Office control suggests that these alternatives are in fact sequential steps in the growth of the system.

5.0

Evolution of a Service

Recognizing that a phased plan is essential for the introduction of any electronic mail service, and that significant user aspects remain to be resolved through marketing study, for example of customer interests including technical and legal considerations, it remains desirable to identify at least one approach to initiating and evolving electronic mail handling in Canada.

5.1 Initial System

It is suggested first that detailed electronic mail system design, and the necessary equipment selection development, might be undertaken to handle only the present first class letter traffic originated by large-scale users from business system computers, without restrictions as to the type or location of the addresses.

By starting with computer-generated accounts traffic it becomes possible to initiate trial systems on a predetermined scale and to control the rate at which the service grows. For example, by selecting one or more local urban utilities or service operations, a trial system could be contained within a single geographical area. This approach would have the merit of permitting trial systems to be established on a predetermined scale in different localities which could then be tied together into a national system.

As pre-requisites, such a system would require establishment of a postal code in the selected area, and careful study of the immediate and future advantages of computer sort, store and forward capabilities either local to the selected area or at a distant centralized facility.

The configuration and scale of the initial system and the timing of its growth would have a significant effect on the amount of capital investment required and on operating losses anticipated before a self-supporting system on a national scale could be established.

It is suggested that the capital investment required, and its timing, should be determined by detailed cost benefit analysis of the projected system growth and should be compatible with other capital demands of the Post Office and the communications carrier, with particular consideration being given to competing demands such as the mechanization of letter sorting. The investment in mechanization might be so controlled as to ensure that facilities are installed to meet only the requirement anticipated before an electronic handling capability could begin to reduce the need for physical handling of letter messages. The dependence of the Post Office on physical handling might then be reduced progressively as more and more installations were established, and added to the system.

5.2 Further Development

It is possible that growth and development of a national system could proceed in several dimensions, for example extending printout facilities from postal stations to customer concentrations, or individual large volume receivers, extension of the service from computer generated mail to input of conventional typed or printed matter, more sophisticated handling of multiple address letters by computer formatting and insertion of individualized data, the addition of pre-printed letterhead to printed messages, and capability of colour reproduction.

For the longer term the potential for creation of new markets and services might be considered, together with extension of the service to other components of mail, e.g. addressed third class, and to the elimination of the need for hand delivery to individual households.

The system design and equipment problems at that stage might substantially comprise those of implementing the wired city.

6.0 Summary

The traditional role of the Post Office of physically transporting original messages is experiencing increasing competition from developments in telecommunications. It is now technically feasible to substitute a switched electronic system to sort and transport many of the messages which comprise conventional letter mail. By not recognizing this trend, it is possible that the opportunity may be lost to take early advantage of the concepts of the "wired nation" and to influence the effects of potential U.S. penetration. Furthermore the prospects of Canadian industry participating in systems and equipment development and supply may be reduced.

System, marketing, and equipment problems to be solved appear to be mainly at the interface between the telecommunications network and potential users. These user aspects include customer acceptance and legal considerations. The terminal facilities and household delivery capability of the Post Office could be valuable assets for participation in the development of an electronic mail system.

Preliminary analysis of potential electronic mail volume yields a national annual volume of 192 million messages

for local delivery, and 288 million messages for inter-city distribution, based on 1968/69 figures.

A number of alternatives for each stage of message generation, transmission and delivery have been identified. It is suggested that the initial national system might commence with computer originated mail and utilize a nation-wide telecommunications network terminated by manual delivery.

In addition to evaluation of various combinations of alternatives on the basis of marketing, technical, and service cost factors to provide a message system at competitive cost, the required capital expenditures and anticipated transitional operational losses should be carefully analyzed so that the phasing of long term costs to the Post Office, of electronic mail and competitive programs such as mechanization, yields the maximum benefit,

APPENDIXSatellite Communications Relays

Communications satellites are particularly attractive for a multiple-terminal high-capacity message system.

It is characteristic of terrestrial telecommunications systems that the amount of operating plant, and therefore message charges, increase more or less linearly with distance (for this reason the airmail letter, at a fixed rate independent of distance, is difficult to compete with). Within the coverage of a single communications satellite, however, any two points are 45,000 miles apart, and terrestrial distance between any two ground stations should be irrelevant. Also, very large numbers of ground stations can be readily accommodated for message transmission in a store and forward computer-switched system.

Such a satellite system has been analyzed by the U.S. General Electric Company in a submission to the Federal Communications Commission in February 1969 and brought forward again recently, presumably in response to the wide-open domestic satellite communications policy announcement by the U.S. President. The recent General Electric paper is interesting because it includes an estimated cost per 600 word message of 10 cents.

The longer-term significance of electronic mail to the later development of the Canadian Telesat system is fully appreciated, and is not inconsistent with the proposal to solve the user interface problems and develop the service at a controllable rate without the need for enormous initial capital outlays. The operational and economic justification for reinforcing or replacing the terrestrial network with satellite repeaters can be examined when the basic system problems have been solved and traffic growth patterns established.

